



QUESTIONS AND ANSWERS ABOUT . . .

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

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## **SPINAL STENOSIS**

This fact sheet contains general information about spinal stenosis. It describes the condition's causes, symptoms, diagnosis, and treatments. At the end is a list of additional resources. If you have further questions after reading this fact sheet, you may wish to discuss them with your doctor.

### **What Is Spinal Stenosis?**

Spinal stenosis is a narrowing of spaces in the spine (backbone) that results in pressure on the spinal cord and/or nerve roots. This disorder usually involves the narrowing of one or more of three areas of the spine: (1) the canal in the center of the column of bones (vertebral or spinal column) through which the spinal cord and nerve roots run, (2) the canals at the base or roots of nerves branching out from the spinal cord, or (3) the openings between vertebrae (bones of the spine) through which nerves leave the spine and go to other parts of the body. The narrowing may involve a small or large area of the spine. Pressure on the lower part of the spinal cord or on nerve roots branching out from that area may give rise to pain or numbness in the legs. Pressure on the upper part of the spinal cord (that is, the neck area) may produce similar symptoms in the shoulders, or even the legs.

### **Who Gets Spinal Stenosis?**

This disorder is most common in people over 50 years of age. However, it may occur in younger people who are born with a narrowing of the spinal canal or who suffer an injury to the spine.

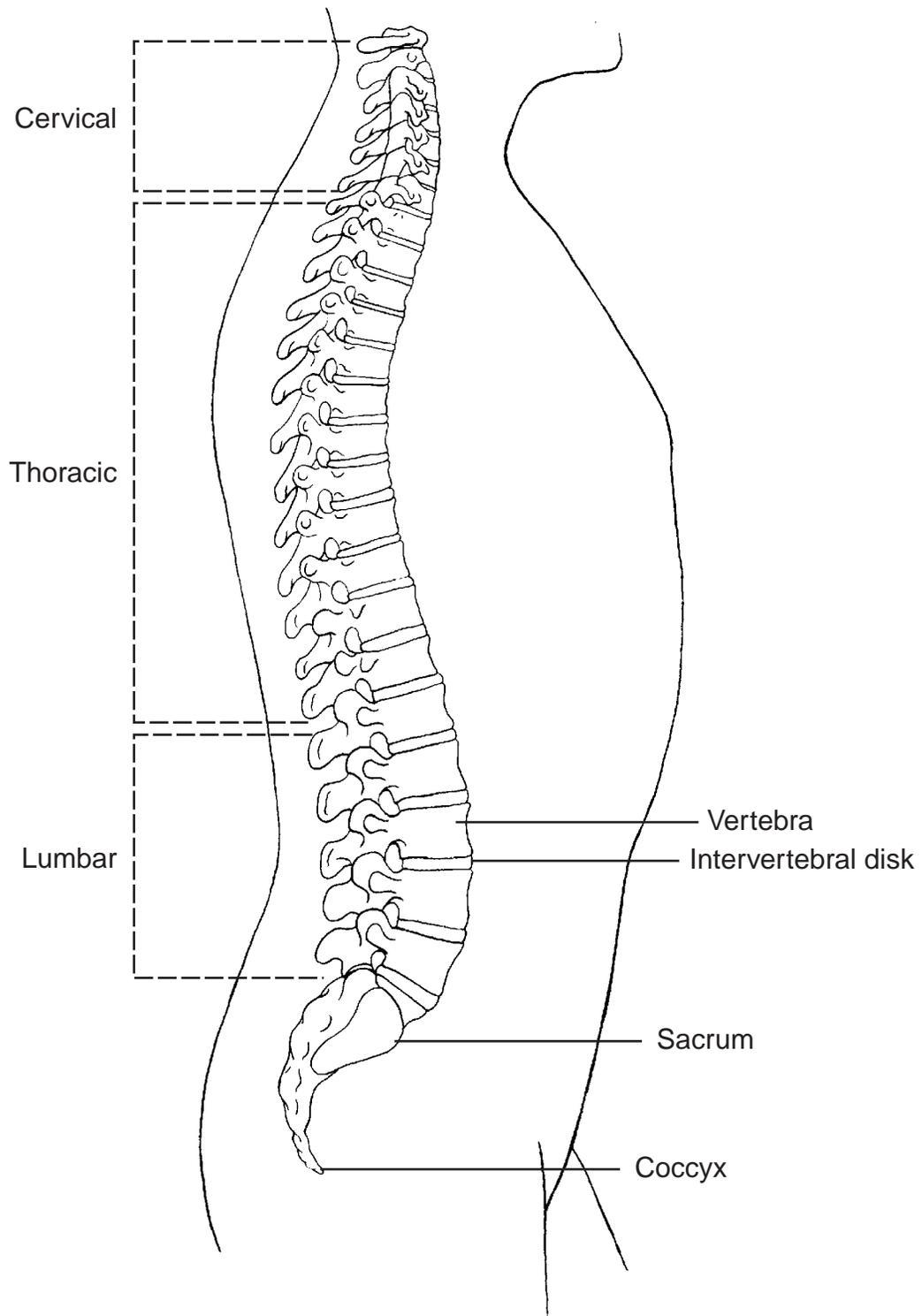
## What Structures of the Spine Are Involved?

The spine is a column of 26 bones that extend in a line from the base of the skull to the pelvis (see fig. 1 on page 3). Twenty-four of the bones are called vertebrae. The bones of the spine include 7 cervical vertebrae in the neck; 12 thoracic vertebrae at the back wall of the chest; 5 lumbar vertebrae at the inward curve (small) of the lower back; the sacrum, composed of 5 fused vertebrae between the hip bones; and the coccyx, composed of 3 to 5 fused bones at the lower tip of the vertebral column. The vertebrae link to each other and are cushioned by shock-absorbing disks that lie between them.

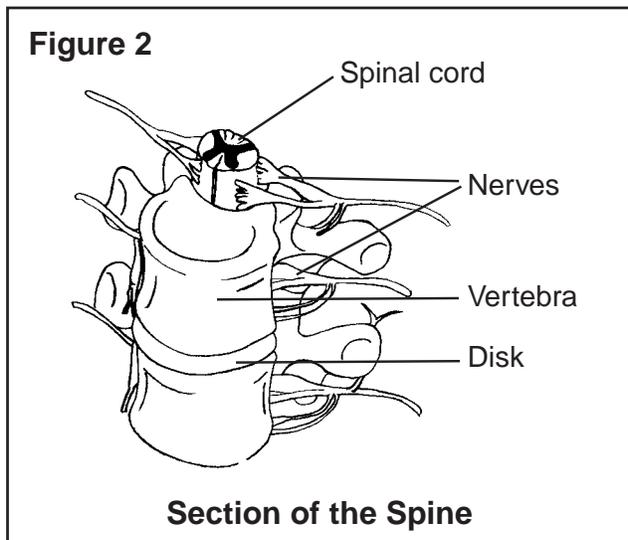
The vertebral column provides the main support for the upper body, allowing humans to stand upright or bend and twist, and it protects the spinal cord from injury. Following are structures of the spine most involved in spinal stenosis.

- **Intervertebral disks**—pads of cartilage between vertebrae that act as shock absorbers.
- **Facet joints**—joints located on both sides and on the top and bottom of each vertebra. They connect the vertebrae to each other and permit back motion.
- **Intervertebral foramen (also called neural foramen)**—an opening between vertebrae through which nerves leave the spine and extend to other parts of the body.
- **Lamina**—part of the vertebra at the upper portion of the vertebral arch that forms the roof of the canal through which the spinal cord and nerve roots pass.
- **Ligaments**—elastic bands of tissue that support the spine by preventing the vertebrae from slipping out of line as the spine moves. A large ligament often involved in spinal stenosis is the ligamentum flavum, which runs as a continuous band from lamina to lamina in the spine.
- **Pedicles**—narrow stem-like structures on the vertebrae that form the walls of the bottom part of the vertebral arch.
- **Spinal cord/nerve roots**—a major part of the central nervous system that extends from the base of the brain down to the lower back and that is encased by the vertebral column. It consists of nerve cells and bundles of nerves. The cord connects the brain to all parts of the body via 31 pairs of nerves that branch out from the cord and leave the spine between vertebrae (see fig. 2 on page 4).

**Figure 1**



**Side View of Spine**



- **Synovium**—a thin membrane that produces fluid to lubricate the facet joints, allowing them to move easily.
- **Vertebral arch**—a circle of bone around the canal through which the spinal cord passes. It is composed of a floor at the back of the vertebra, walls (the pedicles), and a ceiling where two laminae join.

### What Causes Spinal Stenosis?

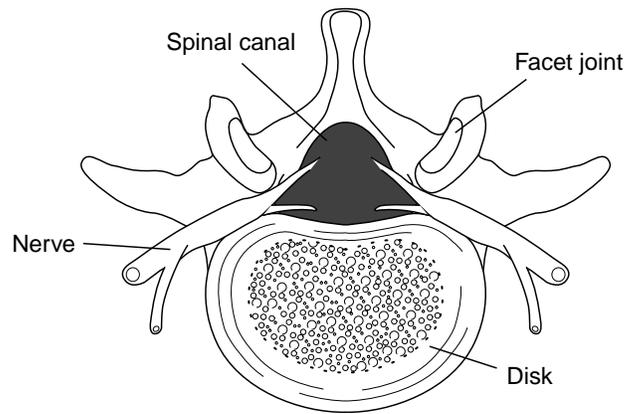
The normal vertebral canal (see fig. 3 on page 5) provides adequate room for the spinal cord. Narrowing of the canal, which occurs in spinal stenosis, may be inherited or acquired. Some people inherit a small spinal canal (see fig. 4 on page 5) or have a curvature of the spine (scoliosis) that produces pressure on nerves and soft tissue and compresses or stretches ligaments. In an inherited condition called achondroplasia, defective bone formation results in abnormally short and thickened pedicles that reduce the diameter (distance across) of the spinal canal.

Acquired conditions that can cause spinal stenosis are listed in the box below and explained in more detail in the text that follows.

#### *Degenerative (Aging) Conditions, Including Osteoarthritis*

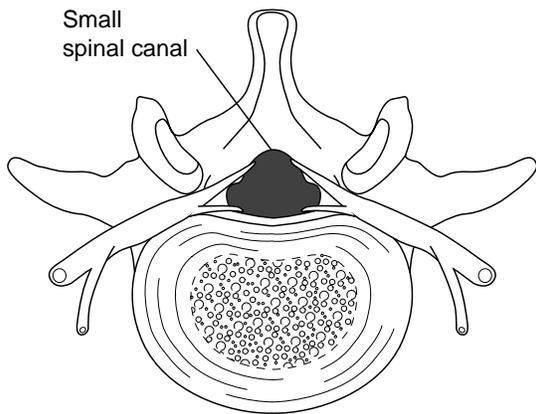
Spinal stenosis most often results from a gradual, degenerative aging process. Either structural changes or inflammation can begin the process. As people age, the ligaments of the spine may thicken and calcify (harden from deposits of calcium salts). Bones and joints may also enlarge, and osteophytes (bone spurs) may form. When the health of one part of the spine fails, it usually places increased stress on other parts of the spine. For example, a degenerative condition affecting the facet joints may eventually cause secondary changes, such as a herniated (bulging) disk that places pressure on the spinal cord or nerve root (see fig. 5 on page 5). When a segment of the spine becomes too mobile, the capsules (enclosing membranes) of the facet joints thicken in an effort to stabilize the segment, and bone spurs may occur. This decreases the space (neural foramen) available for nerve roots leaving the spinal cord.

**Figure 3**

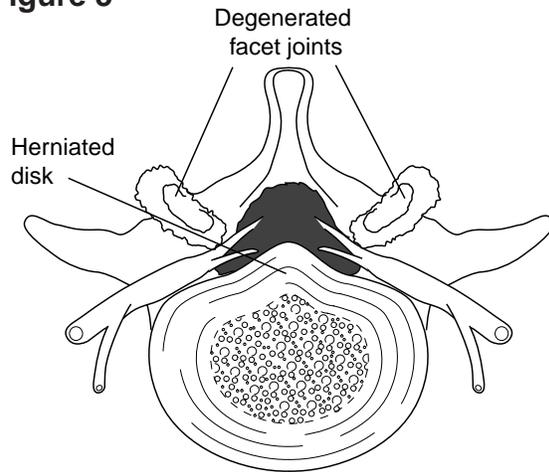


**Normal Vertebra (Cross Section)**

**Figure 4**



**Figure 5**



**Some Causes of Spinal Stenosis**

Aging with secondary changes is the most common cause of spinal stenosis. Two forms of arthritis that may affect the spine are osteoarthritis and rheumatoid arthritis.<sup>1</sup> Osteoarthritis is the most common form of arthritis and is more likely to occur in middle-aged and older people. It is a chronic, degenerative process that may involve multiple joints of the body. It wears away the surface cartilage layer of joints, and is often accompanied by overgrowth of bone, formation of bone spurs, and impaired function. If the degenerative change affects the facet joint(s) and the disk, the condition is sometimes referred to as spondylosis. This condition may be accompanied by disk degeneration, and an enlargement or overgrowth of bone that narrows the central and root canals.

Spondylolisthesis, a condition in which one vertebra slips forward on another, may result from a degenerative condition or an accident, or may be acquired at birth. Poor alignment of the spinal column when a vertebra slips forward onto the one below it can place pressure on the spinal cord or nerve roots at that place.

### *Rheumatoid Arthritis*

Rheumatoid arthritis usually affects people at an earlier age than osteoarthritis does and is associated with inflammation and enlargement of the soft tissues of the joints. Although not a common cause of spinal stenosis, damage to ligaments, bones, and joints that begins as synovitis (inflammation of the synovial membrane) has a severe and disrupting effect on joint function. The portions of the vertebral column with the greatest mobility (for example, the neck area) are often the ones most affected in people with rheumatoid arthritis.

### *Nonarthritic Acquired Spinal Stenosis*

The following conditions that are not related to arthritis or degenerative disease are causes of acquired spinal stenosis:

- *Tumors of the spine* are abnormal growths of soft tissue that may affect the spinal canal directly by inflammation or by growth of tissue into the canal. Tissue growth may lead to bone resorption (bone loss due to overactivity of certain bone cells) or displacement of bone and the eventual collapse of the supporting framework of the vertebral column.

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<sup>1</sup> The National Institute of Arthritis and Musculoskeletal and Skin Diseases Information Clearinghouse has separate information packages on osteoarthritis and rheumatoid arthritis. Single copies are free.

- *Trauma* (accidents) may either dislocate the spine and the spinal canal or cause burst fractures that produce fragments of bone that penetrate the canal.
- Although surgery that involves fusion (union) of vertebrae may be skillfully performed, tissue *swelling after surgery* may place pressure on the spinal cord.
- *Paget's disease of bone* is a chronic (long-term) disorder that typically results in enlarged and deformed bones. Excessive bone breakdown and formation cause thick and fragile bone. As a result, bone pain, arthritis, noticeable deformities, and fractures can occur. The disease can affect any bone of the body, but is often found in the spine. The blood supply that feeds healthy nerve tissue may be diverted to the area of involved bone. Also, structural deformities of the involved vertebrae can cause narrowing of the spinal canal, producing a variety of neurological symptoms.
- *Fluorosis* is an excessive level of fluoride in the body. It may result from chronic inhalation of industrial dusts or gases contaminated with fluorides, prolonged ingestion of water containing large amounts of fluorides, or accidental ingestion of fluoride-containing insecticides. The condition may lead to calcified spinal ligaments or softened bones and to degenerative conditions like spinal stenosis.

### **What Are the Symptoms of Spinal Stenosis?**

Spaces within the spine can narrow without producing any symptoms. However, if narrowing places pressure on the spinal cord or nerve roots, there may be a slow onset and progression of symptoms. The back itself may or may not hurt. More often, people experience numbness, weakness, cramping, or general pain in the legs that occurs during flexing the lower back while sitting. (The flex position “opens up” the spinal column, enlarging the spaces between vertebrae at the back of the spine.) If a disk between vertebrae is compressed, people may feel pain radiating down the leg (sciatica).

People with more severe stenosis may experience abnormal bowel and bladder function and foot disorders. For example, cauda equina syndrome is a partial or complete loss of control of the bowel or bladder and sometimes sexual function; it is due to compression of the collection of spinal roots that descend from the lower part of the spinal cord and occupy the vertebral canal below the cord. In very rare instances, compression above the area where the lumbar vertebrae and sacrum meet results in partial or complete paralysis of the legs.

## How Is Spinal Stenosis Diagnosed?

The doctor may use a variety of approaches to diagnose spinal stenosis and rule out other conditions.

- **Medical history**—the patient tells the doctor details about symptoms and about any injury, condition, or general health problem that might be causing the symptoms.
- **Physical examination**—the doctor (1) examines the patient to determine the extent of limitation of movement; (2) checks for pain or symptoms when the patient hyperextends the spine (bends backwards); and (3) looks for the loss of extremity reflexes, which may be related to numbness or weakness in the arms or legs.
- **X ray**—an x-ray beam is passed through the back to produce a two-dimensional picture. An x ray may be done before other tests to look for signs of an injury, tumor, or inherited abnormality. This test can show the structure of the vertebrae and the outlines of joints, and can detect calcification.
- **MRI (magnetic resonance imaging)**—energy from a powerful magnet (rather than x rays) produces signals that are detected by a scanner and analyzed by computer. This produces a series of cross-sectional images (“slices”) and/or a three-dimensional view of parts of the back. An MRI is particularly sensitive for detecting damage or disease of soft tissues, such as the disks between vertebrae or ligaments. It shows the spinal cord, nerve roots, and surrounding spaces, as well as enlargement, degeneration, or tumors.
- **Computerized axial tomography (CAT)**—X rays are passed through the back at different angles, detected by a scanner, and analyzed by a computer. This produces a series of cross-sectional images and/or three-dimensional views of the parts of the back. The scan shows the shape and size of the spinal canal, its contents, and structures surrounding it.
- **Myelogram**—a liquid dye that x rays cannot penetrate is injected into the spinal column. The dye circulates around the spinal cord and spinal nerves, which appear as white objects against bone on an x-ray film. A myelogram can show pressure on the spinal cord or nerves from herniated disks, bone spurs, or tumors.

- **Bone scan**—an injected radioactive material attaches itself to bone, especially in areas where bone is actively breaking down or being formed. The test can detect fractures, tumors, infections, and arthritis, but may not tell one disorder from another. Therefore, a bone scan is usually performed along with other tests.

## **Who Treats Spinal Stenosis?**

Nonsurgical treatment of spinal stenosis may be provided by internists or general practitioners. The disorder is also treated by specialists such as rheumatologists, who treat arthritis and related disorders; and neurologists, who treat nerve diseases. Orthopaedic surgeons and neurosurgeons also provide nonsurgical treatment and perform spinal surgery if it is required. Allied health professionals such as physical therapists may also help treat patients.

## **What Are Some Nonsurgical Treatments for Spinal Stenosis?**

In the absence of severe or progressive nerve involvement, a doctor may prescribe one or more of the following conservative treatments:

- Nonsteroidal anti-inflammatory drugs, such as aspirin, naproxen (Naprosyn)<sup>2</sup>, ibuprofen (Motrin, Nuprin, Advil), or indomethacin (Indocin), to reduce inflammation and relieve pain.
- Analgesics, such as acetaminophen (Tylenol), to relieve pain.
- Corticosteroid injections into the outermost of the membranes covering the spinal cord and nerve roots to reduce inflammation and treat acute pain that radiates to the hips or down a leg.
- Restricted activity (varies depending on extent of nerve involvement).
- Physical therapy and/or prescribed exercises to maintain motion of the spine and build endurance, which help stabilize the spine.

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<sup>2</sup> Brand names included in this fact sheet are provided as examples only. Their inclusion does not mean that these products are endorsed by the National Institutes of Health or another Government agency. Also, if a particular brand name is not mentioned, this does not mean or imply that the product is unsatisfactory.

- A lumbar brace or corset to provide some support and help the patient regain mobility. This approach is sometimes used for patients with weak abdominal muscles or older patients with degeneration at several levels of the spine.

### **When Should Surgery Be Considered and What Is Involved?**

In many cases, the conditions causing spinal stenosis cannot be permanently altered by nonsurgical treatment, even though these measures may relieve pain for a time. To determine the extent to which nonsurgical treatment will help, a doctor seldom recommends surgery during the first 3 months of treatment. However, surgery might be considered within the 3-month period if a patient experiences numbness or weakness that interferes with walking, impaired bowel or bladder function, or other neurological involvement.

The purpose of surgery is to relieve pressure on the spinal cord or nerves and restore and maintain alignment and strength of the spine. This can be done by removing, trimming, or adjusting diseased parts that are causing the pressure or loss of alignment. The most common surgery is called decompressive laminectomy: removal of the lamina (roof) of one or more vertebrae to create more space for the nerves. A surgeon may perform a laminectomy with or without fusing vertebrae or removing part of a disk. Various devices may be used to enhance fusion and strengthen unstable segments of the spine following decompression surgery.

Patients with spinal stenosis caused by spinal trauma or achondroplasia may need surgery at a young age. When surgery is required in patients with achondroplasia, laminectomy (removal of the roof) without fusion is usually sufficient.

### **What Are the Major Risks of Surgery?**

All surgery, particularly that involving general anesthesia and older patients, carries risks. The most common complications of surgery for spinal stenosis are a tear in the membrane covering the spinal cord at the site of the operation, infection, or a blood clot that forms in the veins. These conditions can be treated but may prolong recovery.

## **What Are the Long-Term Outcomes of Surgical Treatment for Spinal Stenosis?**

Removal of the obstruction that has caused the symptoms usually gives patients some relief; most patients have less leg pain and are able to walk better following surgery. However, if nerves were badly damaged prior to surgery, there may be some remaining pain or numbness or no improvement. Also, the degenerative process will likely continue, and pain or limitation of activity may reappear 5 or more years after surgery.

## **What Research on Spinal Stenosis Is Being Supported by the NIAMS?**

The National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) is supporting several research projects on spinal stenosis. For example, at the Multipurpose Arthritis and Musculoskeletal Disease Center at the Hospital for Special Surgery in New York City, doctors are comparing the effectiveness of injecting a steroid (cortisone-like) medicine with that of injecting an analgesic medicine into the epidura (outermost membrane covering the spinal cord) for relief of pain and disability due to spinal stenosis. In another NIAMS-funded study involving 11 different medical centers, researchers are comparing surgical vs. nonsurgical treatment of spinal stenosis and two other conditions that cause back pain.

Other researchers are exploring why spinal cord changes lead to a decreased pain threshold or an increased sensitivity to pain, and how fractures of the spine and their repair affect the spinal canal and intervertebral foramen.

## **What Are Other Sources of Information on Spinal Stenosis?**

- American Academy of Orthopaedic Surgeons  
P.O. Box 2058  
Des Plaines, IL 60017  
800-824-BONE (2663)  
World Wide Web address: <http://www.aaos.org/>

The academy provides education and practice management services for orthopaedic surgeons and allied health professionals. It also serves as an advocate for improved patient care and informs the public about the science of orthopaedics. The orthopaedist's scope of practice includes disorders of the body's bones, joints, ligaments, muscles, and tendons. For a single copy of an AAOS brochure, send a self-addressed stamped envelope to the address above or visit the AAOS Web site.

- North American Spine Society  
6300 North River Road, Suite 500  
Rosemont, IL 60018-4231  
847/698-1630  
Fax: 847/823-8668  
World Wide Web address: <http://www.spine.org/>

This professional association can identify specialists throughout the country who treat disorders of the spine.

- American College of Rheumatology/Association  
of Rheumatology Health Professionals  
1800 Century Place, Suite 250  
Atlanta, GA 30345  
404/633-3777  
Fax: 404/633-1870  
E-mail: [acr@rheumatology.org](mailto:acr@rheumatology.org)  
World Wide Web address: <http://www.rheumatology.org/>

This national professional organization can provide referrals to rheumatologists and allied health professionals, such as physical therapists. One-page fact sheets are available on various forms of arthritis. Lists of specialists by geographic area and fact sheets are also available on the American College of Rheumatology's Web site.

- Arthritis Foundation  
1330 West Peachtree Street  
Atlanta, GA 30309  
404/872-7100  
800/283-7800 or your local chapter listed in your local telephone directory  
Fax: 404/872-9959  
E-mail: [helpdesk@arthritis.org](mailto:helpdesk@arthritis.org)  
World Wide Web address: <http://www.arthritis.org/>

The foundation has a free brochure on back pain and several free brochures about coping with arthritis, taking nonsteroid and steroid medicines, and exercise. The foundation also provides referrals to doctors treating various forms of arthritis.

- Spondylitis Association of America  
P.O. Box 5872  
Sherman Oaks, CA 91413  
818/981-1616  
800/777-8189  
Fax: 818/981-9826  
E-mail: [info@spondylitis.org](mailto:info@spondylitis.org)  
World Wide Web address: <http://www.spondylitis.org>

This association provides physician referrals and information on spondylitis.

- National Institute of Arthritis and Musculoskeletal  
and Skin Diseases Information Clearinghouse  
National Institutes of Health  
1 AMS Circle  
Bethesda, MD 20892-3675  
301/495-4484  
Fax: 301/718-6366  
TTY: 301/565-2966  
World Wide Web address: <http://www.nih.gov/niams/>

The clearinghouse has additional information about some back problems and about arthritis. Single copies of fact sheets and information packages are available free upon request.

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The mission of the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), a part of the National Institutes of Health (NIH), is to support research into the causes, treatment, and prevention of arthritis and musculoskeletal and skin diseases, the training of basic and clinical scientists to carry out this research, and the dissemination of information on research progress in these diseases. The National Institute of Arthritis and Musculoskeletal and Skin Diseases Information Clearinghouse is a public service sponsored by the NIAMS that provides health information and information sources. Additional information can be found on the NIAMS Web site at [www.nih.gov/niams](http://www.nih.gov/niams).

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