Back pain and Sciatica

Highlights

Statistics:

- According to the Bureau of Labor Statistics, in 2006 back pain was responsible for 62% of cases of people missing work due to pain involving the upper body.

Overview:

- Back pain can be acute, subacute, or chronic.
  - Acute back pain develops suddenly and lasts up to several weeks. Acute pain is the most common type of back pain.
  - Subacute back pain is pain that lasts up to three months.
  - Chronic back pain can begin abruptly or gradually, but it lasts longer than 3 months.
- Back pain can occur in any area of the back, but it is more common in the lower part, which supports most of the body's weight.

Diagnosis:

- Although most episodes of new back pain, as well as flare-ups of chronic back pain, clear up or return to a previous level of discomfort, a medical history and a brief physical examination is always necessary.
- The main goal of a physical exam is to try and determine the source of the pain and the limits of movement.
- Because most patients with back pain are on the mend or completely recovered within 6 weeks, imaging techniques such as x-rays or scans are rarely recommended in the first month unless the health care provider suspects a tumor, fracture, infection, cauda equina syndrome, or progressive neurological disease.

Treatment:

- The most commonly prescribed medications for the treatment of back pain are nonsteroidal anti-inflammatory drugs (NSAIDs)
- Injections of corticosteroids (commonly called steroids) are sometimes used to treat low back pain caused by nerve impingement.
- Spinal manipulation may sometimes be useful for acute back pain that persists beyond 2 - 3 weeks.
- Patients should always try all possible non-surgical treatments before opting for surgery.

Introduction

Back pain is one of the most common reasons people visit their doctor. According to the National Institute of Arthritis and Musculoskeletal and Skin Diseases, 8 out of 10 people have some type of backache.

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The Spine

The back is highly complex, and pain may result from damage or injury to any of its various bones, nerves, muscles, ligaments, and other structures. Still, despite sophisticated techniques, which provide detailed anatomical images of the spine and other tissues, the cause of most cases of back pain remains unknown.

Vertebrae. The spine is a column of small bones, or *vertebrae,* that support the entire upper body. The column is grouped into three sections:

- The *cervical* (C) vertebrae are the seven spinal bones that support the neck.
- The *thoracic* (T) vertebrae are the twelve spinal bones that connect to the rib cage.
- The *lumbar* (L) vertebrae are the five lowest and largest bones of the spinal column. Most of the body's weight and stress falls on the lumbar vertebrae.

Below the lumbar region is the *sacrum,* a shield-shaped bony structure that connects with the pelvis at the *sacroiliac joints.*

At the end of the sacrum are two to four tiny, partially fused vertebrae known as the *coccyx,* or "tail bone."

Each vertebra is designated by using a letter and number, allowing the doctor to determine where it is in the spine.

- The letter reflects the spinal region where the vertebra is located:
  - C=cervical (neck region)
  - T= thoracic (chest, or middle back, region)
  - L=lumbar (lower back)
- The number signifies the vertebra's place within that spinal region. The numbers start with 1 at the top of a region and count up as the vertebrae descend within the region. For

example, C4 is the fourth bone down in the cervical region, and T8 is the eighth thoracic vertebrae.

The Disks. Vertebrae in the spinal column are separated from each other by small cushions of cartilage known as *intervertebral disks*. The disks have no blood supply of their own. They rely on nearby blood vessels to keep them nourished.

Each disk is 80% water and contains two structures.

- Inside each disk is a jelly-like substance called the *nucleus pulposus.*
- The nucleus pulposus is surrounded by a tough, fibrous ring called the *annulus.*

Processes. Each vertebra in the spine has a number of bony projections called processes. The spinous and transverse processes attach to the muscles in the back and act like little levers, allowing the spine to twist or bend. The particular processes form the joints between the vertebrae themselves, meeting together and interlocking at the zygapophysial joints (more commonly known as facet, or z-joints).

Spinal Canal. Each vertebra and its processes surround and protect an arch-shaped central opening. These arches, aligned to run down the spine, form the spinal canal, which encloses the spinal cord.

Spinal Cord. The spinal cord is the central trunk of nerves that connects the brain with the rest of the body. Each nerve root passes from the spinal column to other parts of the body through small openings, bounded on one side by the disk and on the other by the facets. When the spinal cord reaches the lumbar region, it splits into four bundled strands of nerve roots called the *cauda equina* (meaning horsetail in Latin).

Symptoms and Causes

The origin of the pain is often unknown, and imaging studies may fail to determine its cause. Disk disease, spinal arthritis, and muscle spasms are the most common diagnoses. Other problems can also cause back pain, however.

Muscle and Ligament Injuries/Lumbar Strain

Strain and injury to the muscles and ligaments supporting the back are the major causes of low back pain. The pain is typically more spread out in the muscles next to the spine, and may be associated with spasms in those muscles. The pain may move to the buttocks but rarely any farther down the leg.

Sciatica

The sciatic nerve is a large nerve that starts in the lower back.

- It forms near the spine and is made up from branches of the roots of the lumbar spinal nerves.
- It travels through the pelvis and then deep into each buttock.
- It then travels down each leg. It is the longest and widest single nerve in the body.

Sciatica is not a diagnosis but a description of symptoms. Anything that places pressure on one or more of the lumbar nerve roots can cause pain in parts or all of the sciatic nerve. A herniated disk, spinal stenosis, degenerative disc disease, spondylolisthesis, or other abnormalities of vertebrae can all cause pressure on the sciatic nerve.

Some cases of sciatica pain may occur when a muscle located deep in the buttocks pinches the sciatic nerve. This muscle is called the piriformis. The resulting condition is called piriformis syndrome. Piriformis syndrome usually develops after an injury. It is sometimes difficult to diagnose.

The main nerve traveling down the leg is the sciatic nerve. Pain associated with the sciatic nerve usually originates when nerve roots in the spinal cord become compressed or damaged. Symptoms can include tingling, numbness, or pain that radiates to the buttocks, legs, and feet.

Pain or numbness due to sciatica can vary widely. It may feel like a mild tingling, dull ache, or a burning sensation. In some cases, the pain is severe enough to cause immobility.

The pain most often occurs on one side and may radiate to the buttocks, legs, and feet. Some people have sharp pain in one part of the leg or hip and numbness in other parts. The affected leg may feel weak.

The pain often starts slowly. Sciatica pain may get worse:

- At night
- After standing or sitting for long periods of time
- When sneezing, coughing, or laughing
- After bending backwards or walking more than 50 - 100 yards (particularly if it is caused by spinal stenosis -- see below)

Sciatica pain usually goes away within 6 weeks, unless there are serious underlying conditions. Pain that lasts longer than 30 days, or gets worse with sitting, coughing, sneezing, or straining may indicated a longer recovery. Depending on the cause of the sciatica, symptoms may come and go.

Herniated Disk

A herniated disk, sometimes (incorrectly) called a slipped disk, is a common cause of severe back pain and sciatica. A disk in the lumbar area becomes herniated when it ruptures or thins out, and degenerates to the point that the gel within the disk (the nucleus pulposus) pushes outward. The damaged disk can take on many forms:

- A bulge -- The gel has been pushed out slightly from the disk and is evenly distributed around the circumference.
- Protrusion -- The gel has pushed out slightly and asymmetrically in different places.
- Extrusion -- The gel balloons extensively into the area outside the vertebrae or breaks off from the disk.

Pain in the leg may be worse than the back pain in cases of herniated disks. There is also some debate about how pain develops from a herniated disk and how frequently it causes low back pain. Many people have disks that bulge or protrude and do not suffer back pain. Extrusion (which is less common than the other two conditions) is highly associated with back pain, since the gel is likely to extend out far enough to press against the nerve root, most often the sciatic nerve. Extrusion is very uncommon, however, while sciatic and low-back pain are very common. But there may be other causes of low back pain.

Abnormalities in the Annular Ring. Research has also focused on tears in the annular ring -- the fibrous band that surrounds and protects the disk. The annular ring contains a dense nerve network and high levels of peptides that heighten perception of pain. Tears in the annular ring are a frequent finding in patients with degenerative disk disease. Some cases of chronic low back pain may be caused by inward growth of nerve fibers into the annular ring, which triggers pain within the intervertebral disk.

Cauda equina syndrome. Cauda equina syndrome is the impingement of the cauda equina (the four strands of nerves leading through the lowest part of the spine). The cause is usually massive extrusion of the disk material. Cauda equina syndrome is an emergency condition that can cause severe complications to bowel or bladder function. It can cause permanent incontinence if not promptly treated with surgery. Symptoms of the cauda equina syndrome include:

- Dull back pain
- Weakness or numbness in the buttocks, in the area between the legs, or in the inner thigh, backs of legs, or feet; may cause stumbling or difficulty in standing
- An inability to control urination and defecation
- Pain accompanied by fever (can indicate an infection)

Lumbar Degenerative Disk Disease/Spondylosis

Osteoarthritis occurs in joints of the spine, usually as a result of aging, but also in response to previous back injuries, excessive wear and tear, previously herniated discs, prior surgeries, and fractures. Cartilage between the joints of the spine is destroyed and extra bone growth or bone spurs develop. The rate at which these changes develop varies between people.. The end result of these changes is a gradual loss of mobility of the spine, narrowing of the spaces for spinal nerves and spinal cord, and drying out or degeneration of the spinal discs. Depending on which part and how much of the spine is involved, symptoms may be similar to that of a herniated disc, lumbar strain, or spinal stenosis (narrowing of the spinal canal).

Spinal Stenosis

Spinal stenosis is the narrowing of the spinal canal, or narrowing of the openings (called neural foramina) where spinal nerves leave the spinal column. This condition typically develops as a person ages and the disks become drier and start to shrink. At the same time, the bones and ligaments of the spine swell or grow larger due to arthritis and chronic inflammation. However, other problems, including infection and birth defects, can sometimes cause spinal stenosis.

Most patients will report the presence of gradually worsening history of back pain over time. For others, there may be minimal history of back pain, but at some point in this process any disruption, such as a minor injury that results in disk inflammation, can cause impingement on the nerve root and trigger pain.

Patients may experience pain or numbness, which can occur in both legs, or on just one side. Other symptoms include a feeling of weakness or heaviness in the buttocks or legs. Symptoms are usually present or will worsen only when the person is standing or walking upright. Often the symptoms will ease or disappear when sitting down or leaning forward. These positions may create more space in the spinal canal, thus relieving pressure on the spinal cord or the spinal nerves. Patients with spinal stenosis are not usually able to walk for long periods of time. They may be able to ride an exercise bike.

Spondylolisthesis

Spondylolisthesis occurs when one of the lumbar vertebrae slips over another, or over the sacrum.

In children, spondylolisthesis usually occurs between the fifth bone in the lower back (lumbar vertebra) and the first bone in the sacrum area. It is often due to a birth defect in that area of the spine. In adults, the most common cause is degenerative disease (such as arthritis). The slip usually occurs between the fourth and fifth lumbar vertebrae. It is more common in adults over 65 and women.

Other causes of spondylolisthesis include stress fractures (commonly seen in gymnasts) and traumatic fractures. Spondylolisthesis may occasionally be associated with bone diseases.

Spondylolisthesis may vary from mild to severe. It can produce increased lordosis (swayback), but in later stages may result in kyphosis (roundback) as the upper spine falls off the lower spine.

Symptoms may include:

- Lower back pain
- Pain in the thighs and buttocks
- Stiffness
- Muscle tightness
- Tenderness in the slipped area

Pain generally occurs with activity and is better with rest. Neurological damage (leg weakness or changes in sensation) may result from pressure on nerve roots, and may cause pain radiating down the legs.

Inflammatory Conditions and Arthritis

Inflammatory disorders and arthritis syndromes can produce inflammation in the spine.

Ankylosing spondylitis is a chronic inflammation of the spine that may gradually result in a fusion of vertebrae. Symptoms include a slow development of back discomfort, with pain lasting for more than 3 months. The back is usually stiff in the morning; pain improves with movement or exercise. In severe cases, the patient stands or sits stooped over. It can be quite mild, however, and it rarely affects a person's ability to work. It occurs mostly in young Caucasians in their mid-20s. The disease is more common in men, but about 30% of the cases are in women. Researchers believe that in most cases the cause is hereditary.

About 20% of people with inflammatory bowel disease and about 20% of people with psoriasis develop a similar form of arthritis involving the spine. There are multiple treatments for this potentially disabling disease, including various immune suppressant medications. Etanercept (Enbrel) and infliximab (Remicade), anti-inflammatory agents known as TNF-blockers, are proving to be beneficial.

Osteoporosis and Compression Fractures

Osteoporosis is a disease of the skeleton in which the amount of calcium present in the bones slowly decreases to the point where the bones become fragile and prone to fractures. It usually does not cause pain unless the vertebrae collapse suddenly, in which case the pain is often severe. More than one vertebra may be affected.

In a compression fracture of the vertebrae, the bone tissue of the vertebra collapses. More than one vertebra may collapse as a result. When the fracture is the result of osteoporosis, the vertebrae in the thoracic (chest) and lower spine are usually affected, and symptoms may be worse with walking.

With multiple fractures, kyphosis (a forward hump-like curvature of the spine) may result. In addition, compression fractures are often responsible for loss of height. Pressure on the spinal cord may also occur, producing symptoms of numbness, tingling, or weakness. Symptoms depend upon the area of the back that is affected; however, most fractures are stable and do not produce neurological symptoms. [For more information, see *In-Depth Report #18*: Osteoporosis.]

Back Pain Emergencies

Several serious conditions can also cause back pain. Often, these symptoms develop over a short period of time, become more severe, and may have other findings that go along with them. Some of these conditions include:

- Infection in the bone (osteomyelitis) or the disk (diskitis)
- Cancer that has spread to the spine from another part of the body (most commonly lung cancer, colon cancer, prostate cancer, and breast cancer)
- Cancer that begins in the bones (the most common diagnosis in adults is probably multiple myeloma, seen in middle age or older adults); benign tumors such as osteoblastoma or neurofibroma and cancers, including leukemia, can also cause back pain in children
- Trauma

Miscellaneous Abnormalities and Diagnoses

Any abnormality in joints, vertebrae, or nerve roots can cause back pain, including:

- Fibromyalgia.
- Other medical conditions that cause referred back pain, occurring in conjunction with problems in organs unrelated to the spine (although usually located near it); such conditions include ulcers, kidney disease (including kidney stones), ovarian cysts, and pancreatitis.
- Chronic uterine or pelvic infections can cause low back pain in women.
- The facet joints (z-joints) can wear down; in such cases, pain occurs on arching the back or when walking.
- In some cases a segment (consisting of two vertebrae and their common joint and disk) becomes unstable when its parts wear down.
- Injury to nerve roots, notably deep root ganglia (nerve cells in the spine whose fibers extend from skin to muscle tissue), may be important in some cases; some patients may have scar tissue that traps the nerve roots in the lower spine and causes sciatica.

Risk Factors

In most known cases, pain begins with an injury, after lifting a heavy object, or after making a sudden movement. Not all people have back pain after such injuries, however. In the majority of back pain cases, the causes are unknown.

Aging

Intervertebral disks begin deteriorating and growing thinner by age 30. One-third of adults over 20 show signs of herniated disks (although only 3% of these disks cause symptoms). As people continue to age and the disks lose moisture and shrink, the risk for spinal stenosis increases. The incidence of low back pain and sciatica increases in women at the time of menopause as they lose bone density. In older adults, osteoporosis and osteoarthritis are also common. However, the risk for low back pain does not mount steadily with increasing age, which suggests that at a certain point, the conditions causing low back pain plateau.

High-Risk Occupations

Jobs that involve lifting, bending, and twisting into awkward positions, as well as those that cause whole-body vibration (such as long-distance truck driving), place workers at particular risk for low back pain. The longer a person continues such work, the higher their risk. Some workers wear back support belts, but evidence strongly suggests that they are useful only for people who currently have low back pain. The belts offer little added support for the back and do not prevent back injuries.

A number of companies are developing programs to protect against back injuries. However, studies have been mixed on the outcome of company interventions. Employers and workers should make every effort to create a safe working environment. Office workers should have chairs, desks, and equipment that support the back or help maintain good posture.

Low back pain accounts for significant losses in workdays and dollars. According to the Bureau of Labor Statistics, back pain was responsible for around 60% of cases of people missing work due to pain involving the upper body. A 2004 study analyzed health care expenses in the United States. The analysis found back pain cost over $90 billion, of which $26 billion was spent directly on treating the back pain.

Osteoporosis is a condition characterized by progressive loss of bone density, thinning of bone tissue, and increased vulnerability to fractures. Osteoporosis may result from disease, dietary or hormonal deficiency, or advanced age. Regular exercise and vitamin and mineral supplements can reduce and even reverse loss of bone density.

Medical Conditions in Children

Persistent low back pain in children is more likely to have a serious cause that requires treatment than back pain in adults.

Stress fractures (spondylolysis) in the spine are a common cause of back pain in young athletes. Sometimes a fracture may not show up for a week or two after an injury. Spondylolysis can cause spondylolisthesis, a condition in which the spine becomes unstable and the vertebrae slip over each other.

Hyperlordosis is an inborn exaggerated inward curve in the lumbar area. Scoliosis, an abnormal curvature of the spine in children, does not usually cause back pain.

Juvenile chronic arthropathy is an inherited form of arthritis. It can cause pain in the sacrum and hip joints of children and young people. It used to be grouped under juvenile rheumatoid arthritis, but is now defined as a separate problem.

Injuries can also cause back pain in children.

Pregnancy

Pregnant women are prone to back pain due to a shifting of abdominal organs, the forward redistribution of body weight, and the loosening of ligaments in the pelvic area as the body prepares for delivery. Tall women are at higher risk than short women.

Psychological and Social Factors

Psychological factors are known to play a strong influential role in three phases of low back pain:

- Some evidence suggests preexisting depression and the inability to cope may be more likely to predict the onset of pain than physical problems. A "passive" coping style (not wanting to confront problems) was strongly associated with the risk of developing disabling neck or low back pain.
- Social and psychological factors, as well as job satisfaction, all play a role in the severity of a person's perception of back pain. For example, one study compared truck drivers and bus drivers. Nearly all the truck drivers liked their work. Half of them reported low back pain but only 24% lost time at work. Bus drivers, on the other hand, reported much lower job satisfaction than truck drivers, and these workers with back pain had a significantly higher absentee rate than truck drivers in spite of less stress on their backs. Similarly, another study found that pilots, who generally reported "loving their jobs," reported far fewer back problems than their flight crews. And yet another study reported that low rank, low social support, and high stress in soldiers was associated with a higher risk for disabling back pain.
- Depression and a tendency to develop physical complaints in response to stress also increase the likelihood that acute back pain will become a chronic condition. The way a patient perceives and copes with pain at the beginning of an acute attack may actually condition the patient to either recover or develop a chronic condition. Those who over-respond to pain and fear for their long-term outlook tend to feel out of control and become discouraged, increasing their risk for long-term problems.

Studies also suggest that patients who reported prolonged emotional distress have less favorable outcomes after back surgeries. It should be strongly noted that the presence of psychological factors in no way diminishes the reality of the pain and its disabling effects. Recognizing this presence as a strong player in many cases of low back pain, however, can help determine the full range of treatment options.

Diagnosis

Although most episodes of new back pain, as well as exacerbations of chronic back pain, clear up or return to a previous level of discomfort, a medical history and a brief physical examination is always necessary. Depending on the severity of the symptoms, how long they have been present, and any associated medical problems, history and physical exam alone may or may not be sufficient.

Medical History

The patient should be able to describe the back pain and its history in the following manner:

- Frequency, duration, and nature of the pain
- When the pain occurs
- What triggered the pain (such as lifting a heavy object)
- Conditions that make the pain worse, such as coughing
- Other relevant symptoms, such as morning stiffness, weakness, or numbness in the legs
- Previous episodes of back pain
- Severity of the pain and how it affects the person's ability to perform everyday activities or work activities
- Any situation that relieves the pain
- Any history of injuries or accidents involving the neck, back, or hips
- Other medical conditions, such as arthritis or osteoporosis

A patient should report any serious health problems, symptoms, and concerns that may raise a red flag for a more serious condition. These include:

- HIV infection or AIDS
- Pain that is persistently increasing in intensity and cannot be relieved
- Fever that is associated with the back pain
- Any new or worsening neurological symptoms, such as weakness in a specific part of the legs or feet
- History of cancer, or currently being treated for cancer
- Problems emptying the bowels or bladder, including incontinence
- Unexplained weight loss

Physical Examination

The main goal of a physical exam is to try and determine the source of the pain and the limits of movement.

- Patients are asked to sit, stand, and walk in different ways (flat-footed, on the toes, and on their heels).
- Patients will be requested to bend forward, backward, and sideways and to twist.
- Patients will be asked to lift their leg straight up while lying down. The health care provider will also move the patient's legs in different positions and bend and straighten the knees. (Pain caused by sciatica can be intensified by lifting the affected leg straight in the air. It is usually sharp, localized, and accompanied by numbness or tingling. Pain caused by inflammation is duller and more generalized and not affected by lifting a straight leg.)
- The health care provider may measure the circumference of the calves and thighs to look for muscle wasting.

- To test nerve function and reflexes, the health care provider will tap the knees and ankles with a rubber hammer. The health care provider may also touch parts of the body lightly with a pin, cotton swab, or feather to test for numbness and nerve sensitivity.
- The health care provider will assess strength in different muscle groups of the legs.

Imaging Techniques

Imaging tests used to evaluate back pain range from a simple x-ray to a CT scan or MRI of the spine. Depending on medical diagnoses that are identified by the history, the patient may need such tests as a Dual energy X-ray absorptiometry (DEXA) scan for osteoporosis or a nuclear scan for suspected arthritis, cancer, or infection.

Because most patients with back pain are on the mend or completely recovered within 6 weeks, imaging techniques such as x-rays or scans are rarely recommended in the first month unless the health care provider suspects a tumor, fracture, infection, cauda equina syndrome, or progressive neurological disease.

Even when symptoms last longer, unless a potentially serious diagnosis is suspected, MRI or CT scans can often be delayed until the time when surgery or epidural steroid injections come into consideration as treatment options.

X-Rays. Many patients with acute and uncomplicated low back pain believe that plain x-rays of the spinal column are important in a diagnosis. However, they are not very helpful in most patients with nonspecific back pain.

Patients who have the following symptoms or experience certain events may need more sophisticated imaging studies:

- Significant pain that lasts more than 1 - 2 months
- Symptoms such as pain, numbness, or tingling extending from the buttocks down the leg that are very severe or get worse
- Muscle weakness that is significant, persistent, or getting worse
- A previous accident or injury that might have affected the disks or vertebra
- A history of cancer
- Indications of an underlying disease such as fever or unexplained weight loss
- New pain that occurs in patients over 65 years of age

Magnetic Resonance Imaging (MRI). Magnetic resonance imaging (MRI) can provide very well-defined images of soft tissue and bone. The test is not painful or dangerous, but some people may feel claustrophobic in scanners where they are fully enclosed. MRIs can detect tears in the disks, disk herniation, or disk fragments. It can also detect spinal stenosis. and non-spinal causes of back pain, including infection and cancer.

MRI scans often detect spine abnormalities that are not causing symptoms in the patient. At least 40% of *all* adults have bulging or protruding vertebral disks, and most have no back pain. Also, the degree of disk abnormalities revealed by MRIs often has very little to do with the severity of

the pain or the need for surgery. Disk abnormalities in people who have back pain may simply be a coincidence rather than an indication for treatment.

Patients are also more likely to think of themselves as having a serious back problem if abnormalities are identified on MRI scans, even if the scans do not result in treatment changes. This perception may sometimes slow down their recovery.

CT stands for computerized tomography. In this procedure, a thin x-ray beam is rotated around the area of the body to be visualized. Using very complicated mathematical processes called algorithms the computer is able to generate a 3-D image of a section through the body. CT scans are very detailed and provide excellent information for the doctor.

Bone Scintigraphy and SPECT Imaging. In rare cases, doctors may use bone scintigraphy (bone scanning) to determine abnormalities in the bones. The technique may be useful for early detection of spinal fractures, cancer that has spread to the bone, or certain inflammatory arthritic conditions. During this exam, a small amount of radioactive material is injected into a vein. It circulates through the body, and is absorbed by the bones. The bones can then be seen using x-rays or *single photon emission computed tomography* (SPECT).

An *x-ray myelogram* is an x-ray of the spine that requires a spinal injection of a special dye and the need to lie still for several hours to avoid a very painful headache. It has value only for select patients with pain on moving and standing. It has largely been replaced by CT and MRI scans.

Electrodiagnostic Tests

Tests that analyze the electric waveforms of nerves and muscles may be useful for detecting nerve abnormalities that may be causing back pain, and identifying possible injuries. They are also useful to determine if any abnormal structural findings on an MRI or other imaging tests have real significance as a cause of back pain. It should be noted that any nerve injuries that affect these tests may not be present for 2 - 4 weeks after symptoms begin.

Nerve conduction studies and electromyography are the electrodiagnostic tests most commonly performed. These tests are not used often in the evaluation and management of patients with low back pain.

Other Tests

Diskography: Since many people have evidence of disk degeneration on their MRI scans, it is not always easy to tell if the finding on this MRI scan explains pain the patient may be experiencing. Diskography is a test that is used to help determine whether an abnormal disk seen on MRI explains someone's pain. When performed, it is generally reserved for patients who did not experience relief from other therapies, including surgery. This procedure requires injections into disks suspected of being the source of pain and disks nearby. It can be painful. There is controversy among physicians who take care of the spine regarding the usefulness of diskography for making decisions about care, particularly surgery

Blood and urine samples may be used to test for infections, arthritis, or other conditions.

Injecting a drug that blocks pain into the nerves in the back helps locate the level in the spine where problems occur.

A procedure called a facet block is also useful in locating areas of specific damage.

Medications

Patients should understand that most people who have sudden low back pain, even with sciatica, have a high likelihood of substantial improvement over the first month.

The most commonly prescribed medications for the treatment of back pain are nonsteroidal anti-inflammatory drugs (NSAIDs). Evidence suggests that short-term use of NSAIDs brings effective relief in patients with acute back pain. The benefits of NSAIDs for chronic back pain are less certain.

There are dozens of available NSAIDs:

- Over-the-counter (OTC) NSAIDs include aspirin, ibuprofen (Motrin IB, Advil, Nuprin, Rufen), naproxen (Aleve), ketoprofen (Actron, Orudis KT).
- Prescription NSAIDs include ibuprofen (Motrin), naproxen (Naprosyn, Anaprox), flurbiprofen (Ansaid), diclofenac (Voltaren), tolmetin (Tolectin), ketoprofen (Orudis, Oruvail), and dexibuprofen (Seractil).
- Taking NSAIDs with food can reduce stomach discomfort, although it may slow down the pain-relieving effect.

In April 2005, the Food and Drug Administration (FDA) asked drug manufacturers of prescription NSAIDs to include with their products the same warning label used for the COX-2 inhibitor celecoxib (Celebrex). This "black box" warning, the FDA's strongest, emphasizes the increased risks for cardiovascular events (heart-related problems) and gastrointestinal (digestive tract) bleeding associated with the use of these drugs. The FDA also requested manufacturers of OTC NSAIDs to be more specific in their labels concerning potential cardiovascular and gastrointestinal risks. Due to its proven heart benefits, aspirin was excluded from these labeling revisions. In December 2006, the FDA proposed even stronger labeling changes to highlight the potential of these drugs to cause liver damage, as well as risks of alcohol and drug interactions with NSAIDs.

Long-term, regular use of NSAIDs can increase the risk for heart attack, especially for people who have a heart condition. Long-term use of NSAIDs is also the second most common cause of ulcers and gastrointestinal bleeding. To reduce the risks associated with NSAIDs, take the lowest dose possible for pain relief.

Other possible side effects of NSAIDs may include:

- Upset stomach
- Dyspepsia (burning, bloated feeling in pit of stomach)
- Drowsiness
- Skin bruising
- High blood pressure
- Fluid retention
- Headache
- Rash
- Reduced kidney function

NSAID-Induced Ulcers and Gastrointestinal Bleeding

Long-term use of NSAIDs is the second most common cause of ulcers. Ulcers caused by NSAIDs are more likely to bleed than those caused by the bacteria *Helicobacter pylori*.

Those at high risk for bleeding include people over age 60, anyone with a history of ulcers or gastrointestinal bleeding, patients with serious heart conditions, people who abuse alcohol, and those who take medications such as anticoagulants (blood thinners) and corticosteroids.

Proton-pump inhibitor (PPI) drugs may help prevent and heal ulcers caused by NSAIDs. PPIs include omeprazole (Prilosec), esomeprazole (Nexium), and lansoprazole (Prevacid).

COX-2 Inhibitors (Coxibs). Coxibs inhibit an inflammation-promoting enzyme called COX-2. This drug class was initially thought to provide benefits equal to NSAIDs but cause less gastrointestinal distress. However, following numerous reports of heart problems, skin rashes, and other adverse effects, the FDA re-evaluated the risks and benefits of this drug class. This lead to the removal of rofecoxib (Vioxx) and valdecoxib (Bextra) from the United States market. Celecoxib (Celebrex) is still available, but patients should ask their doctor whether the drug is appropriate and safe for them. In December 2006, the FDA approved celecoxib for the relief of symptoms of juvenile rheumatoid arthritis in patients ages 2 years and older.

An ulcer is a crater-like lesion on the skin or mucous membrane that is caused by an inflammatory, infectious, or cancerous condition. To avoid irritating an ulcer, stop smoking and try to eliminate certain substances from your diet, including caffeine and alcohol. Prescription medicines are available to suppress the acid in the stomach that causes erosion of the stomach lining. Endoscopic therapy can be used to stop ulcer-related bleeding.

Tramadol

Tramadol (Ultram) is a pain reliever that has been used as an alternative to opioids. While the drug has opioid-like properties, it is not as addictive. (Dependence and abuse have been reported, however.) It can cause nausea, but does not cause the severe gastrointestinal problems that NSAIDs can. Some patients who take tramadol experience severe itching. A combination of

tramadol and acetaminophen (Ultracet) is now available. It provides more rapid pain relief than tramadol alone.

Opioid Pain Relievers

Narcotics are pain-relievers that act on the central nervous system. They are the most powerful medications available for the management of pain.

There are two types of narcotics:

- *Opiates*, such as morphine and codeine, are derived from natural opium.
- *Opioids* are synthetic drugs and include oxycodone (Percodan, Percocet, OxyContin), hydrocodone (Vicodin), and oxymorphone (Numorphan).

Opioids are effective for short-term relief of back pain. Using them for longer than 16 weeks to treat low back pain has not been well studied and may increase the risk of abuse, if a health care provider does not manage usage well.

Newer ways to deliver pain medicine have been developed. A skin patch containing an opioid called transdermal fentanyl (Duragesic) may relieve chronic back pain more effectively than oral opioids.

Common side effects of opioids include anxiety, constipation, nausea, vomiting, dizziness, drowsiness, paranoia, urinary retention, restlessness, and labored or slow breathing. Addiction is a risk, although less than is commonly believed when these medications are used for pain relief. In fact, when prescribed properly, use of opioids for chronic pain can be safer in some cases than on-going use of NSAIDs. Unfortunately, opioid abuse among young people is a major concern. Unless the pain is very severe, experts advise against routinely prescribing opioids.

Epidural Steroid Injections

Injections of corticosteroids (commonly called steroids) are sometimes used to treat low back pain caused by nerve impingement. The injection is placed into the epidural space, just inside the outer membrane covering the spine.

The injection is directed as close to the location of the affected nerve as possible. Corticosteroids reduce inflammation.

Studies that measure the benefits of steroid injections on sciatica or low back pain are conflicting.

No high quality studies have shown that these injections provide long-term benefit for most patients, compared to more conservative treatments. However, reasonable evidence shows that patients receive short-term pain relief, generally over a 1 - 2 month period, from these injections.

Serious and painful side effects, including meningitis and inflammation, are possible. However, such risks are very low.

Epidural steroid injections for spinal stenosis may provide short-term relief of pain but generally do not improve the patient's daily functioning, nor do they help patients avoid surgery.

Botulinum Toxin Injections

Researchers are investigating whether injections of botulinum toxin (Botox) in the lower back can safely and effectively relieve pain. Botox is commonly used to smooth out wrinkles and to treat other neuromuscular disorders. Very small amounts of Botox temporarily paralyze muscle tissue. Some studies have suggested that Botox may be of help in relieving chronic low back pain but its role in the treatment of back pain has not yet been determined.

Antidepressants

Some studies show that antidepressants may lessen the severity of pain in some patients, although they have little effect on daily functioning. Antidepressants called tricyclics may be effective painkillers in non-depressed people with chronic back pain. Such antidepressants include amitriptyline (Elavil, Endep), desipramine (Norpramin), doxepin (Sinequan), imipramine (Tofranil), amoxapine (Asendin), nortriptyline (Pamelor, Aventyl), and maprotiline (Ludiomil).

Tricyclics can have severe side effects. Nonetheless, experts believe there is a useful role for these drugs that warrants further investigation.

A recent review of existing studies found no clear evidence that antidepressants help people with chronic low back pain. However, the reviewers noted that antidepressants help in other cases of chronic pain and that additional, larger studies are needed to clarify their effect on chronic low back pain.

Muscle Relaxants

A combination of nonsteroidal anti-inflammatory drugs and muscle relaxants -- such as cyclobenzaprine (Flexeril), diazepam (Valium), carisoprodol (Soma), or methocarbamol (Robaxin) -- are sometimes used for patients with acute low back pain. Evidence has shown that they can help relieve non-specific low back pain, but some experts warn that these drugs should be used cautiously, since they target the brain, not the muscles. Patients who take muscle relaxants may experience a number of central nervous system side effects, such as drowsiness. The muscle relaxant Soma can be addictive and does little more than induce sleep.

Herbs and Supplements

Generally, manufacturers of herbal remedies and dietary supplements do not need FDA approval to sell their products. Just like a drug, herbs and supplements can affect the body's chemistry, and therefore have the potential to produce side effects that may be harmful. There have been a

number of reported cases of serious and even lethal side effects from herbal products. Always check with your doctor before using any herbal remedies or dietary supplements.

Most herbal remedies used for back pain are said to have both pain-relieving and anti-inflammatory effects. A few have been found to have some benefit when compared to placebo or sugar pill. However, none of these have been compared to other standard treatments.

White willow bark, bromelain, and Boswellia have blood-thinning properties and can interfere with anticoagulant medications, such as warfarin (Coumadin).

Other Treatments

A number of complementary and alternative treatments are used to relieve back pain. Complementary means it is used together with conventional medicine. Alternative means it is done in place of conventional medicine.

Acupuncture

Acupuncture is now a common alternative treatment for certain kinds of pain. It involves inserting small needles or exerting pressure on certain "energy" points in the body. When the pins have been placed successfully, the patient is supposed to experience a sensation that brings a feeling of fullness, numbness, tingling, and warmth with some soreness around the acupuncture point. Unfortunately, rigorous studies of acupuncture are difficult to perform, and most evidence on its benefits is weak. In any case, it may be specifically helpful for certain patients with back pain, such as pregnant women, who must avoid medications. Anyone who undergoes acupuncture should be sure it is performed in a reputable location by experienced practitioners who use sterilized equipment.

Acupuncture has not shown any benefits for acute low back pain in most patients, but may provide some help for patients with chronic low back pain.

Massage Therapy

Some studies have shown that massage therapy can help some patients with chronic or acute back pain, especially when combined with exercise and patient education.

Cognitive-Behavioral Therapy

Some studies report that a course of cognitive-behavioral therapy helps reduce chronic back pain, or at least enhances the patient's ability to deal with it. The primary goal of this form of therapy in such cases is to change the distorted perceptions that patients have of themselves, and change their approach to pain. Patients use specific tasks and self-observations to help them change their thinking. They gradually shift their perception of helplessness against the pain that dominates their lives into the perception that pain is only one negative among many positives and, to a degree, a manageable experience.

Spinal Manipulation

Chiropractors typically perform spinal manipulations, but so do osteopathic doctors.

- One in three people with low back pain seeks treatment from a chiropractor. Chiropractic was founded in the U.S. in the late 1800s. The specific goal of chiropractors is to perform spinal manipulations to improve nerve transmission. Many studies have now confirmed that patients feel more satisfied with their chiropractic care than with treatment from general practitioners.
- Osteopathy was also founded in the 1800s, and its core approach to healing also involves physical manipulation. Osteopathy manipulates the bones, muscles, and tendons to optimize blood circulation. The general direction of osteopathy over the years has widened to employ a broader range of treatments, which now approach those of standard medicine.

Spinal Manipulation for Uncomplicated Low Back Pain.

There is evidence of benefit for spinal manipulation treatment of subacute pain and exacerbations of chronic pain. Ongoing or maintenance spinal manipulation has not been proven to alter the course of chronic back pain.

Mild and temporary side effects from spinal manipulation are common. The potential for serious adverse effects from low back manipulations is low.

Some chiropractors may take a lot of x-rays, particularly those of the full spine, which may have long-term harmful consequences. Patients should also be aware that some chiropractors use alternative treatments that have not been proven or rigorously studied. All patients should require objective evidence on the benefits of their treatments.

Electrical Stimulation

Percutaneous Neuromodulation Therapy. A technique called percutaneous neuromodulation therapy (PNT) uses a small device that delivers electrical stimulation to deep tissues and nerve pathways near the spine.

Electrical Nerve Stimulation. Transcutaneous electrical nerve stimulation (TENS) uses low-level electrical pulses to suppress back pain. A variant of this procedure, percutaneous electrical nerve stimulation (PENS), applies these pulses through a small needle to acupuncture points.

When tested in high-quality studies, electrical nerve stimulation has not been found to provide much help.

Exercise and Physical Therapy

The Role of Physical Therapy

Physical therapy with a trained professional may be useful if pain has not improved after 3 - 4 weeks. It is important for any person who has chronic low back pain to have an exercise program. Professionals who understand the limitations and special needs of back pain, and can address individual health conditions, should guide this program. One study indicated that patients who planned their own exercise program did worse than those in physical therapy or doctor-directed programs.

Physical therapy typically includes the following:

- Education and training the patient in correct movement.
- Exercises to help the patient keep the spine in neutral positions during all daily activities.

Incorrect movements or long-term high-impact exercise is often a cause of back pain in the first place. People vulnerable to back pain should avoid activities that put undue stress on the lower back or require sudden twisting movements, such as football, golf, ballet, and weight lifting.

Exercises performed after a simple diskectomy do not seem to provide much added benefit over time.

Specific and regular exercise under the guidance of a trained professional is important for reducing pain and improving function, although patients often find it difficult to maintain therapy.

Exercise and Acute or Subacute Back Pain

Exercise does not help acute back pain. In fact, overexertion may cause further harm. Beginning after 4 - 8 weeks of pain, however, a rehabilitation program may benefit the patient.

An incremental aerobic exercise program (such as walking, stationary biking, and swimming) may begin within 2 weeks of symptoms. Jogging is usually not recommended, at least not until the pain is gone and muscles are stronger.

Patients should avoid exercises that put the lower back under pressure until the back muscles are well toned. Such exercises include leg lifts done in a facedown position, straight leg sit-ups, and leg curls using exercise equipment.

In all cases, patients should never force themselves to exercise if, by doing so, the pain increases.

Exercise and Chronic Back Pain

Exercise plays a very beneficial role in chronic back pain. Repetition is the key to increasing flexibility, building endurance, and strengthening the specific muscles needed to support and

neutralize the spine. Exercise should be considered as part of a broader program to return to normal home, work, and social activities. In this way, the positive benefits of exercise not only affect strength and flexibility but also alter and improve patients' attitudes toward their disability and pain. Exercise may also be effective when combined with a psychological and motivational program, such as cognitive-behavioral therapy.

There are different types of back pain exercises. Stretching exercises work best for reducing pain, while strengthening exercises are best for improving function.

Exercises for back pain include:

- *Low Impact Aerobic Exercises.* Low-impact aerobic exercises, such as swimming, bicycling, and walking can strengthen muscles in the abdomen and back without over-straining the back. Programs that use strengthening exercises while swimming may be a particularly beneficial approach for many patients with back pain. Medical research has shown that pregnant women who engaged in a water gymnastics program have less back pain and are able to continue working longer.
- *Spine Stabilization and Strength Training.* Exercises called lumbar extension strength training are proving to be effective. Generally, these exercises attempt to strengthen the abdomen, improve lower back mobility, strength, and endurance, and enhance flexibility in the hip, the hamstring muscles, and the tendons at the back of the thigh.
- *Yoga, Tai Chi, Chi Kung.* Practices originating in Asia that combine low-impact physical movements and meditation may be very helpful. They are designed to achieve a physical and mental balance and can be very helpful in preventing recurrences of low back pain.
- *Flexibility Exercises.* Flexibility exercises may help reduce pain. A stretching program may work best when combined with strengthening exercises.

Specific Exercises for Low Back Strength

Perform the following exercises at least three times a week:

Partial Sit-ups. Partial sit-ups or crunches strengthen the abdominal muscles.

- Keep the knees bent and the lower back flat on the floor while raising the shoulders up 3 - 6 inches.
- Exhale on the way up, and inhale on the way down.
- Perform this exercise slowly 8 - 10 times with the arms across the chest.

Pelvic Tilt. The pelvic tilt alleviates tight or fatigued lower back muscles.

- Lie on the back with the knees bent and feet flat on the floor.
- Tighten the buttocks and abdomen so that they tip up slightly.
- Press the lower back to the floor, hold for one second, and then relax.
- Be sure to breathe evenly.

Over time increase this exercise until it is held for 5 seconds. Then, extend the legs a little more so that the feet are further away from the body and try it again.

Stretching Lower-Back Muscles. The following are three exercises for stretching the lower back:

- Lie on the back with knees bent and legs together. Keeping arms at the sides, slowly roll the knees over to one side until totally relaxed. Hold this position for about 20 seconds (while breathing evenly) and then repeat on the other side.
- Lying on the back, hold one knee and pull it gently toward the chest. Hold for 20 seconds. Repeat with the other knee.
- While supported on hands and knees, lift and straighten right hand and left leg at the same time. Hold for 3 seconds while tightening the abdominal muscles. The back should be straight. Alternate with the other arm and leg and repeat on each side 8 - 20 times.

Note: No one with low back pain should perform exercises that require bending over right after getting up in the morning. At that time, the disks are more fluid-filled and more vulnerable to pressure from this movement.

Surgery and Invasive Procedures

The health care provider should give patients solid information on the expected course of their low back pain and self-care options before discussing surgery. Patients should ask their health care provider about evidence favoring surgery or other (nonsurgical) treatments in their particular case. They should also ask about the long-term outcome of the recommended treatment. Would the improvements last and, if so, for how long? Another consideration when surgery is an option is the overall safety of the recommended procedure, weighed against its potential short-term benefits and its benefits in the long run.

Patients should generally try all possible non-surgical treatments before opting for surgery. The most common reasons for surgery for low back pain are disk herniation and spinal stenosis. The vast majority of back pain patients will not need aggressive medical or surgical treatments.

Nevertheless, when it is appropriate, surgery can provide great relief. Many approaches and procedures are available or being investigated. However, there have been few well-conducted studies to determine if any type of back pain surgery works better than others, or if a single procedure is better than no surgery at all.

It should be noted that surgery does not always improve outcome and, in some cases, can even make it worse. Surgery can be an extremely effective approach, however, for certain patients whose severe back pain does not respond to conservative measures.

Diskectomy

Diskectomy is the surgical removal of the diseased disk. The procedure relieves pressure on the spine. It has been performed for 40 years, and increasingly less invasive techniques developed over time. However, few studies have been conducted to determine the procedure's real

effectiveness. In appropriate candidates it provides faster relief than medical treatment, but long-term benefits (over 5 years) are uncertain.

Diskectomy is recommended when a herniated disk causes one or more of the following:

- Leg pain or numbness that are severe or persistent, making it hard for the patient to perform daily tasks
- Weakness in the muscles of the lower leg or buttocks
- An inability to control bowel movements or urination

Most other people with low back or neck pain, numbness, or even mild weakness are often first treated without surgery. Often, many of the symptoms of low back pain caused by a herniated disc get better or disappear over time, without surgery.

When the soft, gelatinous central portion of an intervertebral disk is forced through a weakened part of a disk, it is called a slipped disk. Most slipped disks (herniated disks) take place in the lumbar area of the spine. Slipped disks are one of the most common causes of lower back pain. The mainstay of treatment is an initial period of rest with pain and anti-inflammatory medications followed by physical therapy. If pain and symptoms persist, surgery to remove the herniated portion of the intervertebral disk may be needed.

Microdiskectomy. Microdiskectomy is the current standard procedure. It is performed through a small incision (1 to 1-1/2 inch). The back muscles are lifted and moved away from the spine. After identifying and moving the nerve root, the surgeon removes the injured disk tissue under it. The procedure does not change any of the structural supports of the spine, including joints, ligaments, and muscles.

Other, less invasive procedures are available, including endoscopic diskectomy, percutaneous diskectomy (PAD), and laser diskectomy. The long-term benefits are of these procedures are unknown, however. There is currently no evidence that any of these less-invasive procedures are as effective as the standard microdiskectomy.

Complications and Outlook. Most people achieve pain relief and can move better after microdiskectomy. Numbness and tingling should get better or disappear. Your pain, numbness, or weakness may NOT get better or go away if the disk damaged your nerve before surgery.

Scar tissue is a potential problem, since it can cause persistent low back pain afterward Other complications of spinal surgery can include nerve and muscle damage, infection, and the need for another operation.

Patients are usually up and walking soon after disk surgery. It may take 4 - 6 weeks for full recovery, however. Gentle exercise may be recommended at first. Starting intensive exercise 4 - 6 weeks after a first-time disk surgery appears to be very helpful for speeding up recovery. Little or no physical therapy is usually needed.

Laminectomy

Laminectomy is surgery to remove either the lamina, two small bones that make up a vertebra, or bone spurs in your back. Laminectomy opens up your spinal canal so your spinal nerves or spinal cord have more room. It is often done along with a diskectomy, foraminotomy, and spinal fusion.

Laminectomy is frequently done to treat spinal stenosis. You and your doctor can decide when you need to have surgery for your condition. Spinal stenosis symptoms often become worse over time, but this may happen very slowly. When your symptoms become more severe and interfere with your daily life or your job, surgery may help.

Laminectomy for spinal stenosis will often provide full or partial relief of symptoms for many patients, but it is not always successful

Future spine problems are possible for all patients after spine surgery. If you had spinal fusion and laminectomy, the spinal column above and below the fusion are more likely to have problems in the future. If you needed more than one kind of back surgery (such as laminectomy and spinal fusion), you may have more of a chance of future problems.

Some recurrence of back pain and sciatica occurs in half to two-thirds of postoperative patients. Minimally invasive variations are under investigation. For spinal stenosis, the traditional approach is a laminectomy and partial removal of the facet joint. There is controversy whether performing a fusion procedure along with these procedures is needed. Only a few randomized trials have compared this procedure with nonoperative treatment. Their results suggest that surgical treatment is better, at least over the first 2 years after surgery.

Spinal Fusion

Spinal fusion is surgery to fuse spine bones (vertebrae) that cause you to have back problems. Fusing means two bones are permanently placed together so there is no longer movement between them.

Spinal fusion is usually done along with other surgical procedures of the spine, such as a diskectomy, laminectomy, or a foraminotomy. It is done to prevent any movement in a certain area of the spine.

Conditions fusion may be done for include:

- Spinal stenosis
- Injury or fractures to the bones in the spine
- Weak or unstable spine caused by infections or tumors
- Spondylolisthesis, a condition in which one vertebrae slips forward on top of another
- Abnormal curvatures, such as those from scoliosis or kyphosis

The surgeon will use a graft (such as bone) to hold (or fuse) the bones together permanently. There are several different ways of fusing vertebrae together:

- Strips of bone graft material may be placed over the back part of the spine.
- Bone graft material may be placed between the vertebrae
- Special cages may be placed between the vertebrae. These cages are packed with bone graft material.

The surgeon may get the graft from different places:

- From another part of your body (usually around your pelvic bone). This is called an autograft. Your surgeon will make a small cut over your hip and remove some bone from the back of the rim of the pelvis.
- From a bone bank, in a procedure called an allograft.
- A synthetic bone substitute can also be used, but this is not common yet.

The vertebrae are often also fixed together with screws, plates, or cages. These are used to keep the vertebrae from moving until the bone grafts fully heal.

Future spine problems are possible for all patients after spine surgery. After spinal fusion, the area that was fused together can no longer move. Therefore, the spinal column above and below the fusion is more likely to be stressed when the spine moves, and develop problems later on. Also, if you needed more than one kind of back surgery (such as laminectomy and spinal fusion), you may have more of a chance of future back problems.

There are currently a number of video-assisted fusion techniques. These new techniques are less invasive than standard "open" surgical approaches, which use wide incisions. To date, however, the newer procedures have higher complication rates than the open approaches, and some medical centers have abandoned them.

Other Surgical Procedures

Percutaneous Vertebroplasty. Percutaneous vertebroplasty involves the injection of a cement-like bone substitute into vertebrae with compression fractures. It is done under endoscopic and x-ray guidance. The technique is proving useful for stabilizing the spine and relieving pain in patients with spinal compression fractures due to osteoporosis or cancer.

Warning: The Food and Drug Administration (FDA) has warned consumers that polymethylmethacrylate bone cement, used during vertebroplasty, could leak. Such leakage could cause damage to soft tissues and nerves. It is extremely important that the patient is sure that the health care provider has had significant experience performing the vertebroplasty procedure.

Percutaneous kyphoplasty. The health care provider injects bone cement into the space surrounding a fractured vertebra. (Vertebroplasty injects the cement directly into the vertebra.) Kyphoplasty is used to stabilize the spine and return spinal height to as normal as possible. Kyphoplasty should only be done if bed rest, medicines, and physical therapy do not relieve back pain. Those with severe fractures or spinal infections should not have kyphoplasty.

Artificial Disk Replacement. Total disk replacement is an investigative procedure for some patients with severely damaged disks. It is done instead of spinal fusion surgery, but has not yet been shown to be superior to it. The technique implants artificial disks (ProDisc, Link, SB Charite) consisting of two metal plates and a soft core. The surgery can be performed using a minimally invasive laparoscopic procedure, which is performed through tiny cuts using miniature tools and viewing devices. An artificial cushioning device called the prosthetic disk nucleus (PDN) replaces only the inner gel-like core (nucleus pulposus) within the intervertebral space, rather than the entire disk. . A possible benefit of these artificial disks is that they would allow more movement of the spine, and therefore prevent disk degeneration below and above the site of surgery (a frequent complication of spinal fusion). This benefit has not been yet been proven in large studies.

Intradiscal Electrothermal Treatment (IDET). Intradiscal electrothermal treatment (IDET) uses electricity to heat a painful disk. Heat is applied for about 15 minutes. Pain may temporarily feel worse, but after healing, the disk shrinks and becomes desensitized to pain. However, healing takes several weeks. While some studies have reported benefit, many consider the evidence to support the use of this procedure weak.

Prognosis

Most people with acute low back pain are back at work within a month and fully recover within a few months. According to one study, about a third of patients with uncomplicated low back pain significantly improved after a week; two-thirds recovered by 7 weeks.

However, studies now suggest that up to 75% of patients suffer at least one recurrence of back pain over the course of a year. After 4 years, fewer than half of patients may be symptom-free. Some doctors are approaching the problem as one that is not necessarily curable and that needs a consistent on-going approach.

Specific conditions can determine the rate of improvement. For example:

- In the majority of patients with herniated disks, the condition improves (although the actual physical improvement may be slower than the reduction in pain). Researchers attempted to identify factors most likely to predict an elevated risk for recurrent pain and found that only depression was a significant factor in the majority of those who had not recovered.
- Spinal stenosis stabilizes in about 70% of cases and worsens in 15%.

Prevention and Self-Care

Most patients should understand that they are likely to improve over the first month after their low back pain begins, often with no treatments.

Home Care Tips for Relieving Pain

- Resume normal activity as soon as possible. Bed rest is no longer recommended and may delay recovery. Activities should be done without strain or stretching.
- Avoid intense exercise and physical activity, particularly heavy lifting and trunk twisting, if there is acute back pain.
- Try an over-the-counter nonsteroidal anti-inflammatory such as aspirin or ibuprofen. These medicines often provide significant benefits.
- Apply heat (104° F) to the painful area. Heat may work better than ibuprofen or acetaminophen. One group of researchers found that people with low back pain who wear low-level heat wraps for 8 hours a day have significantly less pain and disability.
- Try alternating between hot and cold packs. Some doctors recommend changing from hot to cold every 3 minutes and repeating this sequence three times. Others believe ice packs should be applied first. This routine should be done two or three times during the day. (Note: Heat or cold treatments do not have much effect on sciatica.)
- Supportive back belts, braces, or corsets may help some people temporarily, but these products can reduce muscle tone over time and should be used only briefly.
- Get plenty of sleep. Healthy sleep plays a vital role in recovery. Avoid caffeine in the afternoon and evening, and unwind before bed by taking a warm bath or practicing relaxation techniques. It is often difficult to get a good night's sleep when suffering from back pain, particularly because the pain can intensify at night. Some people may need medicine to help manage nighttime pain or treat sleeplessness. Lying curled up in a fetal position with a pillow between the knees or lying on the back with a pillow under the knees may help.
- Yoga relieves low back pain better than conventional exercise or self-help books, according to a study published in the *Annals of Internal Medicine*. For the study, 101 adults with low back pain were randomly assigned to one of three groups. One group attended yoga classes and lessons; the second did aerobics, weight training, and stretching; the third group read a self-help book about back pain. After 12 weeks, those who took yoga could better perform daily activities requiring the back than those in the other two groups. After 26 weeks, those who took yoga had less pain and better back function, and used fewer pain relievers than the others.
- Exercise, diet, stress, and weight all have a significant influence on back pain. Changing certain lifestyle factors can help reduce, and possibly prevent, backaches.

Quit Smoking

Smokers are at higher risk for back problems, perhaps because smoking decreases blood circulation. The link may also be due to an unhealthy lifestyle in general. A British study found that young adults who were long-term smokers were nearly twice as likely to develop low back pain as nonsmokers were.

Exercise and Obesity

Sedentary Lifestyle. People who do not exercise regularly face an increased risk for low back pain, especially when they perform sudden, stressful activities such as shoveling, digging, or

moving heavy items. Although no definitive studies have been done to prove the relationship between lack of exercise and low back pain, some doctors believe that an inactive lifestyle may be to blame in some cases. Lack of exercise leads to the following conditions that may threaten the back:

- Stiff muscles can make it hard to move, rotate, and bend the back.
- Weak stomach muscles can increase the strain on the back and cause an abnormal tilt of the pelvis.
- Weak back muscles may increase the risk for disk compression.
- Obesity puts more weight on the spine and increases pressure on the vertebrae and disks. However, studies report only a weak association between obesity and low back pain.

Improper or Intense Exercise. Improper or excessive exercise may also increase one's chances for back pain.

- Some research suggests that over time, high-impact exercise may increase the risk for degenerative disk disease. A survey of people who played tennis, however, found no increased risk for low back pain or sciatica.
- Between 30 - 70% of cyclists experience low back pain. One study reported that 70% of cyclists reported improvement simply by adjusting the angle of the bicycle seat.
- Improper exercise instruction and inattention to body movements can lead to back trouble. For example, a single jerky golf swing or incorrect use of exercise equipment (especially free weights, nautilus, and rowing machines) can cause serious back injuries.

Tips for Daily Movement and Inactivity

The way a person moves, stands, or sleeps plays a major role in back pain.

- Maintaining good posture is very important. This means keeping the ears, shoulders, and hips in a straight line with the head up and stomach pulled in. It is best not to stand for long periods of time. If it is necessary, walk as much as possible and wear shoes without heels, preferably with cushioned soles. Use a low foot stool and alternate resting each foot on top of it.
- Sitting puts the most pressure on the back. Chairs should either have straight backs or low-back support. If possible, chairs should swivel to avoid twisting at the waist, have arm rests, and adjustable backs. While sitting, the knees should be a little higher than the hip, so a low stool or hassock is useful to put the feet on. A small pillow or rolled towel behind the lower back helps relieve pressure while either sitting or driving.
- Riding in or driving a car for long periods of time increases stress. Move the car seat as far forward as possible to avoid bending forward. The back of the seat should not be reclined more than 30 degrees. If possible, the seat bottom should be tilted slightly upward in front. A traveler should stop and walk around about every hour. Avoid lifting or carrying objects immediately after the ride.
- A common cause of temporary back pain in children is carrying backpacks that are too heavy. Backpacks should not weigh more than 20% of the child's body weight. They

should weigh even less for very young children. Emotional or behavioral problems may also contribute to back pain in children.

Tips for Lifting and Bending

Anyone who engages in heavy lifting should take precautions when lifting and bending.

- If an object is too heavy or awkward, get help.
- Spread your feet apart to give yourself a wide base of support.
- Stand as close as possible to the object being lifted.
- Bend at the knees, not at the waist. As you move up and down, tighten stomach muscles and tuck buttocks in so that the pelvis is rolled under and the spine remains in a natural "S' curve. (Even when not lifting an object, always try to use this posture when stooping down.)
- Hold objects close to the body to reduce the load on the back.
- Lift using the leg muscles, not those in the back.
- Stand up without bending forward from the waist.
- Never twist from the waist while bending or lifting any heavy object. If you need to move an object to one side, point your toes in that direction and pivot toward it.
- If an object can be moved without lifting, pull it, don't push.

There are four natural curves in the spinal column: the cervical, thoracic, lumbar, and sacral curvature. The curves, along with the intervertebral disks, help to absorb and distribute stresses that occur from everyday activities such as walking or from more intense activities such as running and jumping.

Resources

- www.niams.nih.gov -- National Institute of Arthritis and Musculoskeletal and Skin Diseases
- www.aaos.org -- American Academy of Orthopaedic Surgeons
- www.arthritis.org -- Arthritis Foundation
- www.spine.org -- North American Spine Society
- www.apta.org -- American Physical Therapy Association
- www.ampainsoc.org -- American Pain Society
- www.theacpa.org -- American Chronic Pain Association
- www.iasp-pain.org -- International Association for the Study of Pain