

Spinal Fusion: Anterior Lumbar Interbody Fusion (ALIF)

Overview

Anterior lumbar interbody fusion is a surgery to treat disc problems in the low back. Fusion locks together two or more bones to stop painful motion and correct their alignment. Through an incision in the front of the belly, the disc is removed. A bone graft is placed in the empty space to restore the height and relieve nerve pinching. During healing, the bones fuse into one solid piece.

What is anterior lumbar spine fusion?

Your doctor may recommend spinal fusion to repair damaged discs and realign bones causing back or leg pain. There are several ways to reach the spine and perform a fusion (Fig. 1). Your surgeon will discuss the best approach for your unique problem.

During anterior fusion, an incision is made in the front of the belly. A vascular surgeon and spine surgeon work as a team. The vascular surgeon clears a path to the spine, moving aside the vessels to the legs. The spine surgeon removes the damaged disc and fills the space between the bones with a spacer bone graft. The spacer restores the height between the bones, corrects the spinal curvature, and relieves pinched nerves. The graft becomes a bridge between the two bones to promote fusion. In some cases, the graft is strengthened with a metal plate and screws.

As the body heals, new bone grows around the graft. After 3 to 6 months, the graft should fuse the two vertebrae into one solid piece of bone. Like reinforced concrete, instrumentation and fusion work together.

Depending on the symptoms, a one-level or multi-level fusion may be performed. A one-level fusion joins two bones while a two-level fusion joins three bones. Fusion will take away some flexibility in your spine, but most patients do not notice.

Anterior spine fusion has several advantages:

1. A larger spacer device can be used, providing more support and a better chance of fusion.
2. The path to the spine is from the front so there is less pain and disruption to the back muscles.
3. Moving a forward-slipped L5 vertebra back into normal position and restoring proper tilt (lordosis) is easier from the front.

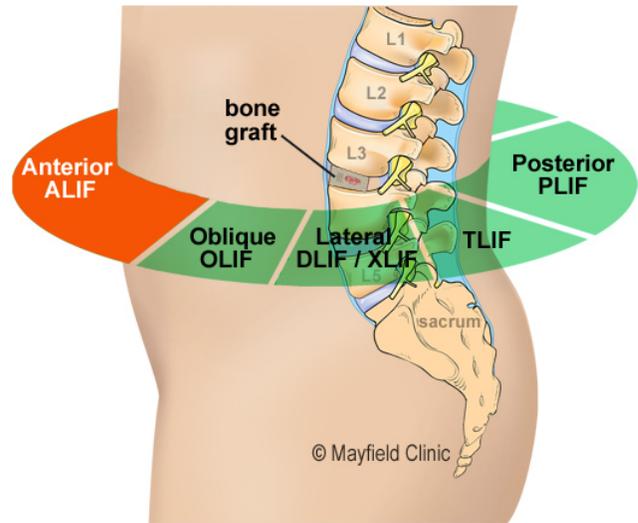


Figure 1. Through an incision made in your belly, anterior lumbar fusion (ALIF) reaches the spine from the front. The damaged disc is removed and replaced with a bone graft.

4. Anterior fusion allows the surgeon to avoid working around the spinal nerves.

The ALIF is performed in a hospital setting. Patients typically go home a day or two after surgery; recovery takes 6 to 12 weeks.

Who is a candidate?

You may be a candidate for ALIF if you have:

- degenerative disc disease
- spondylolisthesis
- scoliosis or flat back syndrome
- symptoms that have not improved with physical therapy or medication

You are not a candidate for ALIF if you have:

- problems that would prevent bone fusion
- significant prior abdominal surgery
- severe atherosclerosis of the aorta or iliac vessels; peripheral vascular disease
- obesity (a weight loss plan is advised)
- severe osteoporosis

Fusion may be helpful in treating:

- **Degenerative disc disease:** the drying and shrinkage of discs with age. As the disc thins or herniates, the vertebrae bones rub and pinch the nerves.
- **Spondylolisthesis:** a forward slip of a vertebra bone out of its normal position. It can kink and compress the nerves, causing pain.
- **Spinal stenosis:** the narrowing of the spinal canal and nerve root canals. Enlarged facet joints and ligaments pinch the nerves causing pain and numbness in the legs.
- **Scoliosis:** an abnormal curve of the spine caused by misalignment of the bones. In adults this occurs from aging discs, arthritis, or previous spine surgery.

The surgical decision

If you are a candidate for spinal fusion, the surgeon will explain your options. Consider all the risks and benefits as you make your decision. Fusion is performed only after other treatments have been explored. It will stop the motion in the painful area of your spine, allowing increased function and a 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 are placed within the remaining disc space and act as a kind of mortar between the bones as your body heals. Each type has advantages and disadvantages.

- **Autograft** is your living bone. The marrow contains bone-growing proteins. It can be collected from drillings during the surgery or taken from the hip as an iliac crest bone graft. The harvested bone is about half an inch thick. The entire thickness of bone is not removed, just the top half layer.
- **BMA (bone marrow aspirate)** is your living bone marrow, collected with a syringe from the hip (iliac bone) or vertebra. It is relatively painless compared to an iliac crest graft.
- **Allograft** is bone from an organ donor, collected and stored by a bone bank. The donor graft has no bone-growing cells.
- **Cellular bone matrix** is allograft from an organ donor that contains bone-growing stem cells. The putty is shaped and added to grafts.
- **BMP (bone morphogenetic protein)** is sometimes added to bone-graft material to stimulate bone growth naturally in the body.

Who performs the procedure?

A neurosurgeon or orthopedic surgeon, along with a vascular surgeon, performs ALIF surgery. Many spine surgeons have specialized training in minimally invasive surgery. Ask your surgeon about his or her training, especially if your case is complex or you have had previous spinal surgery.

What happens before surgery?

Presurgical tests (e.g., blood test, chest x-ray, electrocardiogram) will be done several days before surgery, and you will meet with your vascular surgeon. In the doctor's office, you will sign consent forms and provide your medical history (allergies, medicines/vitamins, bleeding history, anesthesia reactions, previous surgeries). Inform your healthcare provider about all the 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 spine fusion is to eliminate tobacco use (cigarettes, cigars, pipes, chewing tobacco, and snuff / dip) before surgery.

Nicotine prevents bone growth and decreases successful fusion. Smoking risk 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 ways to help you quit smoking: nicotine replacements, pills without nicotine (Wellbutrin, Chantix), and tobacco counseling programs.

You should not drink alcohol 1 week before and 2 weeks after surgery to avoid bleeding problems.

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 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.

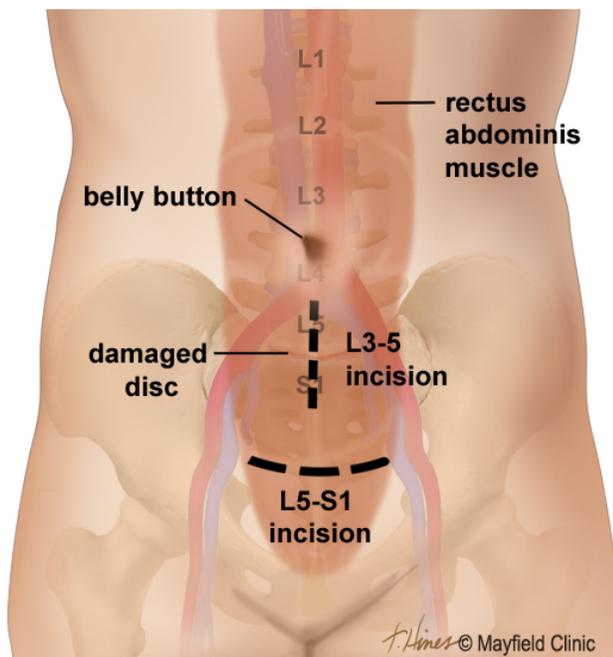


Figure 2. A 2-inch skin incision is made in the lower belly; its exact location depends on the vertebrae being fused.

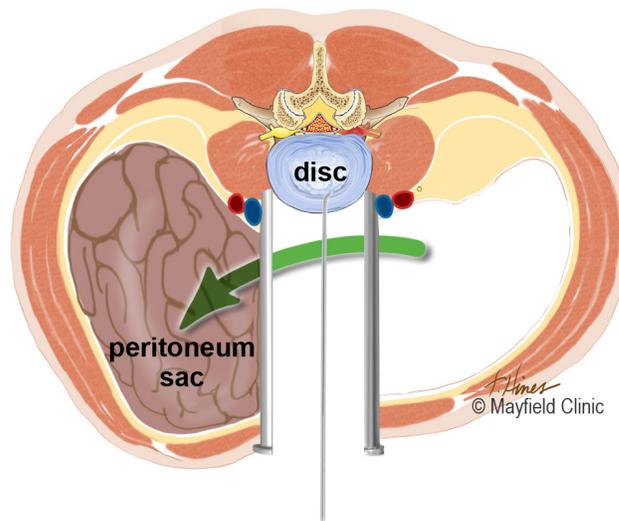


Figure 3. (top view) A vascular surgeon enters the belly and makes a path around the intestines (the retroperitoneal space) to the spine.

What happens during surgery?

This surgery generally takes 1 to 2 hours, depending on how many spine levels are treated.

Step 1: prepare the patient

You will lie on the operating table and be given anesthesia. Once asleep, your belly is cleansed and prepped.

Step 2: make the incision

An x-ray fluoroscope or image guidance is used to plan the approach. The vascular surgeon makes a 2- to 3-inch incision in your belly at the specific disc level (Fig. 2).

Step 3: locate the damaged disc

The vascular surgeon gently clears a path between the abdominal cavity and the retroperitoneal space. The intestines are protected in the peritoneum sac, which is temporarily moved to the right side of the belly (Fig. 3). The veins and arteries overlying the damaged disc(s) are gently moved and held aside (Fig. 4).

Step 4: remove the disc

Next, the spine surgeon removes the damaged disc (Fig. 5). The number of discs removed depends on how many spine levels are affected. A distractor instrument is inserted to open the collapsed disc space. Bone shavers prepare the fusion bed.

Step 5: prepare the disc space

The open disc space is measured, and a spacer size is selected. The trial spacer is slid into the empty

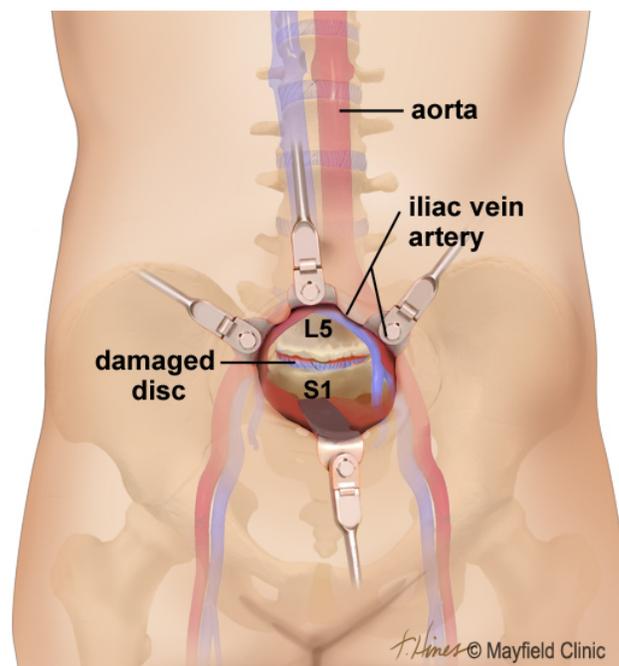


Figure 4. The surgeon carefully moves aside the major blood vessels (iliac arteries and veins) to the legs in order to access and remove the L5-S1 disc.

disc space. An x-ray is taken to ensure that the depth, placement, and wedge angle create sufficient height and decompress the nerves.

When a good fit is made, the bone graft material is prepared for the fusion. The mortar-like paste contains bone-growing proteins that are packed into the permanent bioplastic spacer cage.

Step 6. insert the bone graft

Guided by x-ray fluoroscopy, the permanent spacer graft is inserted into the empty disc space, pushing the two bones apart to restore normal disc height (Fig. 6 and 7).

Step 7. insert plate and screws (optional)

The spacer graft may be held in place with screws or with a metal plate that is screwed into the front of the vertebrae. In some cases, the patient may be turned over so that pedicle screws and rods can be inserted from the back. The hardware provides stability during fusion.

Step 8. close the incision

The instruments are removed and the peritoneum re-expands into its natural position. The abdominal muscle is closed with sutures. The skin incision is closed with skin glue (Dermabond).

What happens after surgery?

You will awaken in the postoperative recovery area. Your 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).

Patients typically go home the next day. Be sure to have someone at home to help you for the first 24 to 48 hours.

Follow these home care instructions for 2 weeks after surgery.

Restrictions

- Avoid bending / twisting your back for 6 weeks.
- Do not lift anything heavier than 5 pounds.
- No strenuous activity including yard work, housework, and sex.
- DON'T SMOKE, vape, dip, chew or use nicotine products. It prevents new bone growth and may cause your fusion to fail.
- Don't drive until after your follow-up appointment.
- Don't drink alcohol. It thins the blood and increases the risk of bleeding. Also, do not mix alcohol with pain medicines.

Incision Care

- Wash your hands before and after cleaning your incision to prevent infection.

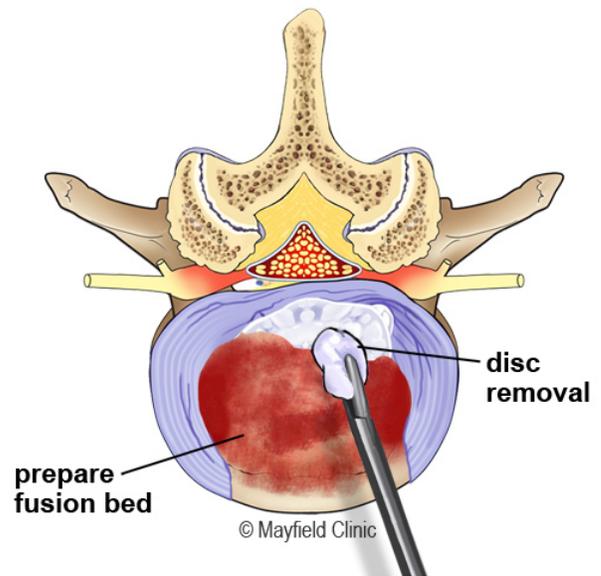


Figure 5. (top view) The disc nucleus is removed. Bone shavers are used to prepare a fusion bed.

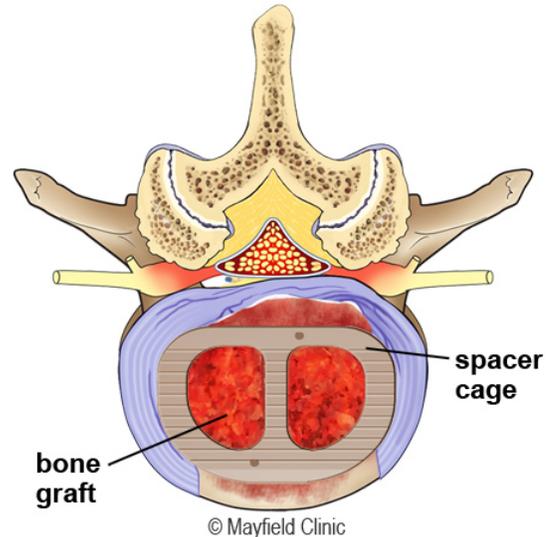


Figure 6. A spacer fusion cage packed with bone graft is inserted to restore the collapsed disc height, realign the bones, and relieve pinching of nerves.

- 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, pool or tub.
- 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.
- Some clear, pinkish drainage from the incision is normal. Watch for increased volume of drainage or spreading redness. An infected incision may have colored drainage and begin to separate.
Staples, steri-strips, and stitches will be 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 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 over-the-counter options.
- If painful constipation does not get better, call the doctor to discuss other medicine.
- Don't take anti-inflammatory pain relievers (Advil, Aleve) without your surgeon's approval. They prevent new bone growth and may cause your fusion to fail.
- You may take acetaminophen (Tylenol).

Managing pain

- 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.

Activity

- Get up and walk 5-10 minutes every 3-4 hours. Gradually increase your walking time, as you are able.

Bracing

- If you were given a brace, wear it at all times except when sleeping, showering, or icing the incision.

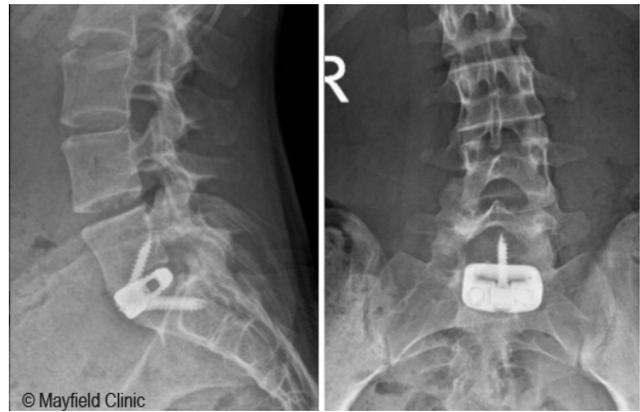


Figure 7. Front and side view x-ray shows a bone graft spacer cage at L5-S1 with screws.

When to Call Your Doctor

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

Recovery and prevention

Schedule a follow-up appointment with your surgeon for 2 weeks after surgery. Recovery time to daily activities is usually 6 to 12 weeks. X-rays may be taken after several weeks to verify that fusion is occurring. The surgeon will decide when to release you back to work at your follow-up visit.

Fusion takes time. Follow the "BLT" of spine surgery recovery by limiting your bending, lifting and twisting for 2 to 3 months. Work modifications may be necessary.

Recurrences of pain are common. The key to avoiding recurrence is prevention:

- Proper lifting techniques
- Good body mechanics and 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 whole, unprocessed foods
- No smoking

What are the results?

Anterior lumbar fusion avoids incision of the back muscles, has a short operating time, and poses few serious complications. With its minimal trauma to the spine and nearby tissues, patients often return to daily activities within 6 weeks. Each patient's result and recovery differs based on his or her health and lifestyle. Keep a positive attitude and perform your physical therapy as instructed.

The ALIF surgery relieves painful pinched nerves by indirect decompression. By increasing the height of the disc space, more room is created for the nerves to move freely in the canals. The surgeon does not see or touch the spinal nerves with instruments. By comparison, in a TLIF or PLIF surgery, the nerves are decompressed under direct vision.

Achieving a successful spinal fusion varies, depending on the technique used, your general health, and whether you smoke.

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 ALIF may include [1]:

Injury to abdominal organs. Because the surgical path passes through or near the bladder and ureter, kidneys, part of the colon, and other vital organs, there is a small but real risk of damage to these structures. If the bladder or colon is harmed, additional surgery would be required.

Injury to large blood vessels. At the L4-L5 level, two major arteries and veins branch into the legs. If nicked, significant bleeding can occur. This complication occurs in about 3% of patients.

Retrograde ejaculation occurs when semen flows into the bladder instead of out through the penis. During orgasm, you might ejaculate very little or no semen. Retrograde ejaculation isn't harmful, but it can cause male infertility. The risk of damage to the small nerves during ALIF surgery is about 1%.

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

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 them.

Bone graft migration and settling. In rare cases, the bone graft moves from its correct position between the vertebrae soon after surgery. This more often occurs if hardware (plates and screws) is not used or if fusion was for several vertebral levels. Over time, the bone graft spacer may potentially sink into the bone (subsidence) and reduce the indirect decompression. If migration or subsidence occurs, another surgery may be needed to correct the problem.

Transitional syndrome. Fusion causes the transfer of added stress and load to the discs and bones above or below the fusion segment. The added wear and tear can eventually degenerate the adjacent discs 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, for example, the compressed nerve does not spring back. In such cases, spinal cord stimulation or other treatments may provide relief.

Sources & links

If you have more questions, please contact the Rock Creek Neurosurgery at 801-609-9310.

Sources:

1. Xu DS, Walker CT, Uribe JS. Minimally invasive anterior, lateral, and oblique lumbar interbody fusion: a literature review. *Ann Transl Med* 6(6):104, 2018

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): a portion of living tissue taken from a part of one's own body and transferred to another part to fuse two tissues together.



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