



Spinal Fusion: Axial Lumbar Interbody Fusion (AxiaLIF)

Overview

AxiaLIF is a minimally invasive spinal fusion to treat disc problems in the low back. Fusion stabilizes the spine to stop the painful motion and decompress pinched nerves. Through a small incision at the tailbone, the damaged disc is removed and a rod placed to correct the spacing between the vertebrae. During healing, the bones will fuse together. The back muscles are avoided, so recovery is quicker.

What is AxiaLIF?

AxiaLIF stands for *axial lumbar interbody fusion*. When back and leg pain result from injury or degenerative changes in the spine, AxiaLIF surgery may be recommended (Fig. 1). Fusion stabilizes the spine and prevents painful motion.

A small incision is made on the buttock and a tube is inserted to reach the spine. After the damaged disc is removed, the space between the bony vertebrae is filled with bone graft. The graft bridges the two bones to promote fusion. Next, the graft and vertebrae are fixed into place with a threaded rod. Across the space, a rod restores the spacing between the two bones and relieves pinching of the spinal nerves (Fig. 2).

During healing, new bone cells grow around the graft. After 3 to 6 months, the bone graft should fuse the two vertebrae, forming one solid piece of bone. Instrumentation and fusion work together, similar to reinforced concrete.

AxiaLIF is unique for several reasons. First, the incision is small—less than 1-inch long near the buttock. Second, its path to the spine lies in front of the sacrum (presacral). The surgeon tunnels between the bowel and sacral bone to reach the spine. Because this area is usually filled with fat, this presacral path to the disc can be made without disturbing the spinal cord and nerves. Third, the tubular instruments do not cut through any back muscles like other fusion surgeries. Thus, AxiaLIF lessens trauma to these soft tissues and avoids injury to the spinal nerves. However, there is a slight risk of bowel injury. Finally, AxiaLIF can be performed as outpatient surgery and many patients go home the same day.

Depending on the patient's symptoms, a one-level operation joining two bones (L5-S1) or two-level joining three bones (L4-L5-S1) may be used.

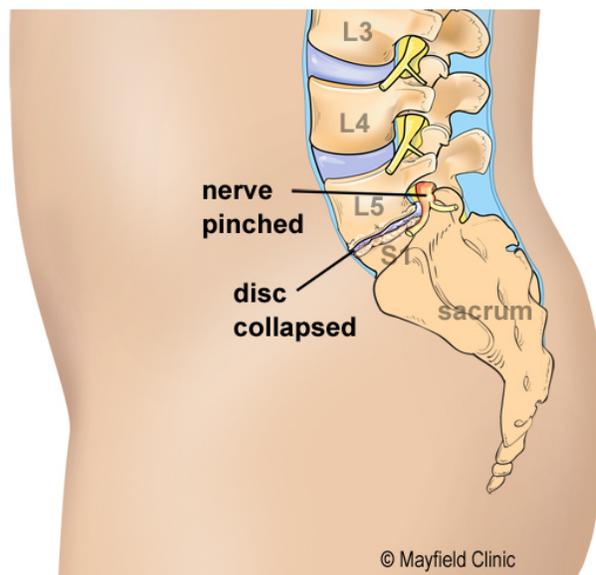


Figure 1. A collapsed degenerative disc pinches the nerves between the bones causing back pain and instability.

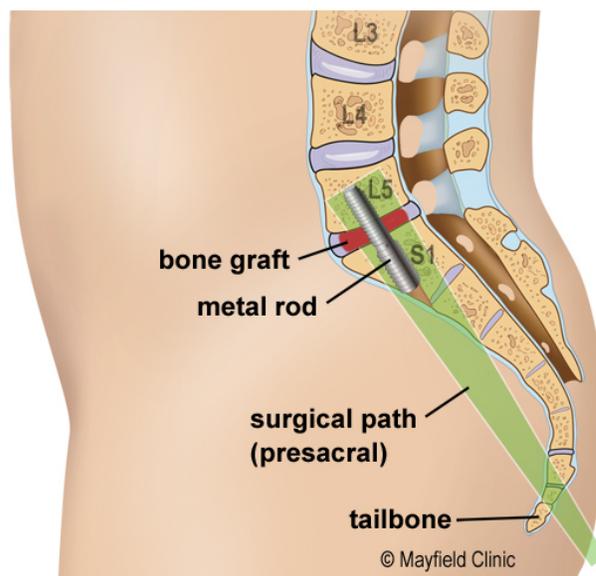


Figure 2. Through an incision near the tailbone, AxiaLIF reaches the disc from the front of the sacrum. The disc center is removed and replaced with graft. A rod restores the disc height and fuses the lumbar (L5) and sacral (S1) bones together.

Who is a candidate?

You may be a candidate for AxiaLIF if you have:

- degenerative disc at L4 or L5
- spondylolisthesis (low grade) at L5-S1
- failed fusion from a previous surgery
- diagnostic tests, such as MRI, CT discography, and x-rays showing degenerative disc
- symptoms that have not improved with physical therapy or medication

You are not a candidate for AxiaLIF if you have:

- bowel or rectal disease, colitis, Crohn's disease
- scoliosis or severe spondylolisthesis
- spine tumor or trauma
- other problems that would prevent bone fusion

The surgeon will evaluate the tailbone's curve to determine if the AxiaLIF approach can be used. This requires a standing x-ray of the lumbar spine, sacrum, and coccyx. MRI or CT will help identify any anomalies in the trajectory.

AxiaLIF fusion may be helpful in treating:

- **Degenerative disc:** with age the discs dry out and shrink. As the disc spaces get smaller, these changes can lead to stenosis or disc herniations that pinch nerves (Fig. 1).
- **Spondylolisthesis:** a forward slip of a vertebra out of alignment with the spinal column. It can kink and compress the nerves causing pain.
- **Spinal stenosis:** narrowing of the spinal canal and nerve root canal as well as enlargement of the facet joints can pinch spinal nerves and cause pain and numbness in legs.

The surgical decision

If you are a candidate for spinal fusion, the surgeon will explain your options. Consider the risks and benefits of each option as you decide. AxiaLIF is performed only after other treatments have been explored. Fusion will not "fix" your back problem or completely relieve pain. Rather, it can stop the motion in the painful area of the spine. This allows increased function and return to a more normal lifestyle—though one that may not be totally pain-free.

Your surgeon will also explain the various types of bone graft. These materials fill the remaining disc space, a kind of mortar between the bones as your body heals. Typically, the graft will include your bone shavings (autograft) and a synthetic BMP. Each type has advantages and disadvantages.

- **Autograft** is your living bone shavings taken as the surgeon cuts out the disc during drilling.
- **Allograft** is bone from an organ donor collected and stored by a bone-bank. The donor graft has no bone-growing cells.
- **BMP (bone morphogenetic protein)** is added to bone graft material to stimulate bone growth naturally in the body.

Who performs the procedure?

A neurosurgeon or orthopedic surgeon can perform spine surgery. Many spine surgeons have specialized training in minimally invasive surgery. Certain minimally invasive techniques are highly technical; they require special instruments and training to avoid complications. Ask your surgeon about their training, especially if your case is complex or you've already had a spinal surgery.

What happens before surgery?

Presurgical tests (e.g., blood test, chest X-ray, electrocardiogram) may be done several days before surgery. In the doctor's office, you will sign consent forms and provide your medical history (allergies, medicines/vitamins, bleeding history, anesthesia reactions, previous surgeries). Tell your healthcare provider about any medications (over-the-counter, prescription, herbal, supplements) that you are taking.

Continue taking the medications your surgeon recommends. Stop taking all non-steroidal anti-inflammatory medicines (Naprosyn, Advil, Motrin, Nuprin, Aleve, etc.) and blood thinners (Coumadin, Plavix, etc.) 1 to 2 weeks before surgery as directed by your doctor. Ask your doctor if you are unsure.

Stop smoking and drinking before surgery

The most important way to achieve a successful spinal fusion is to quit smoking. Stop cigarettes, cigars, pipes, chewing tobacco, and smokeless tobacco (snuff, dip) 1 week before and 2 weeks after surgery.

Nicotine prevents bone growth and decreases successful fusion. Smoking is serious: fusion fails in 40% of smokers compared with 8% of non-smokers [1]. Smoking also decreases blood circulation, resulting in slower wound healing and increased risk of infection. Talk with your doctor about help to quit smoking: nicotine replacements, pills without nicotine (Wellbutrin, Chantix), and tobacco counseling programs.

Stop drinking alcohol 1 week before and 2 weeks after surgery to avoid bleeding problems.

Bowel prep: day before surgery

Emptying the colon is a precaution before AxiaLIF. A bowel empty of feces is easier to move aside during surgery and reduces the infection risk in the unlikely case of puncture. The prep is the same taken to empty the bowel before a colonoscopy.

Of the various bowel preps, each has slightly different instructions, including tips to make it more tolerable or what to drink with it. Get your prep early, read the instructions, and plan for that day in advance.

The day before surgery, stop eating solid foods and begin a clear liquid diet. Take the bowel prep: usually the afternoon/evening before surgery as instructed by your surgeon. Make sure to drink enough while the diarrhea purge continues.

Morning of surgery

- No food or drink.
- Shower using antibacterial soap. Dress in freshly washed, loose-fitting clothing.
- Wear flat-heeled shoes with closed backs.
- If you have instructions to take regular medication the morning of surgery, do so with small sips of water.
- Remove make-up, hairpins, contacts, body piercings, nail polish, etc.
- Leave all valuables and jewelry at home (including wedding bands).
- Bring a list of medications (prescriptions, over-the-counter, and herbal supplements) with dosages and the times of day usually taken.
- Bring a list of allergies to medication or foods.

Arrive at the hospital 2 hours before (surgery center 1 hour before) your scheduled operation to complete the necessary paperwork and pre-procedure work-ups. An anesthesiologist will talk with you and explain the effects of anesthesia and its risks. An intravenous (IV) line will be placed in your arm.

What happens during surgery?

This 8-step procedure generally takes 1 to 3 hours.

Step 1: prepare the patient

You'll lie on your stomach on the operative table and be given anesthesia. Once asleep, your low back and buttocks area are cleansed and prepped. Because the incision is close to the rectum, the surgeon will sometimes check this region visually by air or contrast via a catheter.

Step 2: make the incision

A small incision is made near the tailbone (Fig. 3). The surgeon makes a path between the bowel and sacrum—an area usually filled with fat. The rectum is carefully avoided as muscles and fat are gently moved aside.

Step 3: locate the damaged disc

Looking at the fluoroscope (a special X-ray), the surgeon carefully passes a long narrow tube along the path of the sacrum to the sacral base (S1). A drill passed through this tube will then bore through the bone to reach the damaged disc (Fig. 4).

Step 4: remove the disc

The surgeon uses rotating cutters or brushes to remove only the inner nucleus of the disc without disturbing the outer wall (annulus) (Fig. 5). The loose material is suctioned out leaving an empty disc space. Next, cutters will clean out more of the

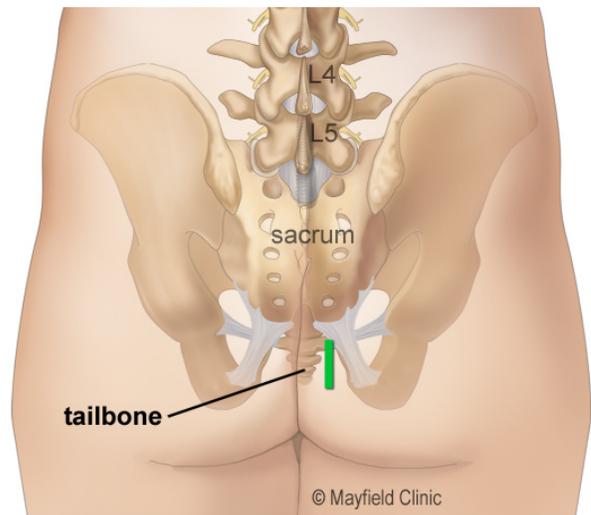


Figure 3. A 1-inch skin incision (green line) is made next to your tailbone (coccyx).

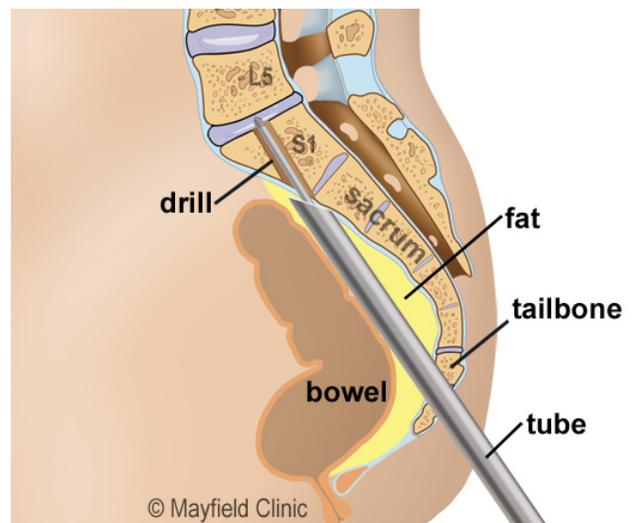


Figure 4. Using tubular dilators and watching an x-ray monitor, the surgeon makes a corridor between the sacrum bone and the bowel. At the base of S1, a channel is drilled through the bone to reach the disc.

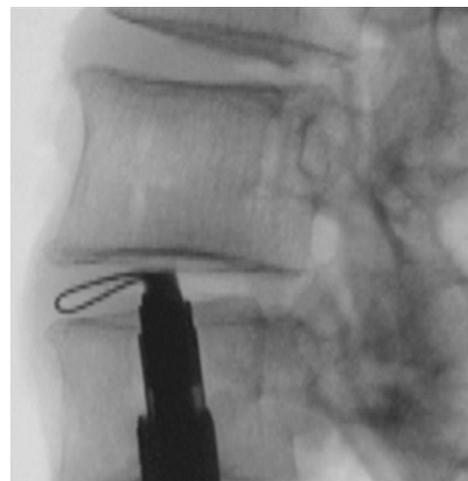


Figure 5. An x-ray shows rotating loop cutters used to remove the disc center.

space, creating the bone shavings that will be collected to make bone graft. The remaining space cannot provide stability for the spine so it will be filled and expanded with bone graft materials.

Step 5: prepare the bone graft

Your bone shavings are mixed with another graft material, typically BMP, into a thick paste. The mortar-like paste is pushed through the tube, filling the empty disc space (Fig. 6). This graft contains proteins that help new bone to form and eventually fuse.

Step 6. insert the rod

Guided by x-ray fluoroscopy, the surgeon drills a channel into the L5 bone. Next, the distance across the disc space, from bone to bone, determines the length of AxiaLIF rod needed. Bridged across the disc space, the rod pushes the two bones apart to restore normal disc space (Fig. 6). The rod is fixed into the bone and more bone graft can be added.

Step 7. insert facet screws (optional)

Depending on the patient's spinal problem, facet screws or pedicle screws may help to strengthen the stabilization. If screws are needed, two small incisions are made below the waist over the L5 joint (Fig. 7). Screws are inserted using fluoroscopy.

Step 8. close the incision

The tubes and instruments are removed. The skin incision is closed with Steri-Strips or biologic glue.

What happens after surgery?

You will awaken in the postoperative recovery area. Blood pressure, heart rate, and respiration will be monitored. Any pain will be addressed. Once awake, you can begin gentle movement (sitting in a chair, walking).

Most patients having a one- or two-level AxiaLIF go home the same day. However, if any difficulty in breathing or unstable blood pressure occurs, the patient can be transferred to a hospital.

Discharge instructions

Discomfort

- Take pain medication as directed by your surgeon. Narcotics can be addictive and are used for a limited period of time.
- Narcotics can also cause constipation. Drink lots of water and eat high-fiber foods. Laxatives and stool softeners such as Dulcolax, Senokot, Colace, and Milk of Magnesia are available without a prescription.
- Do **not** take anti-inflammatory pain relievers (Advil, Aleve) without surgeon's approval. They prevent new bone growth and may cause your fusion to fail.
- You may take acetaminophen (Tylenol).
- Ice your incision 3-4 times per day for 15-20 minutes to reduce pain and swelling.

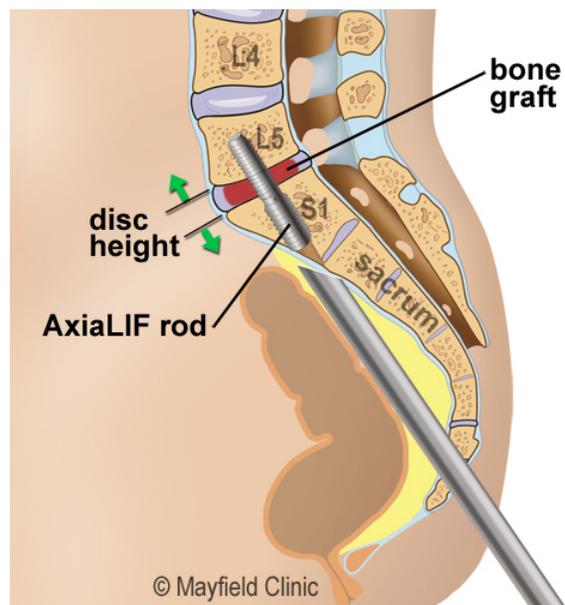


Figure 6. Bone graft material is pushed into the disc space. Then the AxiaLIF rod is inserted through the space and into the bone above. The rod's threads push the two vertebrae apart. This restores the disc height and relieves pressure on nerves.

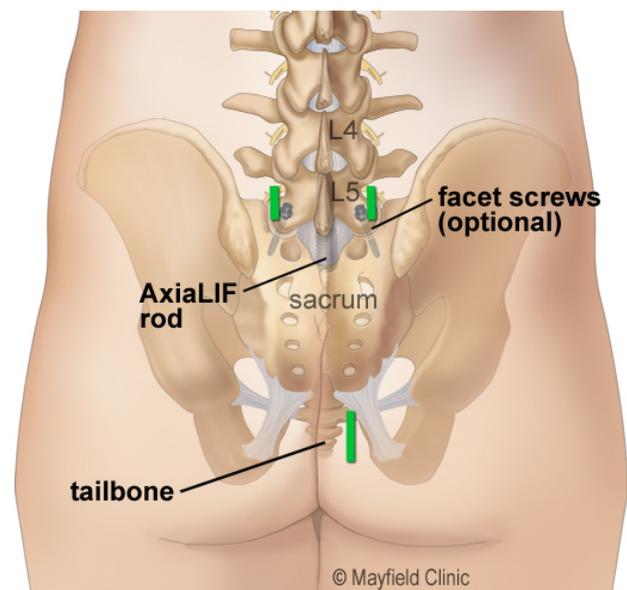


Figure 7. Facet screws may be inserted to keep the bones aligned during fusion.

Restrictions

- Avoid bending, lifting or twisting your back for the next 6 weeks.
- Do not lift anything heavier than 5 pounds for 2 weeks after surgery.
- No strenuous activity for the next 2 weeks, including yard work, housework and sex.
- DO **NOT** SMOKE, vape, dip, chew or use nicotine products. It prevents new bone growth and may cause your fusion to fail.
- Do not drive until after your follow-up appointment. You may ride in the car for short distances of 45 minutes or less if necessary.
- Do not drink alcohol for 2 weeks after surgery or while you are taking narcotic medication.

Activity

- You may need help with daily activities (e.g., dressing, bathing), for the first couple days.
- Get up and walk 5-10 minutes every 3-4 hours. Gradually increase your walking time, as you are able.

Bathing/Incision Care

- Wash your hands thoroughly before and after cleaning your incision to prevent infection.
- If you have Dermabond (skin glue) covering your incision, you may shower the day after surgery. Gently wash the area daily with soap and water. Pat dry.
- If you have staples, steri-strips, or stitches, you may shower 2 days after surgery. Remove the gauze dressing and gently wash the area with soap and water. Replace the dressing or completely remove it if no drainage. Inspect and wash the incision daily.
- Do not submerge or soak the incision in water (bath, pool or tub).
- Some drainage from the incision is normal. A large amount of drainage, foul smelling drainage, or drainage that is yellow or green should be reported to your surgeon's office immediately.
- Staples, steri-strips, and stitches will be removed at your follow-up appointment.

Bracing

- If you were given a brace, wear it at all times unless you are sleeping or showering.

When to Call Your Doctor

- Call if your temperature exceeds 101° F. Call if the incision begins to separate or show signs of infection, such as redness, swelling, pain, or drainage.

Recovery and prevention

Schedule a follow-up appointment with your surgeon for 2 to 4 weeks after surgery. Recovery to resume daily activities is usually 2 to 4 weeks. Several weeks later, X-rays may be taken to ensure that fusion is occurring. At your follow up, the surgeon will decide when you may return to work.

Pain recurrences are common. The key to avoiding recurrence is prevention by:

- Proper lifting techniques
- Good posture during sitting, standing, moving, and sleeping
- Appropriate exercise program
- An ergonomic work area
- Healthy weight and lean body mass
- A positive attitude and relaxation techniques (e.g., stress management)
- Healthy diet of real foods
- No smoking

What are the results?

As a minimally invasive procedure, AxiaLIF uses a small incision, has a short operating time, minimizes blood loss, and poses few serious complications. With its minimal trauma to the spine and nearby tissues, patients often return to daily activities within weeks. Each patient's recovery differs based on health and lifestyle. Keep a positive attitude and diligently perform your physical therapy exercises.

Outcomes of AxiaLIF show 88-92% fusion rates. Patients report an average 54% improvement in back function and a 63% improvement in back pain for single-level AxiaLIF. Results for two-level fusion are 42% improvement in back function and a 56% improvement in back pain. [1,2,3].

What are the risks?

No surgery is without risks. General complications of any surgery include bleeding, infection, blood clots (deep vein thrombosis), and reactions to anesthesia.

Specific complications related to AxiaLIF spinal fusion may include:

Vertebrae fail to fuse. Common reasons why bones do not fuse include smoking and alcohol use, osteoporosis, obesity, and malnutrition. Nicotine is a toxin that inhibits bone-growing cells. If the fusion doesn't heal (pseudoarthrosis), another surgery may be needed for repair.

Bowel injury. Although rare, bowel or bladder perforations have occurred. In these cases, a surgeon repairs the perforation and the patient receives antibiotics to reduce infection. This complication is usually avoided by imaging studies before surgery that identifies any anatomy issues that might pose a problem.

Hardware fracture. Metal screws that stabilize the spine may move or break before the bones are completely fused. Another surgery may be needed to fix or replace the hardware.

Bone graft migration. In 1 to 2% of cases soon after surgery, the bone graft moves from its correct position between the vertebrae. This more often occurs when hardware (plates, screws) is not used or if fusion was for several vertebral levels. If migration occurs, another surgery may be needed.

Transitional syndrome. Fusion causes extra stress and load transferred to the discs and bones above or below the fusion segment. The added wear and tear can eventually degenerate the adjacent level and cause pain.

Nerve damage or persistent pain. Any spine surgery comes with the risk of injury to the nerves or spinal cord. Damage can cause numbness or even paralysis. The most common cause of persistent pain is nerve damage from the disc herniation itself. If the damage was permanent, the nerve cannot respond to surgical decompression. Unlike memory foam, a compressed nerve cannot spring back. In these cases, spinal cord stimulation or other treatments may provide relief.

Sources & links

If you have questions, please contact Springfield Neurological and Spine Institute at 417-885-3888.

Sources

1. Gerszten PC, Tobler W, et al. Axial presacral lumbar interbody fusion and percutaneous posterior fixation for stabilization of lumbosacral isthmic spondylolisthesis. *J Spinal Disord Tech* 25(2):E36-40, 2012.
2. Tobler WD, Gerszten PC, et al. Minimally invasive axial presacral L5-S1 interbody fusion: two-year clinical and radiographic outcomes. *Spine* 36(20):E1296-1301, 2011
3. Whang PG, Sasso RC, et al. Comparison of axial and anterior interbody fusions of the L5-S1 segment: a retrospective cohort analysis. *J Spinal Disord Tech* 26:437-443, 2013.

Links

<http://www.spine-health.com>
<http://www.spineuniverse.com>
<http://www.knowyourback.org>

Glossary

allograft: a portion of living tissue taken from one person (the donor) and implanted in another (the recipient) to help fuse two tissues together.

autograft (autologous): using a portion of living tissue from a part of one's own body, it is transferred to another part to fuse two tissues together.

bone graft: bone harvested from one's self (autograft) or from another (allograft) for the purpose of fusing or repairing a defect.

discectomy: a surgery to remove herniated disc material so that it no longer irritates and compresses the nerve root.

fusion: to join together two separate bones into one to provide stability.



updated > 11.2018

reviewed by > William Tobler, MD, Mayfield Clinic, Cincinnati, Ohio

Mayfield Certified Health Info materials are written and developed by the Mayfield Clinic. We comply with the HONcode standard for trustworthy health information. This information is not intended to replace the medical advice of your health care provider. © Mayfield Clinic 1998-2018.