

## Spinal Decompression: laminectomy & foraminotomy

### Overview

Decompression surgery (laminectomy) opens the bony canals through which the spinal cord and nerves pass, creating more space for them to move freely. Narrowing / stenosis of the spinal and nerve root canals can cause chronic pain, numbness, and muscle weakness in your arms or legs. Surgery may be recommended if your symptoms have not improved with physical therapy or medications.

### What is spinal decompression?

Spinal stenosis is often caused by age-related changes: arthritis, enlarged joints, bulging discs, bone spurs, and thickened ligaments (Fig. 1). Spinal decompression can be performed anywhere along the spine from the neck (cervical) to the lower back (lumbar). The surgery is performed through an incision in the back (posterior) muscles. The lamina bone forms the backside of the spinal canal and makes a roof over the spinal canal. Removing the lamina and thickened ligament gives more room for the nerves and allows for removal of bone spurs (osteophytes). Depending on the extent of stenosis, one vertebra (single-level) or more (multi-level) may be involved. There are several types of decompression surgery:

- **Laminectomy** is the removal of the entire bony lamina, a portion of the enlarged facet joints, and the thickened ligaments overlying the spinal cord and nerves.
- **Laminotomy** is the removal of a small portion of the lamina and ligaments, usually on one side. Using this method the natural support of the lamina is left in place, decreasing the chance of spinal instability. Sometimes an endoscope may be used, allowing for a smaller, less invasive incision.
- **Foraminotomy** is the removal of bone around the neural foramen - the canal where the nerve root exits the spine. This method is used when disc degeneration has caused the height of the foramen to collapse and pinch a nerve.
- **Laminoplasty** is the expansion of the spinal canal by cutting the lamina on one side and swinging them open like a door. It is used only in the neck (cervical) area.
- **Discectomy** is the removal of a portion of a bulging or degenerative disc to relieve pressure on the nerves.

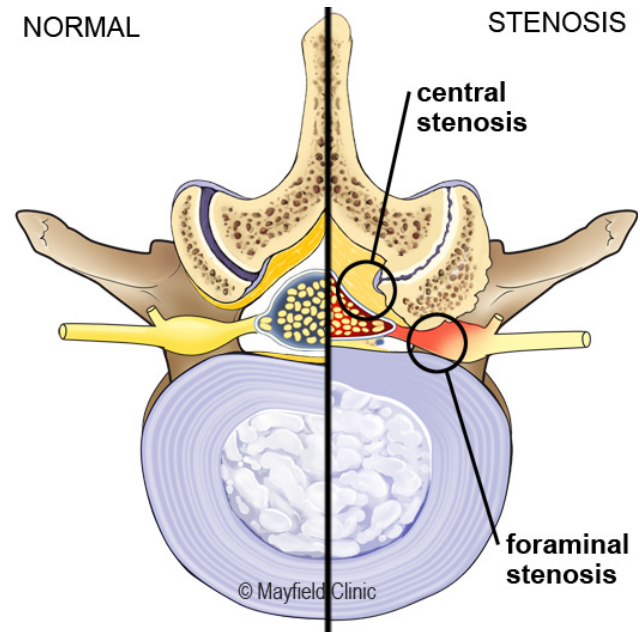


Figure 1. Top view of vertebra showing the difference between normal canals (left) and ones with stenosis (right). Stenosis can include narrowing of the spinal canal, nerve root canals, enlargement of the facet joints, stiffening of the ligaments, bulging disc, and bone spurs. These arthritic changes pinch the spinal cord and nerves, causing them to become swollen and inflamed.

In some cases, spinal fusion may be done at the same time to help stabilize sections of the spine treated with laminectomy. Fusion uses a combination of bone graft, screws, and rods to connect two separate vertebrae together into one new piece of bone. Fusing the joint prevents the spinal stenosis from recurring and can help eliminate pain from an unstable spine.

### Who is a candidate?

You may be a candidate for decompression if you have:

- significant pain, weakness, or numbness in your leg or foot
- leg pain worse than back pain
- not improved with physical therapy or medication
- difficulty walking or standing that affects your quality of life
- diagnostic tests (MRI, CT, myelogram) that show stenosis in the central canal or lateral recess.

## The surgical decision

Decompression surgery for spinal stenosis is elective, except in the rare instance of cauda equina syndrome or rapidly progressing neurologic deficits. Your doctor may recommend treatment options, but only you can decide whether surgery is right for you. Be sure to look at all the risks and benefits before making a decision. Decompression does not cure spinal stenosis nor eliminate arthritis; it only relieves some of the symptoms. Unfortunately, the symptoms may recur as the degenerative aging process that produces stenosis continues.

## Who performs the procedure?

A neurosurgeon or an orthopedic surgeon can perform spine surgery. Many spine surgeons have specialized training in complex spine surgery. Ask your surgeon about their training, especially if your case is complex or you've had more than one spinal surgery.

## What happens before surgery?

In the doctor's office you will sign consent forms and fill out paperwork so that the surgeon knows your medical history (allergies, medicines/vitamins, bleeding history, anesthesia reactions, previous surgeries). Presurgical tests (e.g., blood test, electrocardiogram, chest X-ray) may need to be done several days before surgery. Consult your primary care physician about stopping certain medications and ensure you are cleared for surgery.

Continue taking the medications your surgeon recommends. Stop taking all non-steroidal anti-inflammatory medicines (ibuprofen, naproxen, etc.) and blood thinners (Coumadin, aspirin, Plavix, etc.) 7 days before surgery. Stop using nicotine and drinking alcohol 1 week before and 2 weeks after surgery to avoid bleeding and healing problems.

You may be asked to wash your skin with Hibiclens (CHG) or Dial soap before surgery. It kills bacteria and reduces surgical site infections. (Avoid getting CHG in eyes, ears, nose or genital areas.)

No food or drink is permitted past midnight the night before surgery. Patients are admitted to the hospital the morning of the procedure. An anesthesiologist will explain the effects of anesthesia and its risks.

## What happens during surgery?

There are seven steps of the procedure. The operation generally lasts 1 to 3 hours.

### Step 1: prepare the patient

You will lie on your back on the operative table and be given anesthesia. Once asleep you will be rolled over onto your stomach with your chest and sides supported by pillows. The area where the incision will be made is cleansed and prepped. If a fusion is planned and you have decided to use your own bone, the hip area will be prepped to obtain a bone

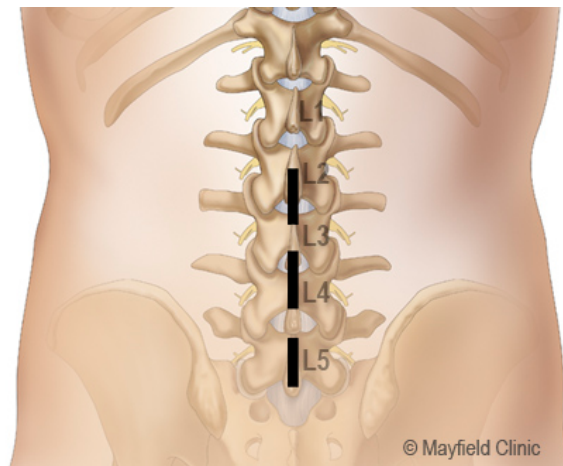


Figure 2. A skin incision is made down the middle of your back.

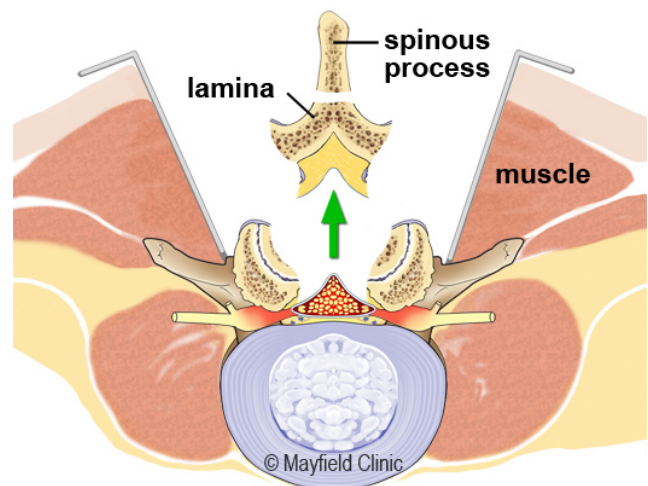


Figure 3. The muscles overlying the vertebrae are dissected off the bone and retracted to either side. A laminectomy removes the entire lamina and ligament.

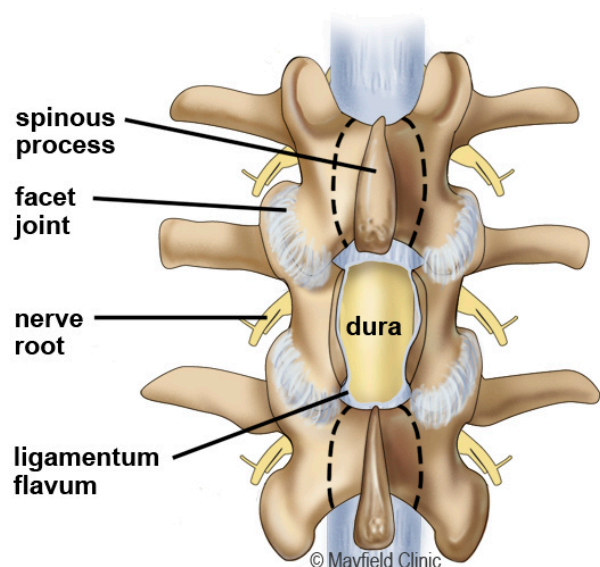


Figure 4. The laminectomy opens a window allowing the dura sac (containing nerves) to re-expand in the empty space. Multiple laminae may be removed.

graft. If you've decided to use donor bone, a hip incision is not necessary.

### Step 2: incision

A skin incision is made down the middle of your back over the appropriate vertebrae (Fig. 2). The length of the incision depends on how many laminectomies are to be performed. The strong back muscles are split down the middle and moved to either side exposing the lamina of each vertebra.

### Step 3: laminectomy or laminotomy

Once the bone is exposed, an X-ray is taken to verify the correct vertebra.

- **Laminectomy:** The surgeon removes the bony spinous process. Next, the bony lamina is removed with a drill or bone-biting tools (Fig. 3). The thickened ligamentum flavum that connects the laminae of the vertebra below with the vertebra above is removed. This is repeated for each affected vertebrae (Fig. 4).
- **Laminotomy:** In some cases, the surgeon may not want to remove the entire protective bony lamina. A small opening of the lamina above and below the spinal nerve may be enough to relieve compression (Fig. 5). Laminotomy can be done on one side (unilateral) or both sides (bilateral) and on multiple vertebrae levels.

### Step 4: decompress the spinal cord

Once the lamina and ligamentum flavum are removed the protective covering of the spinal cord (dura mater) is visible. The surgeon can gently retract the protective sac of the spinal cord and nerve root to remove bone spurs and thickened ligament.

### Step 5: decompress the spinal nerve

The facet joints, which are directly over the nerve roots, may be undercut (trimmed) to give the nerve roots more room (Fig 6). Called a foraminotomy, this maneuver enlarges the neural foramen (where the spinal nerves exit the spinal canal). If a herniated disc is causing compression the surgeon will perform a discectomy.

### Step 6: fusion (if necessary)

If you have spinal instability or have laminectomies to multiple vertebrae, a fusion may be performed. Fusion is the joining of two vertebrae with a bone graft held together with hardware such as plates, rods, hooks, pedicle screws, or cages. The goal of the bone graft is to join the vertebrae above and below to form one solid piece of bone. There are several ways to create a fusion. The right one for you depends on your own choice and your doctor's recommendation.

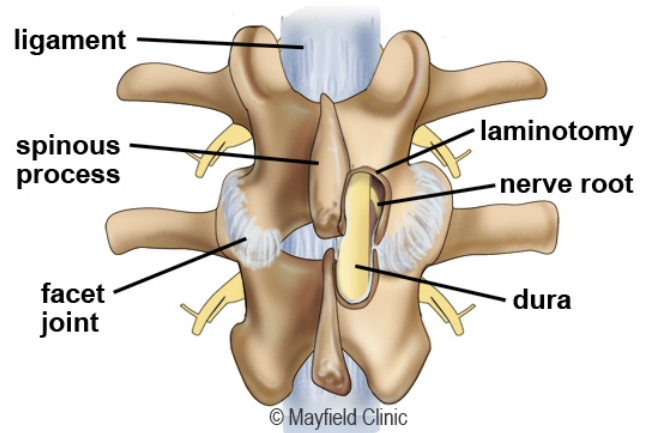


Figure 5. A laminotomy makes a small window by removing bone of the lamina above and below. The spinous process is not removed.

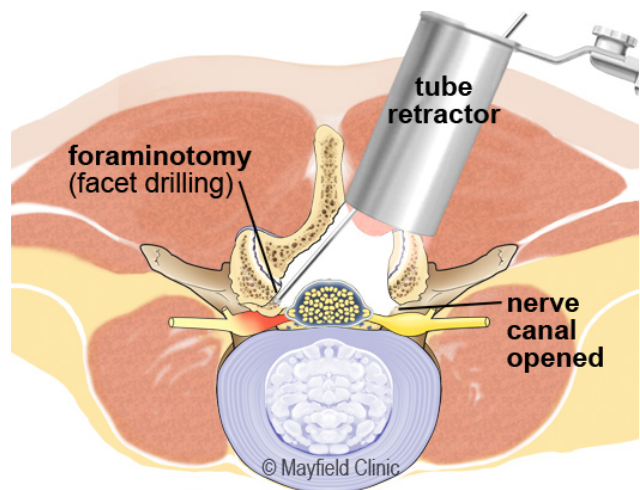


Figure 6. A foraminotomy removes the bone narrowing the nerve root canals. The enlarged facet joints are trimmed to relieve pressure on the spinal nerves. Use of a minimally invasive tube retractor causes less disruption to the back muscles.

The most common type of fusion is called the posterolateral fusion. The topmost layer of bone on the transverse processes is removed with a drill to create a bed for the bone graft to grow. Bone graft, taken from the top of your hip, is placed along the posterolateral bed. The surgeon may reinforce the fusion with metal rods and screws inserted into the vertebrae. The back muscles are laid over the bone graft to hold it in place.

### Step 7: closure

The muscle and skin incisions are sewn together with sutures or staples.



## What happens after surgery?

You will awaken in the postoperative recovery area. Your blood pressure, heart rate, and respiration will be monitored, and your pain will be addressed. Once awake you will be moved to a regular room where you'll increase your activity level (sitting in a chair, walking). If you've had a fusion, a brace may need to be worn. In 1 to 2 days you'll be released from the hospital and given discharge instructions. Be sure to have someone at home to help you for the first 24 to 48 hours.

Follow the surgeon's home care instructions for 2 weeks after surgery or until your follow-up appointment. In general, you can expect:

### Restrictions

- Avoid bending or twisting your back.
- Don't lift anything heavier than 5 pounds.
- No strenuous activity including yard work, housework, and sex.
- Don't drive the first 2-3 days or while taking pain medicines or muscle relaxers. If your pain is well controlled, you can drive.
- Don't drink alcohol. It thins the blood and increases the risk of bleeding. Also, don't mix alcohol with pain medicines.

### Incision Care

- If Dermabond skin glue covers your incision, you may shower the day after surgery. Gently wash the area with soap and water every day. Don't rub or pick at the glue. Pat dry.
- If you have staples, steri-strips or stitches, you may shower 2 days after surgery. Gently wash the area with soap and water every day. Pat dry.
- If there is drainage, cover the incision with a dry gauze dressing. If drainage soaks through two or more dressings in a day, call the office.
- Don't soak the incision in a bath or pool.
- Don't apply lotion/ointment on the incision.
- Dress in clean clothes after each shower. Sleep with clean bed linens. No pets in the bed until your incision heals.
- Staples, steri-strips, and stitches are removed at your follow-up appointment.

### Medications

- Take pain medicines as directed by your surgeon. Reduce the amount and frequency as your pain subsides. If you don't need the pain medicine, don't take it.
- Narcotics can cause constipation. Drink lots of water and eat high-fiber foods. Stool softeners and laxatives can help move the bowels. Colace, Senokot, Dulcolax and Miralax are over-the-counter options.

### Activity

- Ice your incision 3-4 times per day for 15-20 minutes to reduce pain and swelling.
- Don't sit or lie in one position longer than an hour unless you are sleeping. Stiffness leads to more pain.
- Get up and walk 5-10 minutes every 3-4 hours. Gradually increase walking, as you are able.

### When to Call Your Doctor

- Fever over 101.5° (unrelieved by Tylenol).
- Unrelieved nausea or vomiting.
- Signs of incision infection.
- Rash or itching at the incision (allergy to Dermabond skin glue).
- Swelling and tenderness in the calf of one leg.
- New onset of tingling, numbness, or weakness in the arms or legs.
- Dizziness, confusion, nausea or excessive sleepiness.

### What are the results?

Decompressive laminectomy is successful in relieving leg pain in 70% of patients allowing significant improvement in function (ability to perform normal daily activities) and markedly reduced level of pain and discomfort.<sup>1</sup> However, back pain may not be relieved and 17% of older adults need another treatment.<sup>2</sup> Symptoms may return after a few years.

Decompressive laminotomy is successful in relieving back pain (72%) and leg pain (86%), and in improving walking ability (88%).<sup>3</sup> Endoscopic laminotomy results in less blood loss, shorter hospital stay, and less postoperative pain medication than an open laminotomy.

The results of the surgery are largely up to you. It is important to keep a positive attitude and diligently perform your physical therapy exercises. Maintaining a weight that is appropriate for your height can significantly reduce pain. Do not expect your back to be as good as new. Be mindful that you'll always have a bad back and will need to use correct posture and lifting techniques to avoid re-injury.

### What are the risks?

No surgery is without risks. General complications of any surgery include bleeding, infection, blood clots, and reactions to anesthesia. If spinal fusion is done at the same time as a laminectomy, there is greater risk of complications. The following are risks that should be considered:

**Nerve damage or persistent pain.** Any operation on the spine comes with the risk of damaging the nerves or spinal cord. Damage can cause numbness or even paralysis. However, the most common

cause of persistent pain is nerve damage from the stenosis. Some bone spurs may permanently damage a nerve making it unresponsive to decompression surgery. In these cases, spinal cord stimulation or other treatments may provide relief. Be sure to go into surgery with realistic expectations about your pain. Discuss your expectations with your doctor.

**Vertebrae failing to fuse.** Among many reasons why vertebrae fail to fuse, common ones include smoking, osteoporosis, obesity, and malnutrition. Smoking is by far the greatest factor that can prevent fusion. Nicotine is a toxin that inhibits bone-growing cells. If you continue to smoke after your spinal surgery, you could undermine the fusion process.

**Deep vein thrombosis (DVT)** is a potentially serious condition caused when blood clots form inside the veins of your legs. If the clots break free and travel to your lungs, lung collapse or even death is a risk. However, there are several ways to treat or prevent DVT. If your blood is moving it is less likely to clot, so an effective treatment is getting you out of bed as soon as possible. Support hose and pulsatile stockings keep the blood from pooling in the veins. Drugs such as aspirin, Heparin, Lovenox, or Coumadin are also commonly used.

**Hardware fracture.** The metal screws, rods and plates used to stabilize your spine are called "hardware." The hardware may move or break before your vertebrae are completely fused. If this occurs, a second surgery may be needed to fix or replace the hardware.

**Bone graft migration.** In rare cases (1 to 2%), the bone graft can move from the correct position between the vertebrae soon after surgery. This is more likely to occur if hardware (plates and screws) are not used to secure the bone graft. It's also more likely to occur if multiple vertebral levels are fused. If this occurs, a second surgery may be necessary.

**Adjacent segment disease.** 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.

## Sources & links

If you have more questions, please contact Mayfield Brain & Spine at 800-325-7787 or 513-221-1100.

## Sources

- 1) Hu SS, et al. (2000). Stenosis of the lumbar spine. In HB Skinner, ed., Current Diagnosis and Treatment in Orthopedics, 2nd ed., pp. 199–201. New York: McGraw-Hill.
- 2) Turner JA, Ersek M, Herron L, Deyo R. Surgery for lumbar spinal stenosis: Attempted meta-analysis of the literature. Spine 1992; 17:1-8.
- 3) Khoo L, Fessler RG. Microendoscopic decompressive laminotomy for the treatment of lumbar stenosis. Neurosurgery 51:S146-54, 2002

## Links

<https://www.spine-health.com>  
<https://www.KnowYourBack.org>

## Glossary

**annulus (annulus fibrosis):** tough fibrous outer wall of an intervertebral disc.

**cauda equina syndrome:** dull pain and loss of feeling in the buttocks, genitals, and/or thigh with impaired bladder and bowel function; caused by compression of the spinal nerve roots.

**cervical:** the neck portion of the spine made up of seven vertebrae.

**decompression:** opening or removal of bone to relieve pressure and pinching of the spinal nerves.

**discectomy:** a type of surgery in which herniated disc material is removed so that it no longer irritates and compresses the nerve root.

**facet joints:** joints located on the top and bottom of each vertebra that connect the vertebrae to each other and permit back motion.

**foraminotomy:** surgical enlargement of the intervertebral foramen through which the spinal nerves pass from the spinal cord to the body. Performed to relieve pressure and pinching of the spinal nerves.

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

**herniated disc:** a condition in which disk material protrudes through the disk wall and irritates surrounding nerves causing pain.

**lamina:** flat plates of bone originating from the pedicles of the vertebral body that form the posterior outer wall of the spinal canal and protect the spinal cord. Sometimes called the vertebral arch.

**spinal instability:** abnormal movement between two vertebrae that can cause pain or damage the spinal cord and nerves.



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