# Complex Spine Surgery: Optimizing Your Health & Outcome

## Overview

Complex spine surgery is a term your surgeon may use to describe the procedure planned for your condition. *Complex* refers to the difficulty, the risks, the length of recovery, or number of spine levels involved. Examples of *complex* surgery:

- Re-align bones that have slipped or rotated (scoliosis, kyphosis, or spondylolisthesis)
- Correct a spine deformity to restore posture and balance the head over the hips
- Revise a prior back or neck surgery
- Stabilize a fusion that failed to heal solidly (pseudoarthrosis, broken hardware)
- Remove spine tumors that need bony reconstruction
- Repair spine fractures after a trauma

Solutions are designed for each patient's unique problem. Some patients benefit from a targeted minimally invasive surgery at one or two levels. Some patients undergo a multi-level, complex reconstruction using a combination of bone cuts, metal hardware, and fusion methods (Fig. 1).

Preparing yourself for a complex surgery or reconstruction takes time and commitment. Improving your bone health and physical condition **before** surgery will help avoid complications.

This guide will help you mentally prepare and set realistic expectations for a 3 to 6-month long recovery and a year of healing. Share this with family and friends. A home care plan and caregiver support are crucial.

The better you prepare, the more likely you will have a good outcome. Use the time between now and surgery to optimize your health.

## Bone and body health

Your bone health is key to the long-term success of surgery. Nicotine use, poor bone mass, and osteoporosis can prevent fusion from occurring.

Bones can be fused together in a variety of ways: (1) your body's natural healing process, (2) bone from another place in your body (autograft), (3) bone from a bone bank (allograft), or (4) cage devices and biologics. For a fusion to occur

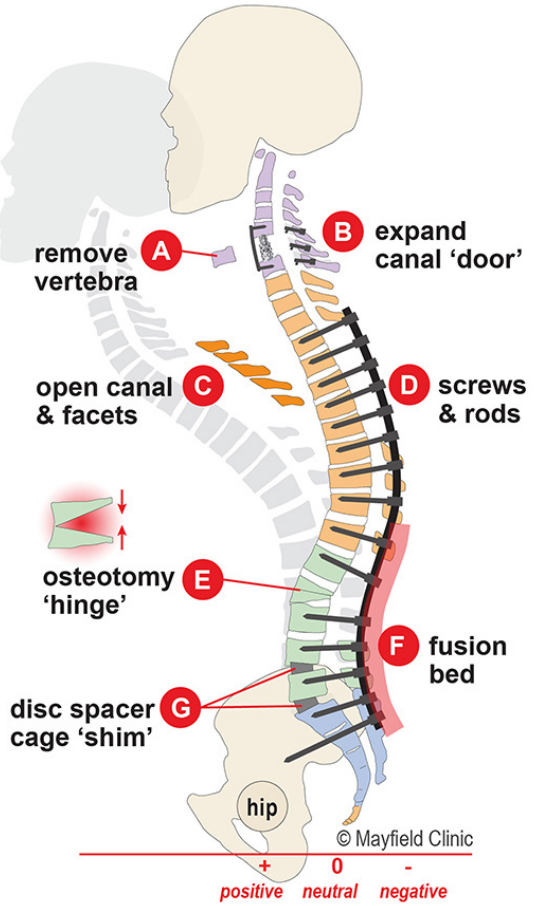



Figure 1. Complex spine surgery is customized for each patient's unique problem. It can involve:

A. **Corpectomy** – the vertebra body is removed to decompress the spinal cord. A spacer cage is inserted in the gap.
B. **Laminectomy or laminaplasty** – a 'door' is opened in the lamina bone to expand the spinal canal space.
C. **Decompression** – opening the spinal canal and facet joints can relieve pinching of the spinal cord and nerves. Stiff ligaments are cut to create 'flexibility.'
D. **Screws and rods** – pedicle screws inserted into each vertebra are pulled toward a rod and secured. This holds the new posture until fusion occurs.
E. **Osteotomy (hinge)** – a wedge of bone cut to create a hinge point helps to re-stack the spinal column.
F. **Fusion** – a fusion bed is created for bone graft and biologics to grow around the metal hardware — like reinforced concrete.
G. **Disc spacers (shims)** – a collapsed disc is removed and a wedge-shaped cage filled with bone graft is inserted to 'shim' the angle of bones.

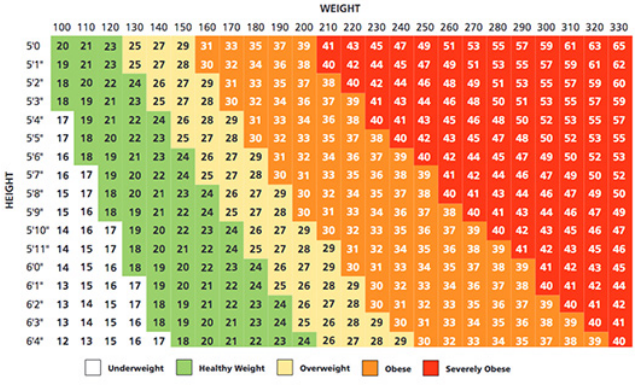
between vertebrae, a bone graft is needed--it serves as a bridge. The bone graft is placed in a "bed" prepared with a drill. The vertebrae are then immobilized while the graft and bed heal and fuse. The fusion area is often held together with metal plates, rods, screws, or cages. After surgery, the body begins its natural healing process and new bone grows. Over 3 to 6+ months, the bone grafts should join to form one solid piece of bone.

**Stop smoking, vaping, dipping**
Nicotine is toxic to bones and discs. You **must stop** using all nicotine products: cigarettes, e-cigarettes, cigars, pipes, chewing tobacco, and dip. Nicotine prevents bone growth and impedes successful fusion. Fusions fail in 40% of smokers compared with 8% of non-smokers.[1,2] Smoking narrows blood vessels, slows wound healing, and increases risks of infection and blood clots in your legs. We want patients to be smoke-free 1 month before surgery and a minimum of 6 months after surgery. We strongly urge you to never smoke again.

Talk with your primary care doctor about medicines to help with withdrawal and in finding a tobacco counseling program.

**Bone density**
Bone density is measured with a DEXA scan. Your surgeon may order this test if you are older, are post menopause, or have weak bones on X-ray. Bone density must be optimal for the hardware to stay in place while a fusion occurs. Calcium and Vitamin D supplements may be prescribed for your bone health. If you have osteoporosis, we may refer you to a primary care provider for medication to help build bone density before surgery.

**Body weight & nutrition**
Body mass index (BMI) is a measure of weight relative to your height. Obesity can make surgery and anesthesia riskier. If your BMI is above 40, your surgeon may advise against surgery until it is lowered, especially if you also have diabetes.




Studies show that people with BMI over 40 have a 20% chance of having a revision surgery due to the added stress extra weight puts on the hardware. Losing body fat lessens the risk of rehospitalization due to hardware failure or infection.

One way to lose weight is to eat more lean protein, vegetables, and fruits. Poor nutrition leads to poor wound healing. We may order blood tests to check your nutritional status (albumin levels). This is a good indicator of your body's healing abilities.

**Blood sugar levels**
If you are diabetic, we want your A1C below 8 before surgery. If your A1C is high, we may refer you to a primary care provider to help you reach an average blood sugar level of 180 mg/dL. Although this can take weeks or months, it is necessary to optimize your body for surgery. High blood sugar increases infection and prolongs hospital stays.

**Muscle strength**
Patients with a spine deformity often have weak muscles due to their imbalance and immobility. We encourage you to walk. Do other weight bearing activities to ready yourself for the long recovery.

Watch: Bone Boosting Exercises for Osteoporosis https://youtu.be/QEJirq-MTZQ

Read: Balance Exercises for Home
https://www.mayfieldclinic.com/pe-balance.htm

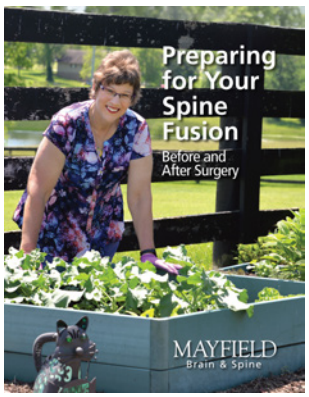
**Fitness & frailty**
Recovery can last longer in patients who are frail — they have less body reserve to heal from the stress of surgery. Frailty markers include:

- Being underweight or obese
- Depression
- Difficulty walking 1 block or climbing stairs
- More than 3 serious health conditions
- Slow walking speed, low grip strength
- History of falls in the past year
- Bladder incontinence
- Unintentional weight loss

Talk with your primary care provider about getting these health issues well managed before surgery.

## Preparing for surgery

Once a surgery date is scheduled, we will email a link to our online spine surgery class. The class will help both you and your caregivers prepare. Two booklets will be in your surgery folder:

***Your Surgery Instructions***
This booklet contains information about:
- Health exam and testing orders
- Medications to stop before surgery
- Shower instructions to reduce infection
- Before-surgery instructions specific to your procedure

***Preparing for Fusion Before and After Surgery***
This booklet contains information about:
- Getting your home ready before surgery.
- Pain control tips. Get ice packs.
- Put non-slip strips in the shower/tub. Get a shower chair. Get a raised toilet seat.
- Find a chair with a firm cushion, armrests and a seat at knee level that is easy to get out of.
- Incision care, mobility tips, and home exercises.

**Neck or back brace**
Your surgeon may or may not prescribe a brace to wear after surgery. Braces limit twisting and bending while the spine heals. However, bracing practices vary depending on your condition. Therefore, follow your surgeon's instructions on when and how long to wear the brace.

**Bone stimulator**
Your surgeon may or may not prescribe a bone stimulator to wear after surgery. The device, worn over the surgical area, emits an electromagnetic field that promotes bone growth. It can enhance fusion in patients at risk of poor bone healing (such as smokers, diabetics, or previous failed fusion). The device is worn for several hours daily for 3 to 6 months. It can be worn over top of a brace (Fig. 3). Most insurances cover the cost. A device rep will help you to get insurance approval and then show how to use the device.

**Plan for caregivers**
Most patients go home 5 to 9 days after surgery. Identify someone who can be with you 24 hours a day for the first 2 weeks to help you move around, use the bathroom, take medications, and eat regularly.

**Night before surgery**
It's very important to follow all pre-surgery instructions found in your surgery folder. The restrictions on medicines, food, and drink help avoid complications. Shower with antibacterial soap (Hibiclens, Dial) and try to get a good night's sleep.

## What happens during surgery?
The surgeon will explain the specifics of your surgery, where incisions will be made, and how long you will be under anesthesia. Some surgeries are staged over several days. For example, an anterior surgery may be done one day and the posterior instrumentation done a day or 2 later. You will remain in the hospital in between the two surgeries.

Figure 3. A bone growth stimulator is worn overtop the back or neck brace for the required hours each day.

**At the hospital**
The nurse will check you in and show you to a room. An anesthesiologist will talk with you and explain the effects of anesthesia and its risks. You will be given antibiotics to decrease the risk of infection.

You will be transported to the operating room. At that time, the nurse will direct your visitors to the Surgery Waiting Area. When surgery is over, your doctor will talk with your visitors there.

**Neuromonitoring**
During surgery, your spinal cord and nerves will be monitored by a system that measures electrical impulses of the nerves. This is called evoked potential monitoring. If there is a change in nerve function, the surgeon can adapt accordingly to ensure the nerves are not damaged. This is a safety feature and allows peace of mind to the patient. You may receive a separate bill for this service.

**Blood transfusion**
Due to the muscle and bone incisions involved, you may have blood loss. Most patients receive blood or platelets to replenish the loss and ensure a good outcome.

## What happens after surgery?
You will awaken in the recovery area. You may have a sore throat from the tube used during surgery to assist your breathing. Your blood pressure, heart rate, and respiration will be monitored. Once awake and stable, you will be moved to the ICU.

**Pain**
Pain and anti-nausea medications will be given as needed. Everyone feels pain differently. Only you know how to describe your pain. Your healthcare team may ask you to rate your pain on a scale of 1 to 10. That is, 1 = mild pain and 10 = worst possible pain. Medication can be adjusted to keep you comfortable yet not overly sedated.

**Nursing care**
Your blood pressure, pulse, temperature, and breathing will be checked at intervals. The nurse will also examine your incision and change the dressing. Antibiotics will be given through your IV. Good nutrition and keeping your incision clean and dry helps prevent infection.

You may have a catheter to drain your bladder. It is usually removed after surgery. If you are having a 2-stage surgery, it will likely remain in place until after the second surgery.

A respiratory therapist will show you how to use an incentive spirometer, which helps your lungs after anesthesia. Breathing deeply helps clear air passages and reduces the risk of pneumonia.

**Mobility**
Being out of bed and walking several times a day is very important to your recovery. At first, you may need help. But gradually you will increase your activity level (sitting in a chair, walking). A therapist will also show you how to safely use the toilet, shower, and get in and out of bed. Avoid bending, lifting, and twisting your spine during the recovery period.

**Preventing blood clots**
Deep vein thrombosis (DVT) is a potentially serious complication of surgery in which blood clots form inside the veins of your legs. The clots can break free and travel to your lungs, causing blockage or even death. Inactivity slows blood flow to the legs. When blood is moving, it is less likely to clot. So, an effective treatment is getting you out of bed as soon as possible.

There are several ways to treat or prevent blood clots. You will wear tight-fitting elastic socks called TEDS. Compression boots sequentially squeeze and release the legs to keep the blood from pooling in the veins. An IVC filter can be used if you have a history of clotting.

## Going home
Depending on the type of surgery, patients go home in 5 to 9 days. A home healthcare provider may be needed to help for a period of time. If you need advanced help, transfer to a transitional care or short-term rehabilitation facility may be arranged.

When you are ready to go home, you will be given discharge instructions. These cover how to manage pain and care for your incisions, and list restrictions and activity.

## Recovery and prevention
Your first follow-up appointment is scheduled for 2 weeks after surgery. Your commitment to follow the post-op instructions will contribute to how fast and how well you recover.

About six weeks later, routine visits with physical therapy will begin your rehabilitation. A physical therapy program often includes exercises to strengthen your back and low-impact aerobics, such as walking or swimming.

**Recovery phases**
Expect recovery from complex spine surgery to take at least 3-6 months and maybe a year.

- **1st month:** Managing pain, sleeping, and moving are a challenge. Ice every 2–3 hours. Try to walk a little more each day. You will need help during the first 2 weeks.
- **2-3 months:** Your muscles are recovering and walking is easier. Pain medications are weaned. Physical therapy begins. Don't overdo it.
- **3-6 months:** You are doing more normal activities. Fusion should be setting in and brace weaning may begin. Physical therapy will work on balance and core strength. Some patients can return to work.
- **6-9 months:** Most people have returned to work and are resuming normal activities. Fusion is still occurring. Low impact exercise and strengthening are advised.

**Plan to be off work**
Most people who have complex spinal surgery are off work for several months depending on the type of work done. You may or may not need to return to work with restrictions based upon your job. If you have a physically demanding position, restrictions may be needed when you return.

**Complex spine surgery can be life changing!**

Patients who've suffered for years can resume activities they've been unable to participate in for a long time. Refer to these Mayfield success stories — they may help you appreciate the commitment to this surgery to obtain the long-term positive results.


Lisa's story


Joelea's story


Jane's story

## What are the risks of surgery?

No surgery is without risks. General risks of any surgery include bleeding, infection, blood clots, and reactions to anesthesia. Specific risks related to complex spine or deformity surgery may include:

**Injury to abdominal organs.** If the surgical path passes through or near the bladder and ureter, kidneys, part of the colon, or 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.** Major arteries and veins lie along the spine. If nicked, significant bleeding can occur.

**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.

**Adjacent segment disease.** 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 pinching 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 call Mayfield Brain & Spine at 800-325-7787 or 513-221-1100.

Strong for Surgery https://www.facs.org/quality-programs/strong-for-surgery/patients

**Sources**


1. Brown CW, et al. The rate of pseudarthrosis (surgical nonunion) in patients who are smokers and patients who are nonsmokers: a comparison study. Spine 9:942-3, 1986
2. Nunna RS, et al. The Risk of Nonunion in Smokers Revisited: A Systematic Review and Meta-Analysis. Global Spine J. September 2021


## Glossary

**allograft:** is bone from an organ donor, collected and stored by a bone bank. The donor graft has no bone-growing cells.

**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.

**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.

**BMP** (bone morphogenetic protein) is sometimes added to bone-graft material to stimulate bone growth naturally in the body.

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

**cellular bone matrix:** is allograft from an organ donor that contains bone-growing stem cells. The putty is shaped and added to grafts.

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

**instrumentation:** titanium, stainless steel, or non-metallic devices implanted in the spine to increase stability. Includes hooks, rods, plates, screws, and interbody cages.

**osteotomy**: a procedure in which spine bone is cut and then realigned. Smith-Peterson osteotomy trims the facet and spinous process. Pedicle subtraction osteotomy removes the pedicle and a wedge of bone from the vertebra body.

**pseudoarthrosis**: failure of the bones to fuse after surgery; also called non-union.

**pedicle screw**: screw placed posteriorly across the pedicle into the anterior part of the vertebral body, used as an anchor for the spinal rod.

**proximal junctional kyphosis:** a complication after surgery in which the vertebra at the top of a long rod fusion angles forward or fractures due to stress.


updated > 12.2021

reviewed by > Banita Bailey, RN, Lisa Cleveland, PT, Jaime Horne, RN, Mayfield Clinic, Cincinnati, Ohio