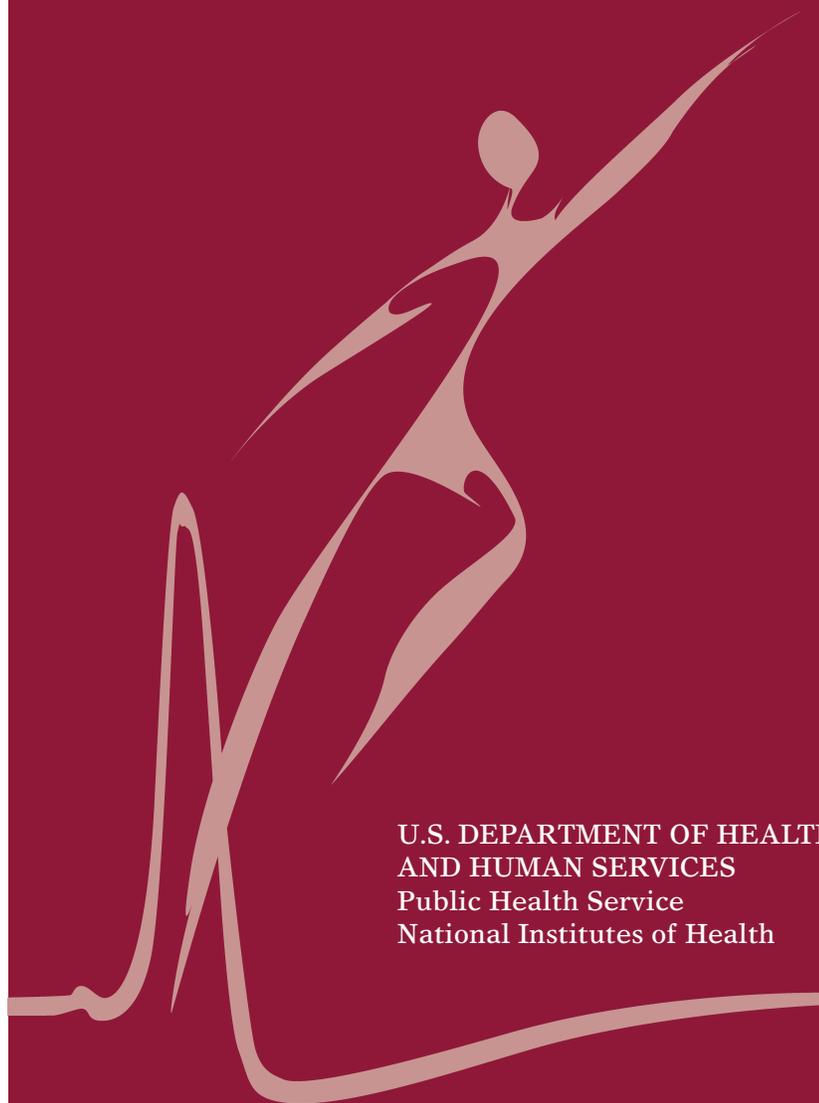


Low Back Pain



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Low Back Pain

If you have lower back pain, you are not alone. About 80 percent of adults experience low back pain at some point in their lifetimes. It is the most common cause of job-related disability and a leading contributor to missed work days. In a large survey, more than a quarter of adults reported experiencing low back pain during the past 3 months.

Men and women are equally affected by low back pain, which can range in intensity from a dull, constant ache to a sudden, sharp sensation that leaves the person incapacitated. Pain can begin abruptly as a result of an accident or by lifting something heavy, or it can develop over time due to age-related changes of the spine. Sedentary lifestyles also can set the stage for low back pain, especially when a weekday routine of getting too little exercise is punctuated by strenuous weekend workout.

Most low back pain is acute, or short term, and lasts a few days to a few weeks. It tends to resolve on its own with self-care and there is no residual loss of function. The majority of acute low back pain is mechanical in nature, meaning that there is a disruption in the way the components of the back (the spine, muscle, intervertebral discs, and nerves) fit together and move.

Subacute low back pain is defined as pain that lasts between 4 and 12 weeks.

Chronic back pain is defined as pain that persists for 12 weeks or longer, even after an initial injury or underlying cause of acute low back pain has been treated. About 20 percent of people affected by acute low back pain develop chronic low back pain with persistent symptoms at one year. In some cases, treatment successfully relieves chronic low back pain, but in other cases pain persists despite medical and surgical treatment.

The magnitude of the burden from low back pain has grown worse in recent years. In 1990, a study ranking the most burdensome conditions in the U.S. in terms of mortality or poor health as a result of disease put low back pain in sixth place; in 2010, low back pain jumped to third place, with only ischemic heart disease and chronic obstructive pulmonary disease ranking higher.

What structures make up the lower back?

The lower back where most back pain occurs includes the five vertebrae (referred to as L1-L5) in the lumbar region, which supports much of the weight of the upper body. The spaces between the vertebrae are maintained by round, rubbery pads called intervertebral discs that act like shock absorbers throughout the spinal column to cushion the bones as the body moves. Bands of tissue known as ligaments hold the vertebrae in place, and tendons attach the muscles to the spinal column. Thirty-one pairs of nerves are rooted to the spinal cord and they control body movements and transmit signals from the body to the brain.

What causes lower back pain?

The vast majority of low back pain is mechanical in nature. In many cases, low back pain is associated with spondylosis, a term that refers to the general degeneration of the spine associated with normal wear and tear that occurs in the joints, discs, and bones of the spine as people get older. Some examples of mechanical causes of low back pain include:

- **Sprains and strains** account for most acute back pain. Sprains are caused by overstretching or tearing ligaments, and strains are tears in tendon or muscle. Both can occur from twisting or lifting something improperly, lifting something too heavy, or overstretching. Such movements may also trigger spasms in back muscles, which can also be painful.
- **Intervertebral disc degeneration** is one of the most common mechanical causes of low back pain, and it occurs when the usually rubbery discs lose integrity as a normal process of aging. In a healthy back, intervertebral discs provide height and allow bending, flexion, and torsion of the lower back. As the discs deteriorate, they lose their cushioning ability.
- **Herniated or ruptured discs** can occur when the intervertebral discs become compressed and bulge outward (herniation) or rupture, causing low back pain.
- **Radiculopathy** is a condition caused by compression, inflammation and/or injury to a spinal nerve root. Pressure on the nerve root results in pain, numbness, or a tingling sensation that travels or radiates to other areas of the body that are served by that

nerve. Radiculopathy may occur when spinal stenosis or a herniated or ruptured disc compresses the nerve root.

- **Sciatica** is a form of radiculopathy caused by compression of the sciatic nerve, the large nerve that travels through the buttocks and extends down the back of the leg. This compression causes shock-like or burning low back pain combined with pain through the buttocks and down one leg, occasionally reaching the foot. In the most extreme cases, when the nerve is pinched between the disc and the adjacent bone, the symptoms may involve not only pain, but numbness and muscle weakness in the leg because of interrupted nerve signaling. The condition may also be caused by a tumor or cyst that presses on the sciatic nerve or its roots.
- **Spondylolisthesis** is a condition in which a vertebra of the lower spine slips out of place, pinching the nerves exiting the spinal column.
- **A traumatic injury**, such as from playing sports, car accidents, or a fall can injure tendons, ligaments or muscle resulting in low back pain. Traumatic injury may also cause the spine to become overly compressed, which in turn can cause an intervertebral disc to rupture or herniate, exerting pressure on any of the nerves rooted to the spinal cord. When spinal nerves become compressed and irritated, back pain and sciatica may result.
- **Spinal stenosis** is a narrowing of the spinal column that puts pressure on the spinal cord and nerves that can cause pain or numbness with walking and over time leads to leg weakness and sensory loss.

- **Skeletal irregularities** include scoliosis, a curvature of the spine that does not usually cause pain until middle age; lordosis, an abnormally accentuated arch in the lower back; and other congenital anomalies of the spine.

Low back pain is rarely related to serious underlying conditions, but when these conditions do occur, they require immediate medical attention. Serious underlying conditions include:

- **Infections** are not a common cause of back pain. However, infections can cause pain when they involve the vertebrae, a condition called osteomyelitis; the intervertebral discs, called discitis; or the sacroiliac joints connecting the lower spine to the pelvis, called sacroiliitis.
- **Tumors** are a relatively rare cause of back pain. Occasionally, tumors begin in the back, but more often they appear in the back as a result of cancer that has spread from elsewhere in the body.
- **Cauda equina syndrome** is a serious but rare complication of a ruptured disc. It occurs when disc material is pushed into the spinal canal and compresses the bundle of lumbar and sacral nerve roots, causing loss of bladder and bowel control. Permanent neurological damage may result if this syndrome is left untreated.
- **Abdominal aortic aneurysms** occur when the large blood vessel that supplies blood to the abdomen, pelvis, and legs becomes abnormally enlarged. Back pain can be a sign that the aneurysm is becoming larger and that the risk of rupture should be assessed.

- **Kidney stones** can cause sharp pain in the lower back, usually on one side.

Other underlying conditions that predispose people to low back pain include:

- **Inflammatory diseases of the joints** such as arthritis, including osteoarthritis and rheumatoid arthritis as well as spondylitis, an inflammation of the vertebrae, can also cause low back pain. Spondylitis is also called spondyloarthritis or spondyloarthropathy.
- **Osteoporosis** is a metabolic bone disease marked by a progressive decrease in bone density and strength, which can lead to painful fractures of the vertebrae.
- **Endometriosis** is the buildup of uterine tissue in places outside the uterus.
- **Fibromyalgia**, a chronic pain syndrome involving widespread muscle pain and fatigue.

What are the risk factors for developing low back pain?

Beyond underlying diseases, certain other risk factors may elevate one's risk for low back pain, including:

Age: The first attack of low back pain typically occurs between the ages of 30 and 50, and back pain becomes more common with advancing age. As people grow older, loss of bone strength from osteoporosis can lead to fractures, and at the same time, muscle elasticity and tone decrease. The intervertebral discs begin to lose fluid and flexibility with age, which decreases their

ability to cushion the vertebrae. The risk of spinal stenosis also increases with age.

Fitness level: Back pain is more common among people who are not physically fit. Weak back and abdominal muscles may not properly support the spine. “Weekend warriors”—people who go out and exercise a lot after being inactive all week—are more likely to suffer painful back injuries than people who make moderate physical activity a daily habit. Studies show that low-impact aerobic exercise is beneficial for the maintaining the integrity of intervertebral discs.

Pregnancy is commonly accompanied by low back pain, which results from pelvic changes and alterations in weight loading. Back symptoms almost always resolve postpartum.

Weight gain: Being overweight, obese, or quickly gaining significant amounts of weight can put stress on the back and lead to low back pain.

Genetics: Some causes of back pain, such as ankylosing spondylitis, a form of arthritis that involves fusion of the spinal joints leading to some immobility of the spine, have a genetic component.

Occupational risk factors: Having a job that requires heavy lifting, pushing, or pulling, particularly when it involves twisting or vibrating the spine, can lead to injury and back pain. An inactive job or a desk job may also lead to or contribute to pain, especially if you have poor posture or sit all day in a chair with inadequate back support.

Mental health factors: Pre-existing mental health issues such as anxiety and depression can influence how closely one focuses on their pain as well as their perception of its severity. Pain that becomes chronic also can contribute to the development of such psychological factors. Stress can affect the body in numerous ways, including causing muscle tension.

Backpack overload in children: Low back pain unrelated to injury or other known cause is unusual in pre-teen children. However, a backpack overloaded with schoolbooks and supplies can strain the back and cause muscle fatigue. The American Academy of Orthopaedic Surgeons recommends that a child's backpack should weigh no more than 15 to 20 percent of the child's body weight.

How is low back pain diagnosed?

A complete medical history and physical exam can usually identify any serious conditions that may be causing the pain. During the exam, a health care provider will ask about the onset, site, and severity of the pain; duration of symptoms and any limitations in movement; and history of previous episodes or any health conditions that might be related to the pain. Along with a thorough back examination, neurologic tests are conducted to determine the cause of pain and appropriate treatment. The cause of chronic lower back pain is often difficult to determine even after a thorough examination.

Imaging tests are not warranted in most cases. Under certain circumstances, however, imaging may be ordered to rule out specific causes of pain, including tumors and spinal stenosis. Imaging and other types of tests include:

X-ray is often the first imaging technique used to look for broken bones or an injured vertebra. X-rays show the bony structures and any vertebral misalignment or fractures. Soft tissues such as muscles, ligaments, or bulging discs are not visible on conventional x-rays.

Computerized tomography (CT) is used to see spinal structures that cannot be seen on conventional x-rays, such as disc rupture, spinal stenosis, or tumors. Using a computer, the CT scan creates a three-dimensional image from a series of two dimensional pictures.

Myelograms enhance the diagnostic imaging of x-rays and CT scans. In this procedure, a contrast dye is injected into the spinal canal, allowing spinal cord and nerve compression caused by herniated discs or fractures to be seen on an x-ray or CT scans.

Discography may be used when other diagnostic procedures fail to identify the cause of pain. This procedure involves the injection of a contrast dye into a spinal disc thought to be causing low back pain. The fluid's pressure in the disc will reproduce the person's symptoms if the disc is the cause. The dye helps to show the damaged areas on CT scans taken following the injection. Discography may provide useful information in cases where people are considering lumbar surgery or when their pain has not responded to conventional treatments.

Magnetic resonance imaging (MRI) uses a magnetic force instead of radiation to create a computer-generated image. Unlike x-ray, which shows only bony structures, MRI scans also produce images of soft tissues such as muscles, ligaments, tendons, and blood

vessels. An MRI may be ordered if a problem such as infection, tumor, inflammation, disc herniation or rupture, or pressure on a nerve is suspected. MRI is a noninvasive way to identify a condition requiring prompt surgical treatment. However, in most instances, unless there are “red flags” in the history or physical exam, an MRI scan is not necessary during the early phases of low back pain.

Electrodiagnostics are procedures that, in the setting of low back pain, are primarily used to confirm whether a person has lumbar radiculopathy. The procedures include electromyography (EMG), nerve conduction studies (NCS), and evoked potential (EP) studies. EMG assesses the electrical activity in a muscle and can detect if muscle weakness results from a problem with the nerves that control the muscles. Very fine needles are inserted in muscles to measure electrical activity transmitted from the brain or spinal cord to a particular area of the body. NCSs are often performed along with EMG to exclude conditions that can mimic radiculopathy. In NCSs, two sets of electrodes are placed on the skin over the muscles. The first set provides a mild shock to stimulate the nerve that runs to a particular muscle. The second set records the nerve’s electrical signals, and from this information nerve damage that slows conduction of the nerve signal can be detected. EP tests also involve two sets of electrodes—one set to stimulate a sensory nerve, and the other placed on the scalp to record the speed of nerve signal transmissions to the brain.

Bone scans are used to detect and monitor infection, fracture, or disorders in the bone.

A small amount of radioactive material is injected into the bloodstream and will collect in the bones, particularly in areas with some abnormality. Scanner-generated images can be used to identify specific areas of irregular bone metabolism or abnormal blood flow, as well as to measure levels of joint disease.

Ultrasound imaging, also called ultrasound scanning or sonography, uses high-frequency sound waves to obtain images inside the body. The sound wave echoes are recorded and displayed as a real-time visual image. Ultrasound imaging can show tears in ligaments, muscles, tendons, and other soft tissue masses in the back.

Blood tests are not routinely used to diagnose the cause of back pain; however in some cases they may be ordered to look for indications of inflammation, infection, and/or the presence of arthritis. Potential tests include complete blood count, erythrocyte sedimentation rate, and C-reactive protein. Blood tests may also detect HLA-B27, a genetic marker in the blood that is more common in people with ankylosing spondylitis or reactive arthritis (a form of arthritis that occurs following infection in another part of the body, usually the genitourinary tract).

How is back pain treated?

Treatment for low back pain generally depends on whether the pain is acute or chronic. In general, surgery is recommended only if there is evidence of worsening nerve damage and when diagnostic tests indicate structural changes for which corrective surgical procedures have been developed.

Conventionally used treatments and their level of supportive evidence include:

Hot or cold packs have never been proven to quickly resolve low back injury; however, they may help ease pain and reduce inflammation for people with acute, subacute, or chronic pain, allowing for greater mobility among some individuals.

Activity: Bed rest should be limited.

Individuals should begin stretching exercises and resume normal daily activities as soon as possible, while avoiding movements that aggravate pain. Strong evidence shows that persons who continue their activities without bed rest following onset of low back pain appeared to have better back flexibility than those who rested in bed for a week. Other studies suggest that bed rest alone may make back pain worse and can lead to secondary complications such as depression, decreased muscle tone, and blood clots in the legs.

Strengthening exercises, beyond general daily activities, are not advised for acute low back pain, but may be an effective way to speed recovery from chronic or subacute low back pain. Maintaining and building muscle strength is particularly important for persons with skeletal irregularities. Health care providers can provide a list of beneficial exercises that will help improve coordination and develop proper posture and muscle balance. Evidence supports short- and long-term benefits of yoga to ease chronic low back pain.

Physical therapy programs to strengthen core muscle groups that support the low back, improve mobility and flexibility, and promote

proper positioning and posture are often used in combinations with other interventions.

Medications: A wide range of medications are used to treat acute and chronic low back pain. Some are available over the counter (OTC); others require a physician's prescription. Certain drugs, even those available OTC, may be unsafe during pregnancy, may interact with other medications, cause side effects, or lead to serious adverse effects such as liver damage or gastrointestinal ulcers and bleeding. Consultation with a health care provider is advised before use. The following are the main types of medications used for low back pain:

- **Analgesic medications** are those specifically designed to relieve pain. They include OTC acetaminophen and aspirin, as well as prescription opioids such as codeine, oxycodone, hydrocodone, and morphine. Opioids should be used only for a short period of time and under a physician's supervision. People can develop a tolerance to opioids and require increasingly higher dosages to achieve the same effect. Opioids can also be addictive. Their side effects can include drowsiness, constipation, decreased reaction time, and impaired judgment. Some specialists are concerned that chronic use of opioids is detrimental to people with back pain because they can aggravate depression, leading to a worsening of the pain.
- **Nonsteroidal anti-inflammatory drugs (NSAIDs)** relieve pain and inflammation and include OTC formulations (ibuprofen, ketoprofen, and naproxen sodium). Several others, including a type of NSAID called COX-2 inhibitors, are available only by

prescription. Long-term use of NSAIDs has been associated with stomach irritation, ulcers, heartburn, diarrhea, fluid retention, and in rare cases, kidney dysfunction and cardiovascular disease. The longer a person uses NSAIDs the more likely they are to develop side effects. Many other drugs cannot be taken at the same time a person is treated with NSAIDs because they alter the way the body processes or eliminates other medications.

- **Anticonvulsants**—drugs primarily used to treat seizures—may be useful in treating people with radiculopathy and radicular pain.
- **Antidepressants** such as tricyclics and serotonin and norepinephrine reuptake inhibitors have been commonly prescribed for chronic low back pain, but their benefit for nonspecific low back pain is unproven, according to a review of studies assessing their benefit.
- **Counter-irritants** such as creams or sprays applied topically stimulate the nerves in the skin to provide feelings of warmth or cold in order to dull the sensation of pain. Topical analgesics reduce inflammation and stimulate blood flow.

Spinal manipulation and spinal mobilization are approaches in which professionally licensed specialists (doctors of chiropractic care) use their hands to mobilize, adjust, massage, or stimulate the spine and the surrounding tissues. Manipulation involves a rapid movement over which the individual has no control; mobilization involves slower adjustment movements. The techniques have been shown to provide small to moderate short-term

benefits in people with chronic low back pain. Evidence supporting their use for acute or subacute low back pain is generally of low quality. Neither technique is appropriate when a person has an underlying medical cause for the back pain such as osteoporosis, spinal cord compression, or arthritis.

Traction involves the use of weights and pulleys to apply constant or intermittent force to gradually “pull” the skeletal structure into better alignment. Some people experience pain relief while in traction, but that relief is usually temporary. Once traction is released the back pain tends to return. There is no evidence that traction provides any long-term benefits for people with low back pain.

Acupuncture is moderately effective for chronic low back pain. It involves the insertion of thin needles into precise points throughout the body. Some practitioners believe this process helps clear away blockages in the body’s life force known as Qi (pronounced chee). Others who may not believe in the concept of Qi theorize that when the needles are inserted and then stimulated (by twisting or passing a low-voltage electrical current through them) naturally occurring painkilling chemicals such as endorphins, serotonin, and acetylcholine are released. Evidence of acupuncture’s benefit for acute low back pain is conflicting and clinical studies continue to investigate its benefits.

Biofeedback is used to treat many acute pain problems, most notably back pain and headache. The therapy involves the attachment of electrodes to the skin and the use of an electromyography machine that

allows people to become aware of and self-regulate their breathing, muscle tension, heart rate, and skin temperature. People regulate their response to pain by using relaxation techniques. Biofeedback is often used in combination with other treatment methods, generally without side effects. Evidence is lacking that biofeedback provides a clear benefit for low back pain.

Nerve block therapies aim to relieve chronic pain by blocking nerve conduction from specific areas of the body. Nerve block approaches range from injections of local anesthetics, botulinum toxin, or steroids into affected soft tissues or joints to more complex nerve root blocks and spinal cord stimulation. When extreme pain is involved, low doses of drugs may be administered by catheter directly into the spinal cord. The success of a nerve block approach depends on the ability of a practitioner to locate and inject precisely the correct nerve. Chronic use of steroid injections may lead to increased functional impairment.

Epidural steroid injections are a commonly used short-term option for treating low back pain and sciatica associated with inflammation. Pain relief associated with the injections, however, tends to be temporary and the injections are not advised for long-term use. An NIH-funded randomized controlled trial assessing the benefit of epidural steroid injections for the treatment of chronic low back pain associated with spinal stenosis showed that long-term outcomes were worse among those people who received the injections compared with those who did not.

Transcutaneous electrical nerve stimulation (TENS) involves wearing a battery-powered device consisting of electrodes placed on the skin over the painful area that generate electrical impulses designed to block incoming pain signals from the peripheral nerves. The theory is that stimulating the nervous system can modify the perception of pain. Early studies of TENS suggested that it elevated levels of endorphins, the body's natural pain-numbing chemicals. More recent studies, however, have produced mixed results on its effectiveness for providing relief from low back pain.

Surgery

When other therapies fail, surgery may be considered an option to relieve pain caused by serious musculoskeletal injuries or nerve compression. It may be months following surgery before the patient is fully healed, and he or she may suffer permanent loss of flexibility.

Surgical procedures are not always successful, and there is little evidence to show which procedures work best for their particular indications. Patients considering surgical approaches should be fully informed of all related risks. Surgical options include:

- **Vertebroplasty and kyphoplasty** are minimally invasive treatments to repair compression fractures of the vertebrae caused by osteoporosis. Vertebroplasty uses three-dimensional imaging to assist in guiding a fine needle through the skin into the vertebral body, the largest part of the vertebrae. A glue-like bone cement is then injected into the vertebral body

space, which quickly hardens to stabilize and strengthen the bone and provide pain relief. In kyphoplasty, prior to injecting the bone cement, a special balloon is inserted and gently inflated to restore height to the vertebral structure and reduce spinal deformity.

- **Spinal laminectomy** (also known as spinal decompression) is performed when spinal stenosis causes a narrowing of the spinal canal that causes pain, numbness, or weakness. During the procedure, the lamina or bony walls of the vertebrae, along with any bone spurs, are removed. The aim of the procedure is to open up the spinal column to remove pressure on the nerves.
- **Discectomy or microdiscectomy** may be recommended to remove a disc, in cases where it has herniated and presses on a nerve root or the spinal cord, which may cause intense and enduring pain. Microdiscectomy is similar to a conventional discectomy; however, this procedure involves removing the herniated disc through a much smaller incision in the back and a more rapid recovery. Laminectomy and discectomy are frequently performed together and the combination is one of the more common ways to remove pressure on a nerve root from a herniated disc or bone spur.
- **Foraminotomy** is an operation that “cleans out” or enlarges the bony hole (foramen) where a nerve root exits the spinal canal. Bulging discs or joints thickened with age can cause narrowing of the space through which the spinal nerve exits and can press on the nerve, resulting in pain, numbness,

and weakness in an arm or leg. Small pieces of bone over the nerve are removed through a small slit, allowing the surgeon to cut away the blockage and relieve pressure on the nerve.

- **Intradiscal electrothermal therapy (IDET)** is a treatment for discs that are cracked or bulging as a result of degenerative disc disease. The procedure involves inserting a catheter through a small incision at the site of the disc in the back. A special wire is passed through the catheter and an electrical current is applied to heat the disc, which helps strengthen the collagen fibers of the disc wall, reducing the bulging and the related irritation of the spinal nerve. IDET is of questionable benefit.
- **Nucleoplasty, also called plasma disc decompression (PDD)**, is a type of laser surgery that uses radiofrequency energy to treat people with low back pain associated with mildly herniated discs. Under x-ray guidance, a needle is inserted into the disc. A plasma laser device is then inserted into the needle and the tip is heated to 40-70 degrees Celsius, creating a field that vaporizes the tissue in the disc, reducing its size and relieving pressure on the nerves. Several channels may be made depending on how tissue needs to be removed to decompress the disc and nerve root.
- **Radiofrequency denervation** is a procedure using electrical impulses to interrupt nerve conduction (including the conduction of pain signals). Using x-ray guidance, a needle is inserted into a target area of nerves and a local anesthetic is introduced as a way of confirming the involvement of

the nerves in the person's back pain. Next, the region is heated, resulting in localized destruction of the target nerves. Pain relief associated with the technique is temporary and the evidence supporting this technique is limited.

- **Spinal fusion** is used to strengthen the spine and prevent painful movements in people with degenerative disc disease or spondylolisthesis (following laminectomy). The spinal disc between two or more vertebrae is removed and the adjacent vertebrae are “fused” by bone grafts and/or metal devices secured by screws. The fusion can be performed through the abdomen, a procedure known as an anterior lumbar interbody fusion, or through the back, called posterior fusion. Spinal fusion may result in some loss of flexibility in the spine and requires a long recovery period to allow the bone grafts to grow and fuse the vertebrae together. Spinal fusion has been associated with an acceleration of disc degeneration at adjacent levels of the spine.
- **Artificial disc replacement** is considered an alternative to spinal fusion for the treatment of people with severely damaged discs. The procedure involves removal of the disc and its replacement by a synthetic disc that helps restore height and movement between the vertebrae.

Can back pain be prevented?

Recurring back pain resulting from improper body mechanics is often preventable by avoiding movements that jolt or strain the back, maintaining correct posture, and lifting objects properly.

Many work-related injuries are caused or aggravated by stressors such as heavy lifting, contact stress (repeated or constant contact between soft body tissue and a hard or sharp object), vibration, repetitive motion, and awkward posture. Using ergonomically designed furniture and equipment to protect the body from injury at home and in the workplace may reduce the risk of back injury.

The use of lumbar supports in the form of wide elastic bands that can be tightened to provide support to the lower back and abdominal muscles to prevent low back pain remains controversial. Such supports are widely used despite a lack of evidence showing that they actually prevent pain. Multiple studies have determined that the use of lumbar supports provides no benefit in terms of the prevention and treatment of back pain. Although there have been anecdotal case reports of injury reduction among workers using lumbar support belts, many companies that have back belt programs also have training and ergonomic awareness programs. The reported injury reduction may be related to a combination of these or other factors. Furthermore, some caution is advised given that wearing supportive belts may actually lead to or aggravate back pain by causing back muscles to weaken from lack of use.

Recommendations for keeping one's back healthy

Following any period of prolonged inactivity, a regimen of low-impact exercises is advised. Speed walking, swimming, or stationary bike

riding 30 minutes daily can increase muscle strength and flexibility. Yoga also can help stretch and strengthen muscles and improve posture. Consult a physician for a list of low-impact, age-appropriate exercises that are specifically targeted to strengthening lower back and abdominal muscles.

- Always stretch before exercise or other strenuous physical activity.
- Don't slouch when standing or sitting. The lower back can support a person's weight most easily when the curvature is reduced. When standing, keep your weight balanced on your feet.
- At home or work, make sure work surfaces are at a comfortable height.
- Sit in a chair with good lumbar support and proper position and height for the task. Keep shoulders back. Switch sitting positions often and periodically walk around the office or gently stretch muscles to relieve tension. A pillow or rolled-up towel placed behind the small of the back can provide some lumbar support. During prolonged periods of sitting, elevate feet on a low stool or a stack of books.
- Wear comfortable, low-heeled shoes.
- Sleeping on one's side with the knees drawn up in a fetal position can help open up the joints in the spine and relieve pressure by reducing the curvature of the spine. Always sleep on a firm surface.
- Don't try to lift objects that are too heavy. Lift from the knees, pull the stomach muscles in, and keep the head down and in line with a straight back. When lifting,

keep objects close to the body. Do not twist when lifting.

- Maintain proper nutrition and diet to reduce and prevent excessive weight gain, especially weight around the waistline that taxes lower back muscles. A diet with sufficient daily intake of calcium, phosphorus, and vitamin D helps to promote new bone growth.
- Quit smoking. Smoking reduces blood flow to the lower spine, which can contribute to spinal disc degeneration. Smoking also increases the risk of osteoporosis and impedes healing. Coughing due to heavy smoking also may cause back pain.

What research is being done?

The National Institute of Neurological Disorders and Stroke (NINDS) is a component of the National Institutes of Health (NIH) and is the leading federal funder of research on disorders of the brain and nervous system. As a primary supporter of research on pain and pain mechanisms, NINDS is a member of the *NIH Pain Consortium*, which was established to promote collaboration among the many NIH Institutes and Centers with research programs and activities addressing pain. On an even broader scale, NIH participates in the *Interagency Pain Research Coordinating Committee*, a federal advisory committee that coordinates research across other U.S. Department of Health and Human Services agencies as well as the Departments of Defense and Veterans Affairs.

NINDS-funded studies are contributing to a better understanding of why some people with acute low back pain recover fully while others go on to develop chronic low back pain. Brain imaging studies suggest that people with chronic low back pain have changes in brain structure and function. In one study, people with subacute back pain were followed for one year. Researchers found that certain patterns of functional connectivity across brain networks correlated with the likelihood of pain becoming chronic. The findings suggest that such patterns may help predict who is most likely to transition from subacute to chronic back pain. Other research seeks to determine the role of brain circuits important for emotional and motivational learning and memory in this transition, in order to identify new preventive interventions.

Disc degeneration remains a key cause of chronic low back pain and the pain often persists despite surgery. NIH-funded basic science and preclinical studies are investigating molecular-level mechanisms that cause discs in the spine to degenerate, as well as protective mechanisms involved in disc remodeling that may diminish with advancing age. Such studies may help identify future therapeutic strategies to block degenerative mechanisms or promote remodeling processes. NIH also is funding early research on stem cell approaches to promote disc regeneration and rejuvenate cells of the nucleus pulposus, the jelly-like substance in the center of intervertebral discs that loses water content as people age.

Several NIH-funded clinical trials and other studies in patients aim to improve treatment options and prevention strategies for chronic low back pain, as well as add to the evidence base about existing treatments. A multi-year multicenter study called the Spine Patient Outcomes Research Trial (SPORT) compared the most commonly used surgical and nonsurgical treatments for patients with the three most common diagnoses for which spine surgery is performed: intervertebral disc herniation, spinal stenosis, and degenerative spondylolisthesis. SPORT represented the largest clinical investigation to date looking at treatment results for these disabling and costly causes of chronic low back pain.

Results after four years of follow-up showed that in general, otherwise healthy people who have surgery for one of these three conditions are likely to fare better than those who receive non-operative care. However, the results also indicated that people who are reluctant to have surgery may also recover with non-operative treatments if their conditions are not progressing and their pain is tolerable, and importantly, delaying or avoiding surgery did not cause additional damage in most cases. Researchers are continuing to track SPORT patient cohorts over a nine-year follow-up period to assess longer term treatment results and cost effectiveness across treatment options. In the interest of improving surgical techniques, NIH also is funding research on factors that contribute to the success or failure of artificial disc replacement surgery, including studies to compare discs on the market for significant differences in their durability rates over time.

Epidural injections of steroid drugs are frequently used to treat sciatica, despite limited evidence for their effectiveness. Moreover, these treatments are based on the assumption that reducing local inflammation in the vertebral column will relieve pain, but an association between structural abnormalities, inflammation, and sciatica symptoms has not been clearly demonstrated. NINDS-funded researchers are using a new imaging technique that can detect inflammation to better understand what causes chronic sciatica pain and to provide evidence to inform treatment selection.

Other NIH-funded studies are investigating physical therapy and chiropractic approaches. For example, researchers are studying whether therapy programs that emphasize certain types of exercises, such as core stabilization exercises, provide benefit to people who experience recurrent low back pain.

The increasing use of spinal manipulation and mobilization, despite lacking evidence for more than small or moderate benefit, has prompted NIH-funded researchers to study the mechanisms of these two techniques and to conduct a randomized controlled trial to assess and compare their effectiveness for the treatment of chronic low back pain.

Finally, NIH-funded researchers are studying various complementary and alternative therapies for low back pain, including those aimed reducing stress and negative emotions believed to aggravate the experience of pain. For example, virtual reality programs are being studied for their ability to help people cope with persistent pain.

Where can I get more information?

For more information on neurological disorders or research programs funded by the National Institute of Neurological Disorders and Stroke, contact the Institute's Brain Resources and Information Network (BRAIN) at:

BRAIN

P.O. Box 5801

Bethesda, MD 20824

800-352-9424

<http://www.ninds.nih.gov>

Information also is available from the following organizations:

**National Institute of Arthritis and
Musculoskeletal and Skin Diseases
Information Clearinghouse**

National Institutes of Health/DHHS

1 AMS Circle

Bethesda, MD 20892-3675

877-226-4267

301-565-2966 (TTY)

<http://www.niams.nih.gov>

American Chronic Pain Association (ACPA)

P.O. Box 850

Rocklin, CA 95677-0850

916-632-0922

800-533-3231

<http://www.theacpa.org>

American Association of Neurological Surgeons

5550 Meadowbrook Drive

Rolling Meadows, IL 60008-3852

847-378-0500

888-566-22267

<http://www.aans.org>

American Academy of Family Physicians
11400 Tomahawk Creek Parkway, Suite 440
Leawood, KS 66211-2680
913-906-6000
800-274-2237
<http://www.aafp.org>

**American Academy of Neurological
and Orthopaedic Surgeons**
10 Cascade Creek Lane
Las Vegas, NV 89113
702-388-7390
<http://www.aanos.org>

**American Academy of Orthopaedic Surgeons/
American Association of Orthopaedic Surgeons**
9400 West Higgins Road
Rosemont, IL 60018
847-823-7186
<http://www.aaos.org>

**American Academy of Physical Medicine
& Rehabilitation**
9700 Bryn Mawr Avenue, Suite 200
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