Minimally Invasive Transforaminal Lumbar Interbody Fusion

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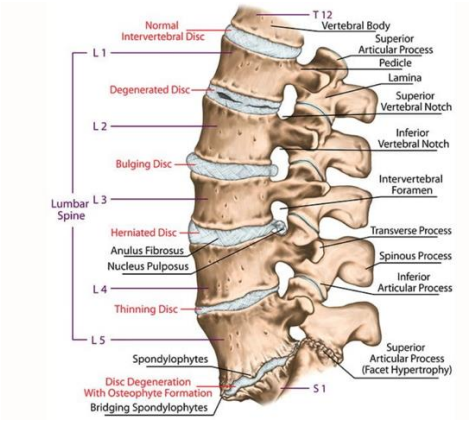
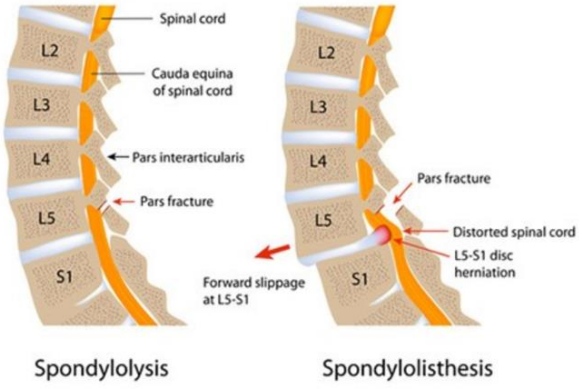
Introduction

I prepared this handout to help review and answer some common questions about spine surgery. Some aspects of this guide may not apply exactly to your case and it is not intended to supersede our discussion. Please feel free to reach out to me if you have any questions.

What is the Lumbar Spine?

The lumbar spine is a part of the trunk that contains the bones, discs, nerves, and spinal cord. The spine is within the center of the trunk and holds up the chest and torso. Lumbar laminectomy is performed to relieve nerve compression in the spine.





Stenosis means that there is not enough space for the nerves. In general, lumbar spine surgery is performed to relieve stenosis. There are many causes of stenosis including herniated discs, facet cysts, instability, bone spurs, osteophytes, or a slipped vertebrate.

What do the nerves look like?

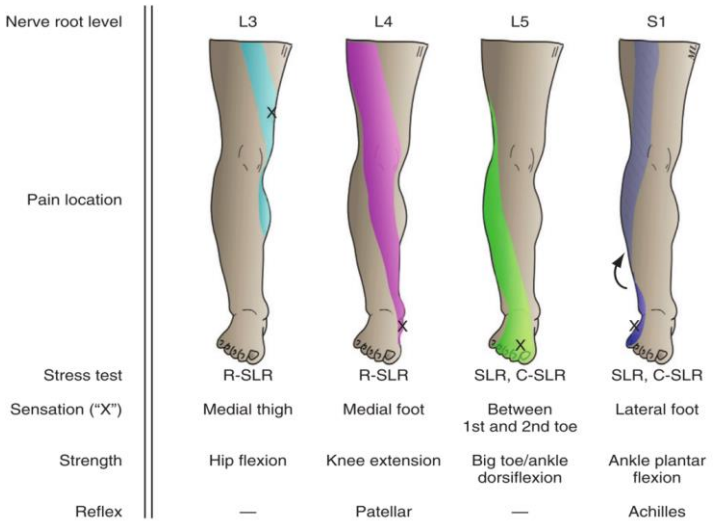
See below. The spinal cord is in the center of the spinal canal. It is a thick, solid nerve about the thickness of a baby carrot. There are small branches that emerge from the central spinal cord and travel through the arms and legs. The small branches are called nerve roots. In the lumbar spine (low back), there is no large central nerve (spinal cord). There are only nerve roots.

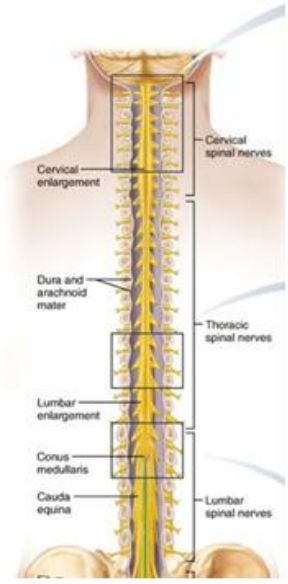
What Are The Symptoms of Lumbar Spine Problems?

Patients usually report back pain and leg pain and foot numbness.

What is Radiculopathy?

Compression of the small nerves in the lumbar spine causes pain, numbness, or weakness in the thigh pain, calves, or ankles and feet.





What is Cauda Equina Syndrome?

Compression of the entire set of lumbar nerves is called cauda equina Syndrome. Cauda equina syndrome is characterized by difficulty with urination, bowel movements, and numbness in the private region. Call immediately if you experience any of the above symptoms.

What Causes Back Pain?

Back pain most often occurs due to a loss of fluid and height in the cartilage in the joints in the spine. When the discs are dried, the spinal bones can bump into each other. Other

causes of back pain involve muscular problems, strain or sprain, fractures, bone spurs, and occasionally disc herniations.

What is Instability?

Instability is abnormal motion of the lumbar spine bones. Instead of normal smooth rotation, the bones are moving in an undesirable way (either sliding backwards and forwards abruptly or twisting). The fusion is intended to prevent further abnormal motion and to realign the bones into a normal position.

Why Do I Need Surgery?

I recommend surgery when the symptoms interfere with your quality of life and when no other reasonable alternatives are available.

When Is Surgery the Right Option for Me?

In most cases, surgery is the last option. I recommend waiting at least six to twelve weeks before having surgery in most cases. I recommend trying other treatments before surgery.

What Can I Do Other Than Surgery?

1. Do nothing/live with the condition
2. Physical therapy,
3. Chiropractic,
4. Acupuncture,
5. Anti-inflammation medications (Ibuprofen/Naproxen),
6. Pain medications (Acetaminophen/Aspirin),
7. Muscle Relaxers (Tizanidine, Flexeril)
8. Mild Opioid Medications (Tylenol #3, Tramadol),
9. Membrane Stabilizing Medications (Gabapentin, Neurontin, Lyrica, Pregabalin)
10. Strong Opioid Medications (Oxycodone or Hydrocodone),
11. Epidural Injections (which are a cortisone shot into the spinal canal also called a nerve block),
12. Facet Injections/Medial Branch Blocks (which are a cortisone shot into the small joins on the sides of the spine),
13. Nerve Ablation (burning or otherwise removing pain nerves in a small injection procedure)
14. Spinal Cord Stimulator (an electrical device to intercept pain signals before they reach your brain).

What is your practice focus? Do you perform other orthopedic surgeries?

I exclusively practice spinal surgery. I do not perform any other aspects of orthopedic surgery (such as hip replacement, shoulder surgery) so that I can stay focused on the latest techniques and literature in spine surgery.

Do you perform nonsurgical treatments such as injections?

No. I do not perform nonsurgical treatments such as injections, manipulation, chiropractic, acupuncture, physical therapy, or prescribe long term pain medications or cannabis. I can certainly give you some information and prescribe some nonsurgical treatments. However, I also have excellent specialists in my group who focus on non-surgical spine care to whom I can refer you for additional information about options to treat the spine other than surgery.

What is a pain management specialist?

A pain management specialist is a doctor who focuses on treatment of pain by means other than surgery. Several different medical specialties train on pain management, including physiatry, anesthesiology, and psychiatry.

What do pain management specialists do?

Pain management specialists perform nonsurgical treatments such as injections in the spine. Pain management specialists prescribe and to some extent supervise physical therapy. Pain management specialists also can prescribe and supervise pain medication prescriptions called “medical management.”

What Are the Types of Surgery That Are Available to Treat This Condition?

There are three types of spine surgery:

a. Decompression alone (to take the pressure off the spinal nerves)
b. Fusion which involves changing the mechanics of the spine.
c. Disc Replacement to replace the joint with a ball-and-socket joint

There are several different ways to perform fusion surgery. They are distinguished by the direction of the approach to the spine.

Each surgery can be more or less invasive. In this case, I recommend a minimally invasive posterior lumbar decompression and fusion to treat the spinal stenosis. This is also called an MIS TLIF, MAS TLIF, MIS PLIF, or MIDLIF.

What is the Goal of Surgery?

With most spinal surgery, the goal of surgery is generally considered to be to reduce leg pain, not necessarily back pain. Back pain may be unchanged, slightly decreased, or even worse after surgery. Surgery does not necessarily reverse nerve damage. Surgery generally stops future nerve damage from occurring.

What is Going to Happen to Me?

https://www.youtube.com/watch?v=ggdKG0OvL90

The procedure is called a MAS (Maximum Access Surgery TLIF) on A Better Way Back.
https://www.thebetterwayback.org/treatment-options/

PROCEDURE

Will I have an incision?

You will two incisions on your low back. The incisions will be approximately 2-3 inches long depending on the level, your height, and your body size.

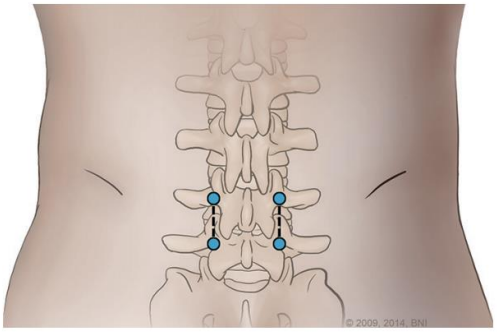
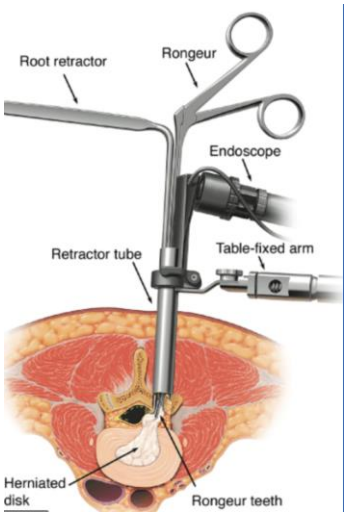


Figure 1. For surgical access for the MIS TLIF, two 28-mm incisions are made approximately 3.0 to 3.5 cm lateral to the midline, centered between the pedicles of the two surgical vertebral bodies.

Do you Use A Camera or Is This Surgery Arthroscopic?

There are two different ways to do minimally invasive spine surgery. Some surgeons use an endoscope. I prefer to use a surgical microscope. The microscope improves view of the delicate spinal structures and therefore your safety. Both types of surgery are considered minimally invasive.

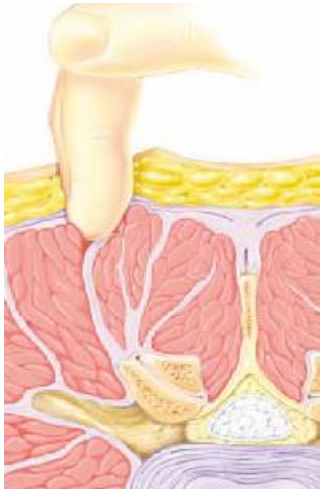


What happens then?

I carefully dissect the fat, muscles, and ligaments aside to expose the spine. Care is taken to spread the muscle as much as possible to avoid cutting muscle tissue.

How do get to the spine through the back muscles?

There is a natural plane (divide) in the muscle which I will find and follow down to the spinal bones. In this way, I do not have to cut the muscle or to separate the muscle from the attachments in the middle of the spinal canal.



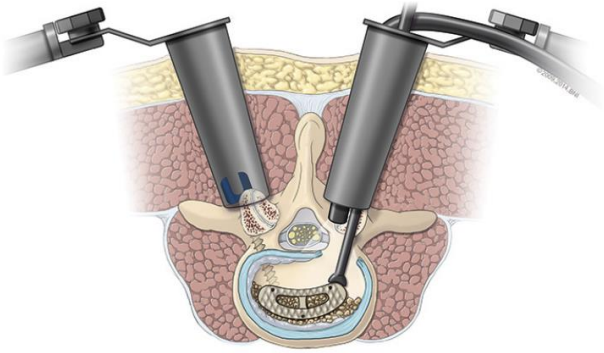


Figure 2. Expandable retractors are placed bilaterally using the Wiltse muscle-splitting technique. After all four pedicle screws are placed through the corridors provided by the expandable retractors, a discectomy is performed, and morcellized autograft and a structural TLIF cage are placed in the intervertebral body disc space.

How Do You Remove the Disc?

I will then remove the disc with a number of special cutting and biting tools. Removing the disc takes about 10-15 minutes. The disc is the consistency of crab meat.

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What Replaces the Disc?

After I have removed the disc, I have to place something into the space where the disc was located in order to maintain proper alignment and separation of the bones. The spacer is usually a metallic box called a cage. The cage is hollow and is loaded with bone. The box has two purposes. The first is to separate the bones (L3 and L4 for example) that were previously separated by the disc. The second is that the cage provides a surface for fusion to grow through.

Where Does the Bone in the Cage Come From?

The bone inside of the cage comes from an organ donor or from your own hip. Occasionally I will also use an artificial bone substitute.

What is Bone Graft?

In preparation for the spinal fusion, a layer of bone off the back surfaces of the spinal column is removed. Small strips of bone called bone grafts are then placed over the now exposed bone surfaces of the spinal column. As healing occurs, the bone strips will grow together across the spaces in between the vertebral bodies, such as the disc spaces or in between the lumbar transverse processes or the facet joint spaces.

Will you tell me directly if you intend to use my hip bone?

Yes. We will discuss it and the consent will say “Iliac crest autograft” or “hip aspiration.”

What is Aspiration?

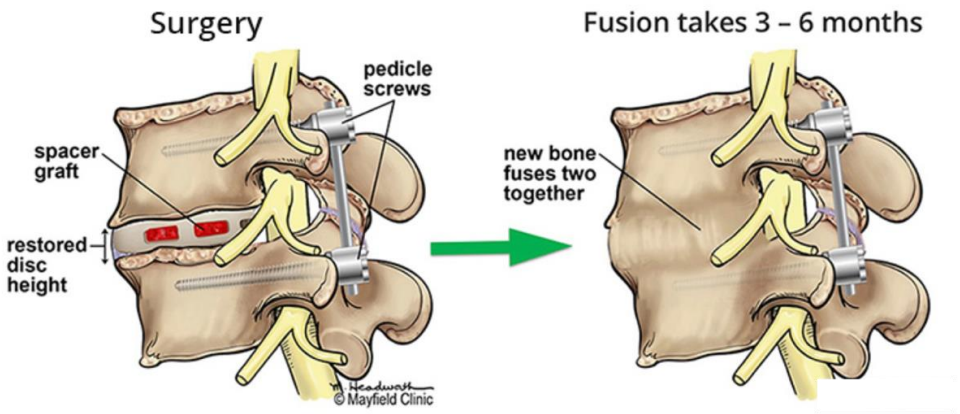
Aspiration is a minimally invasive way for me to harvest stem cells from the hip. I will insert a small needle into the hip and pull out the cells. The pain is very much reduced. I do that procedure on high risk cases or multilevel fusion cases.

What are the risks and benefits of the types of bone grafts?

Your spine will heal best with your own bone. However, harvesting a large piece of hip bone is painful. In some cases, I will pull some of the bone marrow out of the hip with a small needle. Bone from an organ donor carries a risk of infection. Bone from an organ donor is also less likely to heal compared to your own bone.

What is a successful fusion?

Successful fusion requires new bone to grow and connect the space between the vertebrates. Although the operation is called a fusion, the actual bony connection (called an “arthrodesis” does not occur until 3-6 months after surgery.



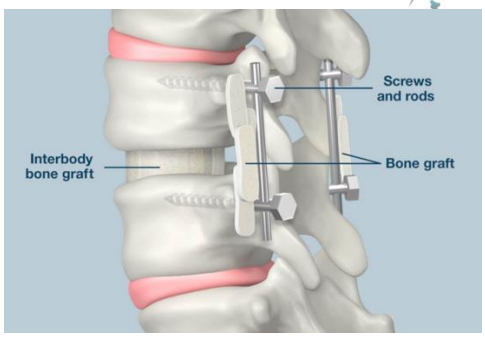
What happens if the bone graft does not grow?
That is called a "pseudarthrosis." If the new bone fails to fill in the space between the vertebrates, the hardware will loosen, and you will have persistent pain.

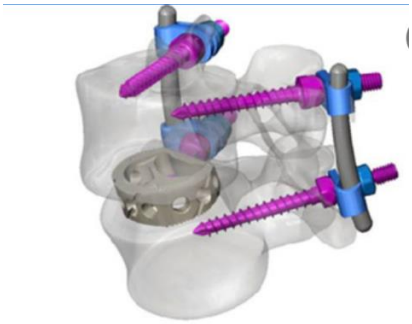
What are some risk factors for the bone graft to fail to heal?
Excessive motion, smoking, soft bone (osteopenia or osteoporosis), steroid use, diabetes, and medical conditions affecting the immune system are risk factors for not fusing.

Will You Place Hardware to Hold The Spine In Place?
Yes. I will place screws into the bones in the spine. The screws hold the bones in place. The screws are called pedicle screws. The screws go into each vertebral body (usually two per level so two in L4 and two in L5) on each side (left and right in both cases). A rod is a round bar that connects the screws. The instrumentation are made of titanium.

Is a rod the same thing as a plate?
A rod is round. A plate is flat. I use round rods. In the neck I use flat plates.

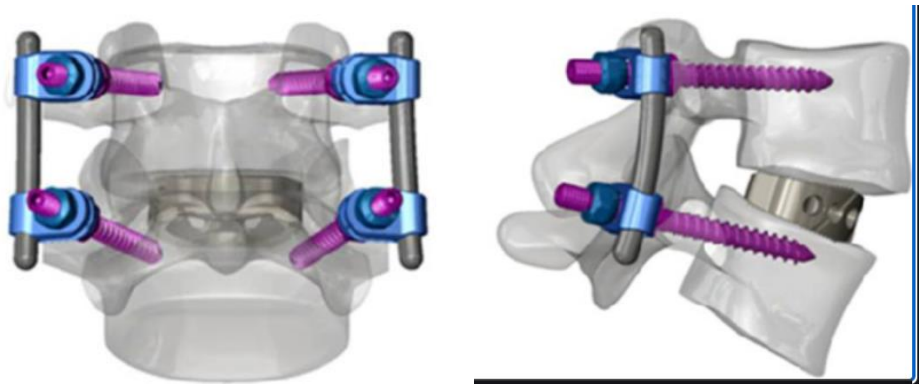
What do the rod and screws do?
The screws and rod hold the bones together to prevent movement during the bone healing process.





What is the hardware made of? Can I get an MRI?

The instrumentation is titanium. Yes, you can have an MRI after surgery because titanium is not very magnetic.



What are the downsides of spinal hardware?

Any spinal hardware may fail or break or loosen. The hardware only holds the bones in place for a few months. Then, your bone has to grow into place and support the hardware. If the bone does not grow successfully, the hardware will loosen and break. Hardware can also irritate the nerves, discs, bones, or other soft tissues such as blood vessels. Sometimes, spinal hardware has to be removed.

How Much Motion Will I Lose?

You will lose very little motion with a fusion. Each disc moves about 4 degrees. The overall lumbar movement is over 60 degrees. Many patients actually report MORE motion after surgery because they have less pain.

What is a disc replacement?

A disc replacement is a ball and socket joint that is placed into the disc space.
Disc replacements move similar to normal disc movement.

Are you familiar with disc replacements? Do you perform

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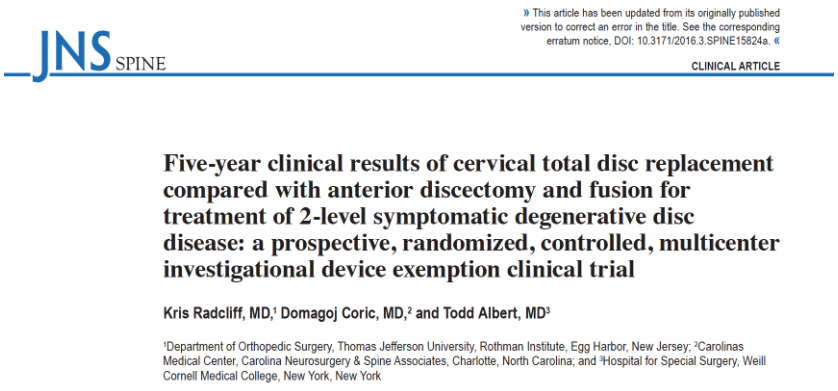
artificial disc replacements?

Yes, and yes. I do disc replacements (most commonly the Simplify Medical disc). I have done extensive research on disc replacements. I am actually the lead author on several disc important replacement publications.



JNS SPINE

» This article has been updated from its originally published version to correct an error in the title. See the corresponding erratum notice, DOI: 10.3171/2016.3.SPINE15824a. «

CLINICAL ARTICLE

Five-year clinical results of cervical total disc replacement compared with anterior discectomy and fusion for treatment of 2-level symptomatic degenerative disc disease: a prospective, randomized, controlled, multicenter investigational device exemption clinical trial

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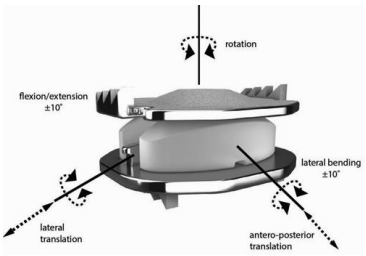


Why Can't I Have a Disc Replacement?

Disc replacements do not work well if someone has pre-existing arthritis, bone spurs, disc space collapse, or a slipped vertebra. Disc replacements can also not be performed at three levels. If I recommended a fusion, that means that I believe that you are NOT a good disc replacement candidate.

What is a bone stimulator?

Electrical stimulation of the spine is the application of an external, electric treatment signal that helps promote the body's own natural healing process following a spinal fusion. A spine fusion stimulator is sometimes used to help the body heal; especially if a patient has specific risk factors or an underlying medical condition that may compromise normal healing. The stimulator improves the odds of fusion by about 20% (For lumbar spinal fusions, overall success rate (clinical and radiographic) was ***84.7%*** in the SpinalPak group vs. 64.9% in the placebo group).

https://www.zimmerbiomet.com/en/products-and-solutions/specialties/bone-healing/biomet-spinalpak-non-invasive-spine-fusion-stimulator-system.html

For additional information about the stimulator, you can contact
Rachel Greenwald Myers, Territory Sales Manager, Zimmer Biomet Bone Healing
Mobile: (856) 693-6537
rmyers@empiremedgroup.com

Do all surgeries need a bone stimulator?
No. Insurance will not approve bone stimulators on many surgeries. In general, patients who receive stimulators have risk factors such as multi-level surgeries, diabetes, steroid use, osteoporosis, or other conditions.

Will you see other areas and fix other areas in the surgery?
No. I can only see the levels that I operate on.

Can you see nerve damage at the time of surgery?
No. I do not see the nerves directly.

Can I have an MRI with all of that metal?
Yes. The titanium plate, screws, and cage are MRI compatible.

Will I go off in the airport?
Not sure. It is possible. I can give you a note if you would like, but in my experience, notes do not help.

How Long Does the Surgery Take?
The surgery takes about 2-3 hours

Will I Have Sutures or Staples?
The incision will be closed with dissolvable sutures. There is no need to remove sutures after surgery. I will place special glue over the incision.

What kind of anesthesia is used?
You will be under general anesthesia.

What exactly is the lamina?
The lamina are bones that cover the back part of the spinal canal. The spinal canal is the bony ring that holds the nerves. The lamina does not carry weight and can be removed.

What is a laminectomy?
Laminectomy is the removal of the bones on the back part of the spinal canal. A laminectomy is an operation performed on the back of the spine to remove the bone covering the spinal canal. The purpose of a laminectomy is to improve space for the nerves. Laminectomy is one of the oldest and most performed spinal surgeries. Laminectomy is used to remove all different types of problems in the spine, such as herniated discs, spinal stenosis, spinal arthritis compressing nerves, tumors, cysts, and infections. Laminectomy does not involve the placement of screws or implants into the spine. When done properly, laminectomy does not make the spine unstable.

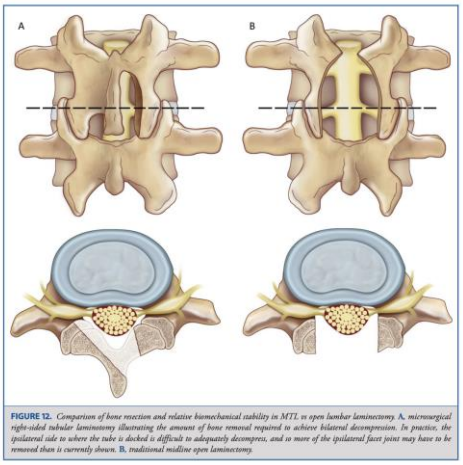


FIGURE 12. *Comparison of bone resection and relative biomechanical stability in MTL vs open lumbar laminectomy.* **A**, *microsurgical right-sided tubular laminotomy illustrating the amount of bone removal required to achieve bilateral decompression. In practice, the ipsilateral side to where the tube is docked is difficult to adequately decompress, and so more of the ipsilateral facet joint may have to be removed than is currently shown.* **B**, *traditional midline open laminectomy.*

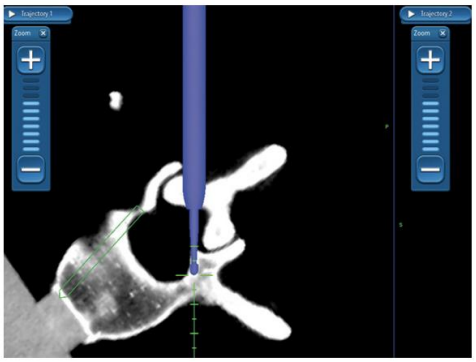


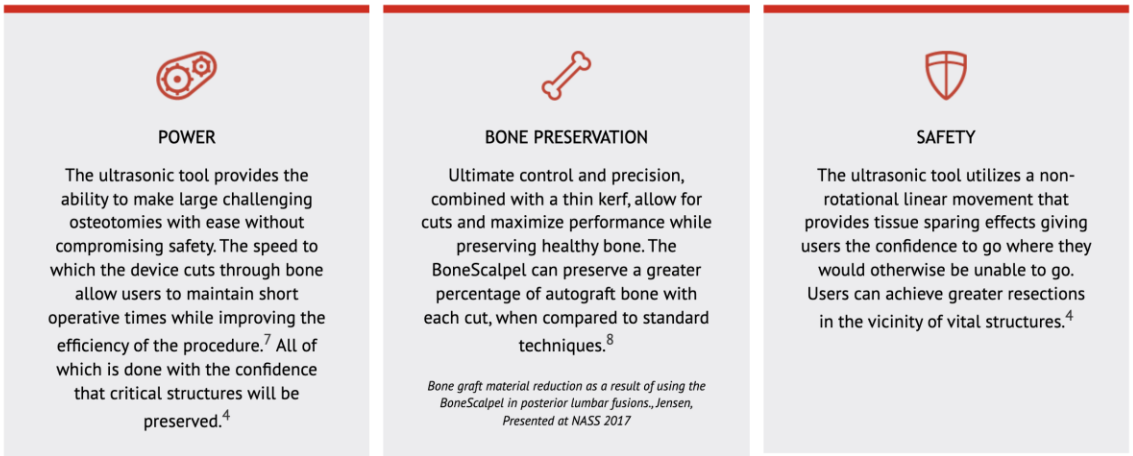
Figure 3. The image from this intraoperative navigational screen illustrates the surgeon's ability to identify and decompress the exiting nerve roots on both sides from a unilateral approach.

How Do You Cut Away The Bones?

As you can imagine, there are a host of specialized tools to be able to remove the lamina.

Do You Have Special Tools To Cut Bone Around the Nerves?

In addition to the conventional tools that have been around for decades, I use a special advanced ultrasonic bone cutting tool called the Bone Scalpel in many cases. These are the advantages of the bone scalpel according to the manufacturer.



"The revolutionary technology of Bone Scalpel is designed for leading surgeons who want high performance every time. Bone Scalpel leaves elastic soft tissues largely unaffected while efficiently slicing through crystalline bone. The revolutionary ultrasonic technology amplifies electrical signals that are then converted into a high-speed back-and-forth motion of the blunt blade"

Will the surgery address bone spurs and stenosis also?

Yes. Once the lamina is removed, I will then hunt for bone spurs on the sides of the spine into a space called the neural foramen.

What are Adhesions and Scar Tissue?

Sometimes, the tissues in the back can become stuck together. There are also often adhesions found between the nerves and the spinal tissues. The tissues can become stuck to the nerves due to previous surgery, inflammation, or injections.

What is a Cyst? Will You Remove a Cyst if Present?

A cyst is a pocket of fluid from a joint on the spine.
The cysts are benign and are not cancerous. If they are present, I will remove the cysts.

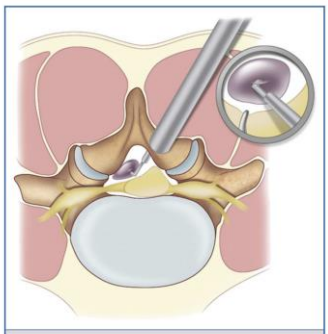


FIGURE 10. *Microtubular resection of lumbar synovial cyst. With the use of a tubular retractor, a synovial cyst should be approached from the contralateral side. The cyst is dissected off the thecal sac and a small sucker is used to protect the dura while the cyst is resected carefully to expose the facet joint.*

What is the Dura?

The nerves are small thin filaments about the size of angel hair spaghetti. They are inside of a thin, delicate tissue called the dura. The nerves are bathed and surrounded by clear fluid called spinal fluid.

What is a Dural Tear?

It is an area of weakness or a hole in the lining of the nerve roots. Spinal fluid will come out of the hole. If that occurs, you may have headaches. Dural tears usually occur and are recognized in surgery.

How often do dural tears occur?

Dura tears about 10-20% of the time in patients with spinal stenosis. In most cases, they are sutured and repaired without a problem. Occasionally, I ask patients to lie flat to take the pressure off the repair for a period.

Will the laminectomy space close again?

No. The laminectomy space that is created is wide enough that it will not close.

What is the Difference Between Inpatient And a Same Day Surgery?

There are two different categories of staying overnight in the insurance company language. One category is called "Extended stay recovery." One other category is "inpatient." Either way, if you need to stay, I will make sure that you can stay overnight.

If the Insurance Considers This To Be A Same Day Surgery Do I Have To Go Home On The Surgery Day?

No.. Even if your insurance considers this procedure to be a surgery that would go home on the say day, I can choose to keep you in the hospital overnight for various medical reasons including help with walking, pain control, or physical therapy.

Who Makes The Decision About Whether I Go Home After Surgery?

I will tell you. If we discuss you staying overnight, please trust that you will stay overnight regardless of whatever the insurance says. Likewise, if we discuss you going home, you will go home. Sometimes, hospital staff or other people may not be aware of our discussion and may tell you what the insurance says. Please disregard any information about inpatient status that contradicts what we discussed. If my recommendation changes, I will advise you directly.

Is the Surgery Minimally Invasive?

Yes. The entire procedure is performed under magnification and/or a microscope. Your major muscles are not cut. I will have to peel the muscles off of the bones. However, I will be as delicate as possible with them. I will repair them carefully at the end of the surgery.

Will I Be Paralyzed After This Surgery?

No. Severe neurological injury causing paralysis is extremely rare. We will discuss in detail if I have a concern about the health and safety of your spinal cord injury.

What technology is available to help make the surgery safer?

I use a computerized monitoring system to follow the safety of your spinal cord on all cervical spine surgeries. Every move and intervention are carefully monitored. If there is the slightest hint of a problem, I will intervene.

What is the neuromonitoring company's name and information?

https://www.accurateneuromonitoring.com/for-patient/
Address: 700 US Highway 46 East, Suite 420, Fairfield, NJ, 07004
Phone: 973-882-3456
Fax: 973-882-3450

Email: info@accurateiom.com

Please feel free to call them if you have any questions about the neuromonitoring process or their bill. They are contracted by the hospital and thus I do not have access to their billing information.

Will the surgery address bone spurs and stenosis also?

Yes. By restoring the disc space to the correct height, the space for the nerves is increased. The point of the surgery is to make you slightly taller. This is called an indirect decompression. The indirect decompression will reduce the stenosis and cause the bone spurs to shrink.

What will cover my nerves if those parts of the bone are gone? What if I fall on something?

I tightly suture your muscles back together. The muscles will cover and protect the nerves, just as the core muscles protect the abdomen.

OUTCOME

What Is the Expected Outcome?

Your pain will be better. However, I cannot promise that you will be pain free. Surgery can help improve function and decrease pain, but surgery is fundamentally fixing something "broken." It is important to focus on this and to mentally prepare yourself so that you put yourself on a reasonably successful path to recovery. Believe me, I would love it if you had a perfect recovery. I just cannot promise that.

How well does pain improve after surgery?

In general, surgery is less effective for the treatment of back pain than for leg pain. Laminectomy and fusion is, overall, more effective for the treatment of leg pain. At 8-10 years approximately 70% of patient are satisfied with the results of laminectomy and fusion surgery for disc herniations and spinal stenosis. In general, about 70% of pain improves. For example, patient who have 10/10 pain prior to surgery improve to about 3/10 pain after surgery. Overall activity and physical function improves gradually after surgery, with the understanding that patients who are de-conditioned before surgery may require longer postoperative rehabilitation.

I have had problems for a long time before surgery. Will that affect my outcome?

Patients who have had longstanding problems and are de-conditioned before surgery will require longer postoperative rehabilitation.

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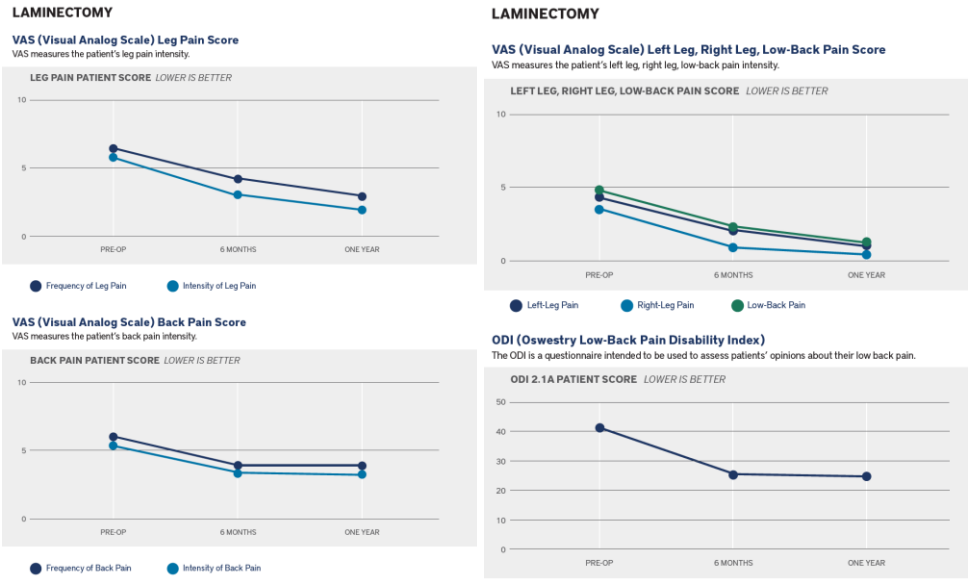
Do statistics guarantee that a specific amount of improvement for me?

No. Although the statistics are helpful to understand the overall outcome for many patients, they do not guarantee the odds of success or failure in any individual case. With any surgical procedure, some patients are improved, some patients are unchanged, and some patients have worse symptoms. There is some variability in how quickly patients improve following surgery.

What is the overall recovery period from a laminectomy and fusion?

The overall recovery period is 3-6 months is the typical recovery period. We published a Rothman Outcome book which describes the improvement in symptoms following laminectomy in our hands (however this data does not reflect laminectomy and fusion patients).



A recent large clinical trial has an interactive calculator that allows your to put in your data and symptoms and get a specific report on your likely outcome.
https://spinesurgerycalc.dartmouth.edu:8443/BackPainCalc/BackPainCalc?diagnosis=DS

When can I expect pain to be reduced?

Patients' leg pain is usually improved/reduced immediately after surgery. About 10-20% of patient's pain will continue until the nerves start to heal.

Why does my pain not go away immediately?

When I relieve pressure on an inflamed, damaged nerve, it does not recover

instantaneously. In most cases, by reducing pressure on the nerve, the nerve stops giving off painful stimuli.

Does the surgical procedure heal the nerve directly?

The surgical procedure does not heal the nerve, only the body is capable of that. The goal of surgery is to create the best possible environment for the body to heal itself and to prevent further damage. This will take a variable length of time depending on the duration and degree of nerve damage and the body's own healing abilities. Most of the healing occurs in the first few months.

When can I expect weakness to improve?

Weakness can take 3-6 months to improve. The amount of time that your nerves have been compressed can influence how quickly you recover after surgery. In the setting of severe compression which has been present for greater than 1 year, nerves may never fully recovery or take some time to do so.

Other factors, such as age, overall physical condition, and severity of nerve damage affect weakness recovery. Your weakness may never improve after surgery.

When can I expect numbness to improve?

Numbness can take 6-12 months to improve. People often have numbness even after surgery for months. In particular, the front of the thigh is often numb for months even after surgery.

Will The Numbness Go Away Entirely?

The amount of improvement in numbness is also dependent on the level of numbness prior to surgery and the length of time that numbness has been present. Other factors, such as age, diabetes overall physical condition, and severity of nerve damage affect numbness recovery. Your numbness may never improve after surgery.

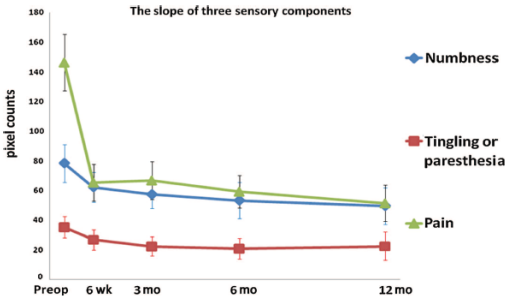


Figure 6. The slope of recovery of numbness, paresthesia, and pain in lumbar radiculopathy patients during the preoperative and postoperative visits at 6 weeks, 3 months, 6 months, and at 1 year after decompression of the nerve root. Pain showed the largest slope of recovery from preoperative value to 6 weeks and then became slow but steady. Numbness and paresthesia showed a moderate recovery during the initial 6 weeks, but further improvement had a decreasing tendency. Preop indicates preoperative.

Is it possible that I will have new nerve symptoms after surgery?

Yes. You can have new pain, weakness, and numbness that is worse than the preoperative symptoms especially temporarily. These new symptoms, if present, likely represent swelling in the nerves that occurs because of surgical manipulation and decompression.

One recent publication on this topic also found that numbness takes a long time to improve. Duration of symptoms and nerve compression was a big predictor of outcome.

One such new transient symptoms that occurs after lumbar laminectomy is a dropfoot, which is weakness lifting the foot and ankle.

Will my back hurt more after surgery?

Yes. People often have more pain in the back over the muscles. That pain is most likely due to realignment of the spine and stretching the muscles. Your muscles need time to adjust to that.

What can I take for the back pain and stiffness?

You will be given muscle relaxers to treat the pain and stiffness in the back. I suggest that you use them instead of opioid medications.

What factors related to my spine may contribute to a poor outcome after surgery?

Previous surgery, scar tissue, the size of the disc herniation, the duration of symptoms, response to previous treatments such as epidurals, arachnoiditis, migrated or extruded fragments, calcified disc, or epidural scarring (due to previous epidurals or intrathecal procedures such as myelograms), or congenital abnormalities can all adversely affect the outcome of surgery.

Do my medical conditions affect the outcome of surgery?
To some extent. Some medical conditions such as obesity, smoking, osteoporosis, scoliosis or deformity, history of cancer, history of previous spine surgery, poor nutrition, noncompliance, diabetes, autoimmune conditions, and being on blood thinners affect the outcome of surgery and the risk of complications. For example, being on blood thinners increases your risk of epidural hematoma and bleeding.

Does cauda equina syndrome get better?
No. Many patients with cauda equina syndrome have long term bowel and bladder problems.

Does surgery reverse nerve damage that has already occurred?
No.

Can you predict prior to surgery whether nerve damage will heal?
No.

Will I have a catheter in my bladder?
Usually no. If you have a history of trouble urinating (prostate problems, etc.) then the anesthesiologists and hospitalists may recommend it.

What if I cannot urinate after surgery?
Some patients may have difficulty urinating after surgery. If this occurs, notify your nurse who may assist you in voiding techniques. This may require placing a catheter in your bladder.

What if I cannot move my bowels after surgery?
After surgery, constipation frequently occurs from inactivity and the side effects of pain medication. Stool softeners and laxatives will be available from your nurse. Once you go home, you can also take some over the counter stool softeners and laxatives. Use of opioid pain medication and prolonged rest may cause constipation. Drinking plenty of fluids and eating high fiber foods (whole grains, raw fruits, and vegetables) will help regain normal bowel function.

What can I do to help move my bowels?
Chewing gum! Chewing gum helps to activate the bowels.

What if I lose control of my urination or bowels after surgery?
That could be an emergency! Tell your nurse or call me immediately.

What if I am numb around my genital (private area)? Is that normal?

No! That is never normal. Tell your nurse or call me immediately.

AFTER THE OPERATION

Will you speak to my family?

Yes. After surgery, I will meet with your family in the surgical waiting room unless otherwise arranged. If I miss them, don't worry. I will find them later. My cellphone is 609-225-4804 if for some reason they don't hear from me.

Will Other Doctors Will See Me After Surgery?

Medical doctors will also consult on your case after surgery if you stay in the hospital.

What do the medical doctors do?

They will see you before surgery in Preadmission testing. These providers have almost decades of experience caring for patients who have undergone spine surgery. They will check your "non-spinal" parts including your heart, lungs, kidneys, etc. They will order the labs that they believe are necessary for you to safely get through surgery. They will review your clearance. They may order additional tests (EKG, echocardiograms, etc.).

Do I need a clearance from my own primary care or cardiologist?

Yes. You should check with them and have them send over a clearance letter. However, you will still have to go to preadmission testing and undergo a second clearance process based upon our hospital standards.

So, my clearance from my primary care doctor or cardiologist may not be enough?

Yes. Each hospital has different rules and standards. Part of our success has been with increased scrutiny for preadmission testing. Your internist or cardiologist may not be as familiar with the surgery as our hospital doctors are. Our medical specialists often order additional tests to ensure that you will be safe in surgery based upon their knowledge of the surgery.

Where does Dr. Radcliff perform surgery?

Capital Health Medical Center (Hopewell). 1 Capital Way, Pennington, NJ 08534. (800) 637-2374. https://www.capitalhealth.org/

Robert Wood Johnson (Hamilton). 1 Hamilton Health Pl, Hamilton Township, NJ 08690. (609) 586-7900. https://www.rwjbh.org/rwj-university-hospital-hamilton/

Shore Medical Center 100 Medical Center Way, Somers Point, NJ 08244 (609) 653-3500 https://shoremedicalcenter.org/

Thomas Jefferson University Hospital, 132 S 10th St, Philadelphia, PA 19107, 215-955-6000, https://www.jeffersonhealth.org/index.html

What is the process for testing and clearance prior to surgery?
You will have to go to the hospital where your surgery is planned to obtain "clearance."

How long does it take to get cleared for surgery?
It depends on your health. If you are healthy and regularly see a physician, it could be only 5-7 days. If you have severe health problems, it could take a month or more.

Who will tell me about my medicines (diabetes medicines, blood pressure medicines, blood thinners, etc.) before surgery?
The medical doctors in the preadmission testing center will give you specific recommendations.

Do I need to stop aspirin for my heart before surgery?
No. Do not stop taking aspirin if your doctor has told you to take it.

Who will see me after surgery?
The same doctors who saw you in the pre-admission testing center will also see you while you are in the hospital. I believe that the best possible outcome occurs when the medical doctors meet you beforehand, learn about your medical needs, and then follow you after surgery.

Is the surgery very painful?
No. I am committed to making your surgery as painless as possible. I have developed an advanced protocol to control your pain after surgery. A group of doctors, including our anesthesiologists, medical doctors, nurses, physician assistants, and myself reviewed medical studies and created a comprehensive protocol to control your pain. We start pain medications before your surgery even begins! During surgery, we run specialized intravenous continuous drips that prevent your body's pain receptor nerves from ever becoming activated.

With this protocol in place, we have achieved postoperative pain scores that are in the ***97-99th percentile*** for hospitals within the United States based on a recent survey. We also reduced patient's opioid consumption 30%.

If needed, you will have access to Percocet, Roxicodone, or Vicodin. I will also prescribe

Dilaudid for intravenous pain medication if needed. However, the opioid medications can create constipation and urinary retention, so use them with care.

When does the pain management protocol start?
Before surgery. It is reinforced during surgery. It is further implemented after surgery.

Will I have access to opioid medications if I need them?
Opioid pain medication will be available for pain relief after surgery. The possible effects vary among patients and may include: sleepiness, nausea, constipation, flushing, sweating, and occasionally euphoria or confused feelings.

What can I do before surgery to control my pain after surgery?
It is important that you reduce your opioid medication prior to surgery. By decreasing your tolerance your body may respond better to postoperative pain medications such as these opioids.

Will I Have To Wear A Brace?
No

Will I Need A Walker?
Possibly. If you need a walker or a raised toilet seat, I will give you a prescription for one.

Will I Have A Cane?
No

What can I do to prepare for activities after surgery?

Activities that include bending/twisting/lifting such as laundry, grocery shopping, caring for pets should be left for others to care for, to avoid potential injury. Possible items to create a safer environment are listed below.

- ***A "grabber" device***. Bending and reaching up can be avoided with this lightweight tool, often sold at pharmacies and discount stores.
- ***Toilet and shower equipment***. Adding a shower mat, toilet riser, and a shower seat makes the bathroom safer and easier to use. Home health equipment is often covered by insurance.
- ***A cane or walker***. Patients who think a cane or walker would help them feel more stable can discuss this option with the surgeon.

- ***A mini-fridge or cooler***. Keeping cool drinks and ice packs close at hand helps patients avoid climbing stairs more than necessary.
- ***A recliner or extra cushions***. The seating position in a recliner takes some pressure off the lower back. Sitting on a cushioned surface is also likely to be more comfortable.
- ***Fall prevention***. It is best to remove anything that may be a tripping hazard, such as loose rugs or clutter. Some people also install handrails as needed, such as on stairs or in the shower.

Why Do I Feel Exhausted After Surgery?

It is very common to feel run down a couple weeks after surgery because your body is getting acclimated to the new changes in your body. You should walk around to help increase blood flow throughout your body. Shifting positions frequently between standing, sitting, and lying down are good to help avoid pain/stiffness. Gradually increasing physical activities are good, but should be stopped if you start to experience increasing pain or exhaustion. You should not do activities that require bending at the waist and lifting anything over 15 pounds or a gallon of milk.

Do I have sleep in a recliner?

No. Sleep in whatever position is most comfortable. If you like to sleep in a recliner feel free to do so.

Can I have sleep in my bed?

Yes. Sleep in whatever position is most comfortable. If you like to sleep in your bed feel free to do so.

Do I need to sleep in a hospital bed?

No. Most patients are most comfortable in their own beds.

Can I move when I sleep? Can I sleep on my side?

Yes. You will not do damage to your back from sleeping in a certain position or turning when you sleep.

Are there specific pillows or mattresses that you recommend?

No. Pillows and mattresses are very individualized. Many of my patients like shredded memory foam pillows, however.

Will I need physical therapy?

Maybe. Regular exercise, including physical therapy, is thought to help prevent binding of the lumbar roots through fibrous adhesions called epidural fibrosis. Specific stretches can help reduce effects of postoperative scarring around the nerve root resulting in better outcomes. Therapy can also improve blood flow which will help your nerve heal and muscle heal. You will begin exercising and moving immediately after surgery. You may be able to do the exercises on your own to recondition your spine. If you have special circumstances, then I will order physical therapy. I usually wait for the incision to heal and for early healing to occur. If necessary, I will prescribe physical therapy at about one month after surgery.

Will I need inpatient rehab?

No. The most important rehab is to walk as much as possible.

If do I need inpatient rehab where should I go?

I suggest that you contact your insurance. Popular rehabilitation facilities include Moss, Magee, Kessler, Bacharach.

Will I be able to stand and walk after surgery?

Yes. The nurse or therapist will assist you in getting out of bed a few hours after surgery. You will be instructed to be up walking every 2 to 3 hours during the day and evening. The nurse will allow you to do this independently once you are steady and feel comfortable.

Is activity helpful for my recovery?

Yes. Early activity after surgery is extremely important to help prevent the complications of prolonged bed rest such as pneumonia and blood clots. It also promotes recovery, relieves muscle stiffness, allows for development of a well-organized scar, and improves your outlook.

Can I start my own exercise program with a trainer or someone?

No. Please do not start any exercise programs unless discussed with me.

What are the lifting restrictions after surgery?

15lbs for the first six weeks. That is the weight of two gallons of milk. Lifting weights increases stress and pressure on the lumbar spine and surgical site. I would like the area to heal before we increase your activity tolerance.

What do postoperative x-rays show?

The x-rays show the position of the bones and the hardware. It is not possible to see evidence of fusion on x-rays until about six months after surgery. On x-rays, I can see

signs of failure of healing, such as hardware pullout, loosening, or subsidence. If I do not see those signs, that is very encouraging and is suggestive that you are healing well.

Do I need to have x-rays to advance my weight limit and tolerance?

No. I base the decision to advance your weightbearing on your pain, activity tolerance, bone quality, and your preferences.

Can I damage my back from turning my back doing routine things such as talking or driving?

No. You will not do damage to your back just from routine activities and driving. In fact, the motion will help to recondition your back muscles.

Why is there a limit on back motion (90 degrees) if I cannot damage the back with activity?

I worry about extreme bending and craning your back. You will not do damage to your back just from routine activities such as talking on the telephone, typing, and minor recreational activities.

When can I resume running and bicycling?

I worry about the repetitive loading to your back. I suggest that you wait six weeks at least.

When can I resume golf?

Six to twelve weeks

When can I resume sedentary (office) work with a 10lb limit?

The earliest is 2-3 weeks to resume desk (sedentary) work. Most patients do not get back to light work until about six weeks.

When can I resume heavy work with a 50lb or more limit?

The earliest is 10 weeks to resume heavy work. Most patients do not get back to heavy work until about 4 months after surgery. It is possible that you will never be able to resume heavy work.

Will you do disability forms for me?

Yes. You must start the disability process. If your employer requires documentation of your work status, our office will provide the necessary information to your employer or other concerned parties. All disability matters must be handled through the office (so that the paperwork is filed and stamped in the Rothman charts). Please do not bring disability paperwork to the hospital.

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When can I go out of work?
In general, I will take you out of work from the date of surgery. I cannot take you out of work prior to the date of my initial visit with you

Can I smoke nicotine products?
Smoking is absolutely forbidden. There is clear evidence that smoking dramatically increases your risk of post-operative complications. Most insurances will deny surgery if you smoke and will make you get urine nicotine testing. You should avoid tobacco exposure for at least six weeks prior to surgery and for two years after surgery. Second hand smoke also applies.

Can I use cannabis?
I do not know. There is little research on cannabis either way because it remains a federally illegal substance. I do not have a license to prescribe cannabis.

When can I bathe?
You should sponge bath only for the first week after surgery.

Should I get the incision wet?
After postoperative day 5

Can I soak the incision underwater?
Please do not soak the incision under water (either in a bath tub or in a swimming pool or the ocean) prior to the postoperative check at two weeks.

Can I apply ointments to the incision?
No. Do not apply any ointments or creams.

What can I eat after surgery?
Your diet will begin with clear liquids, and be advanced to a regular diet as soon as your condition permits.

What can I do to help my breathing after surgery?
Deep breathing is very important after surgery to maintain lung expansion and reduce the risk of pneumonia. You will be provided with an incentive spirometer and instructed about its use. This device should be used every 15 to 30 minutes during your wakeful hours initially, then every 1 to 2 hours as your activity returns to normal. This device is yours to take home. Continue to use it at home for at least 1 week after your discharge. (Use it during TV commercial breaks).

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Can I use smokeless tobacco?
You should avoid tobacco exposure for at least six weeks prior to surgery and for two years after surgery. Second hand smoke also applies.

What will hold the skin together?
Absorbable sutures which are buried. On the outside there will be crazy glue (Dermabond).

When are the postop appointments?
2 weeks, 6 weeks, 3 months, 6 months, 1 year and 2 years from surgery.

Do I see Dr. Radcliff at every visit?
No. The 2-week visit is usually a wound check done with my physician assistant. I am of course always around and available.

When should I call?
Please take your temperature every afternoon for the first week after you are discharged from the hospital. Call your physician at 609-952-5243 if:

1. Your temperature is more than 101.5 degrees,
2. Your incision becomes reddened, swollen
3. You develop any problems urinating or passing bowel movements.
4. You develop any worsening numbness or weakness, especially numbness on your buttocks.
5. Any increase or change in drainage occurs.
6. You develop headaches, light sensitivity, or other serious concerns?
7. You have any other serious concerns.

Does diet affect my healing?
Yes. A well-balanced diet is necessary for good healing and recovery. This includes food from the four basic food groups: dairy products, meat, vegetables, and fruit.

Are specific vitamins necessary for healing?
You should take a multivitamin. You should also take a combination Vitamin D supplement/calcium supplement daily for six months. During this healing period, your calcium and Vitamin D requirements are increased. One brand that I commonly recommend is Os-Cal D

Can you call in a refill of opioid medications after hours?
Opioid pain medications cannot be refilled at night or over the weekend, or holiday.

What are the laws in New Jersey about pain medications?

In New Jersey, there is a recent law that only ***five day prescriptions*** of opioid pain medications can be given to a patient in moderate to severe acute pain (http://www.nj.com/politics/index.ssf/2017/02/bill_limitig_painkiller_prescription_on_christies.html).

What if the patient needs more than 5 days of pain medication?

To address concerns about patients with pain that exceeds 5 days, the law allows physicians to easily add another 5 days to the original opioid prescription if the patient's pain has not subsided.

What if I need opioids after the first five days?

If you need even short term opioids beyond the first refill, I will refer you to a pain management specialist.

When will you refer me to a pain management specialist?

I may refer you to a pain management specialist

1. If you still need opioid pain medication OR
2. If you need strong, long acting pain medication OR
3. IF you have a history of treating with a pain management physician

Are you in most major insurance networks?

Yes. We take all major insurances. In general, if you can see me in the office, I am in your insurance network. Before surgery, my office will precertify the surgery codes with your insurance and will notify you of potential charges and insurance participation.

Is the hospital in network?

Yes. In fact, before surgery, my office will confirm that your surgery is covered by insurance. If needed, please feel free to contact my prior authorization representative Brittany Herron at (267) 339-3543. All the hospital physicians, including the ER doctors, radiologists, anesthesiologists, hospitalists, etc. are also in network.

Do you have any out of network assistants?

No

What are the insurance company criteria for surgery? Who writes them?

Each insurance company has its own specific criteria to determine when a surgery is appropriate which they call “medically necessary.” The criteria are quite subjective and often change.

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What if surgery is denied?

If that happens, I will do a call with another physician to review your case. Usually that first level appeal occurs with a non-spine physician such as a pediatrician or gynecologist. If that appeal is unsuccessful, then the second level appeal occurs with a spine specialist. It can take over a month.

COMPLICATIONS

What Kinds of Complications Can Occur?

There are three categories of complications after spine surgery: perioperative complications (which generally occur immediately after surgery), long term outcome (at six to twelve months after surgery), and the risk of additional procedures in the future. Although I endeavor to list all complications that a reasonable person would want to know, there is always a possibility of other, unforeseen rare complications occurring. There are other, more rare complications, that can occur that are not always possible to anticipate or list.

What are anesthesia related complications of laminectomy and fusion surgery?

Some complications that can occur after anesthesia include blindness, shoulder injury, brachial plexus injury, anesthesia reaction, transfusion reaction.

What are the general complications that can occur after any surgery?

Some complications that can occur after any surgery include pneumonia, deep venous thrombosis (blood clots), phlebitis, pulmonary embolism, renal failure, heart attack, cardiac arrest, stroke, aspiration pneumonia, delayed bowel function (ileus), urinary retention (from genitourinary problems other than neurogenic bladder), C. Diff infection, diarrhea, worsening vision or blindness, blood loss, allergic reaction to medications, and even death.

What are the other complications that can occur following a spinal surgery?

Some of the possible complications following any surgery on the spine include persistent pain/failure to alleviate symptoms or worsening symptoms, worse postoperative pain, other organ injury, neurogenic bladder (usually from spinal cord injury), neurogenic bowel, sexual dysfunction, instability of the spine, need for further surgery/reoperation,), non-improvement, prolonged intubation, arachnoid cyst, and arachnoiditis (i.e., scarring of the nerves in the dural sac).

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What are the other risks of spine surgery?

The risks of surgery have been well studied. The table below is taken from a published reference that is commonly used in England called the International Spine Surgery Information Sheet. These rates are not necessarily my own personal rates. They are the rates published in the medical literature.

SPECIFIC RISKS & COMPLICATIONS

Relevant to you	Complication	Leading to	Odds
	Nerve root injury	Pain/weakness/numbness in the arm / leg. The impairment may be temporary or permanent.	1 in 60
	Damage to the nerves supplying the bladder (cauda equina syndrome)	No control or reduced control passing urine or faeces. Weakness and/or numbness in the legs.	1 in 100
	Tear of the lining of spinal canal (dura)	Headache and a leaky wound. Occasionally a second operation to repair the tear (1 in 300).	1 in 20
	Infection	Wound discharge, fever and chills.	1 in 50
	Wound swelling (Seroma)	Fluid collection under the skin. Majority amenable to aspiration alone. Occasionally wound is re-opened to drain.	1 in 60
	Recurrent disc herniation	Recurrence of pain requiring second operation either within a few days or at any time in the future.	1 in 20
	Respiratory	Need for support of ventilation. Occasionally emergency operation to relieve the obstruction (1 in 50)	1 in 30
	Oesophageal (gullet) injury	Difficulty with swallowing. Generally temporary. Re-operation to repair the oesophagus may be needed (1in 100)	1 in 12
	Recurrent laryngeal nerve injury	Hoarse voice – temporary (common) or permanent (rare).	1 in 20
	Vertebral artery injury	Bleeding	1 in 300
	Failure of bone healing (non-union)	Persistent pain. Recurrence of deformity.	1 in 6
	Bone graft donor site pain	Pain.	1 in 8
	Hardware breakage / loosening, Dislocation of implant	Pain. Recurrent deformity. Probable second operation to re-position or remove any implant.	1 in 100
	Pedicle screw malposition	Weakness / numbness / bleeding / lung injury	1 in 25
	Intestine (gut) blockage (ileus)	Distended abdomen, vomiting and constipation.	1 in 100
	Retrograde ejaculation	Infertility.	1 in 75
	Spinal cord injury	Loss of arm and leg function: Quadriplegia / Paraplegia – permanent. Quadriparesis / Paraparesis – may be temporary or permanent.	1 in 250

http://download.lww.com/wolterskluwer_vitalstream_com/PermaLink/BRS/A/BRS_2010_12_08_NG_204359_SDC1.pdf

What if you slip and lose control of the instruments?

I am trained to handle the surgical instruments safely around the spine in a manner that is safe and avoids injury to vital structures.

What are the specific complications of a laminectomy and fusion surgery?

Some complications that specifically occur after a laminectomy include infection (wound, discitis, osteomyelitis, epidural abscess), spinal fluid leak, dural tear, new numbness/weakness in other nerves, drop foot, foot numbness, epidural hematoma, cauda equina syndrome, recurrent herniation, nerve root injury, development of spondylolisthesis, pars fracture.

Ok. There are a lot of possible complications. What are the ones that I should really worry about?

I really worry about bleeding that can affect the spinal nerves (epidural hematoma), nerve injury, and the possibility that the bone will not fuse to the spine.

Can I Develop Another Herniation at the Level Where You Are Working?

No. I will completely remove that disc.

What about infection? What do you do to prevent infection?

I also worry about infection. An infection may present with wound drainage, fevers, chills, worsening pain, redness, weakness, numbness, tingling, or worsening trouble swallowing. I have done extensive research on infections and I go out of my way to take steps to reduce your risk of infection.

Is it possible that I will need another surgery in the future?

Yes. You may need another surgery in the future, either to treat a complication (such as an infection) or to treat pain or another spinal problem. In the case of a posterior lumbar fusion, more surgery is necessary about 14% of the time at about 5 years. Possible reasons for additional surgery include failure of the healing at the first level, development of problems at another level, spondylolisthesis, instability, scar tissue buildup, junctional breakdown.

Where can I look for additional information?

A Better Way Back is an online information source with credible information. I strongly suggest that you review that program first before doing a Google Search.
Better way back has a section on basic spine anatomy.
https://www.thebetterwayback.org/intro-to-spine/

Better way back has a section on spine conditions.
https://www.thebetterwayback.org/pain-and-conditions/

Better way back has a section on treatments.
https://www.thebetterwayback.org/treatment-options/

Better way back has a section on advanced resources including a nationwide ambassador program that you can call or text and resources for your caregivers.
https://www.thebetterwayback.org/patient-ambassadors/
https://www.thebetterwayback.org/emotional-support/
https://www.thebetterwayback.org/caregivers-guide/

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The First Week

- Early to bed, late to rise and frequent rest periods throughout the day. Get at least 8 hours of sleep each night. A disrupted sleep pattern is common after discharge from the hospital and will return to normal over time.
- You may not drive, but you may be driven, for short distances, using proper restraints such as shoulder and lap belts for 2-4 WEEKS.
- No lifting of more than 15 pounds.
- May climb stairs with hand rail
- Begin a daily walking program with 1 to 2 blocks initially; schedule a daily time and increase distance daily.
- Eat a regular, balanced diet.
- Take medications as prescribed, using narcotics as needed.

The Second Week

- Resume normal rising and retiring schedule, but continue to rest throughout the day.
- You may not drive.
- No lifting of anything weighing more than 15 pounds.
- May climb stairs with hand rail
- Continue scheduled walking, increasing distance and frequency as able.
- May resume sexual relations when comfortable.
- Begin narcotic weaning as pain diminishes, relying mainly on non-narcotic medications
- Follow-up in the office as scheduled, for further instructions.

The Third Week

- Resume normal rising and retiring schedule, resting as needed.
- May resume light work around the home; lifting not to exceed 15 pounds.
- Continue scheduled walking.

The Fourth Week

- Resume normal rising and retiring schedule, resting as needed.
- May resume light work around the home; lifting not to exceed 15 pounds.
- Continue scheduled walking.

The Sixth Week

- Follow-up visit.
- Discontinue weight limit. Ok to lift more than 15 pounds but less than 30 lbs.
- Resume sedentary work

- Initiate physical therapy

The Twelfth Week

- Follow-up visit.
- Assess physical therapy

6 Months

- Follow-up visit or call to the office to cancel if you are doing well
- Conclude physical therapy
- Resume intense work

12 Months

- Follow-up visit or call to the office to cancel if you are doing well
- Fusion is usually solidified by this time

Glossary:

acute: a condition that progresses rapidly

anesthetic: an agent that causes loss of sensation with or without the loss of consciousness.

anterolisthesis: A forward slippage of one bone onto another bone. It can compress the nerve roots, causing pain.

axial pain: pain in the neck or back that does not travel into the extremities (arms and legs)

bulge: A broad type of disc herniation that occupies more than 25% of the circumference of the disc

chronic: a condition of slow progression that continues over a long period of time.

central stenosis: narrowing of the middle of the spinal canal where the nerves travel

cerebrospinal fluid: the water-like fluid that bathes the nerves

corticosteroid: a hormone produced by the adrenal gland or synthetically. Regulates salt and water balance and has an anti-inflammatory effect.

cortisone: the type of steroid used in most injections. Epidural injections involve an injection of cortisone. There are specific brands of cortisone such as depo-medrol, solu-medrol, and methylprednisolone.

degeneration: the process of deterioration of cartilage and tissues due to any number of factors. Degeneration can occur because of an injury ("My car accident caused my back to degenerative prematurely"), genetic factors ("My entire family has back problems") or due to work.

degenerative disc: A breakdown or aging of the intervertebral disc causing collapse of the disc space, tears in the annulus, and growth of bone spurs. Degeneration is a form of arthritis.

disc-osteophyte complex: A combination of disc herniations and bone spurs due to spinal arthritis.

dura: the thin membrane surrounding the nerves that holds spinal fluid

epidural injection: A steroid injection into the spinal canal intended to reduce inflammation and pain given outside of the dura inside of the spinal canal. Cortisone is the most common type of steroid to be injected. Epidurals are also called nerve blocks. There are several different types of epidural injections that are differentiated by the location where the medication is injected. Some common types of epidural injections are interlaminar injections, transforaminal injections, selective nerve root blocks, and caudal epidural injections.

epidural space: the area between the membrane surrounding the spinal cord and the vertebral wall that is filled with fat and small blood vessels.

extrusion: A type of disc herniation which has a broader dome than a neck and/or extends above or below the disc level (and thus migrates)

fluoroscopy: an imaging device that uses x-ray or other radiation to view structures in the body in real time, or "live." Also called a C-arm.

foraminal stenosis: narrowing of the tunnels where the nerves exit the spinal canal

herniated disc: The gel-like material within the disc can bulge or rupture through a weak area in the surrounding wall (annulus). Irritation, pain, and swelling occur when this material squeezes out and meets a spinal nerve. Disc herniations can be subcategorized as "bulge, protrusion, extrusion, or sequestration".

interlaminar: through the lamina.

lateral recess stenosis: narrowing of the side of the spinal canal where the nerves travel

mild stenosis: something occupying less than 1/3 of the spinal canal

moderate stenosis: something occupying between 1/3 to 2/3 of the spinal canal

myelopathy: A spinal cord disorder causing trouble with finger coordination, balance, and bowel/bladder control

osteophyte: A bone spurs. It is a hardened section of disc or an overgrown section of bone

protrusion: A type of disc herniation that occupies less than 25% of the circumference of the disc

radiculopathy: a pinched spinal nerve causing pain generally in the arms and legs

retrolisthesis: A backward slippage of one bone onto another bone. It can compress the nerve roots, causing pain.

sacroiliac joint injection: A cortisone steroid injection into the sacroiliac joints (not the spine) intended to reduce inflammation and pain

sciatica: pain that courses along the sciatic nerve in the buttocks and down the legs. Usually caused by compression of the 5th lumbar or 1st sacral spinal nerves. A form of radiculopathy

scoliosis: left-right curvature of the spine that can occur in childhood (called adolescent) or in adulthood (called degenerative)

sequestration: A type of disc herniation which a piece of disc has broken off and has migrated

severe stenosis: something occupying more than 2/3 of the spinal canal

spinal canal: the round bony tube surrounding the nerves and spinal cord

spinal stenosis: A narrowing of the spinal canal and nerve root canal can cause back and leg pain, especially when walking.

spondylolisthesis: A slippage of one bone over another in the spine, causing instability.

spondylolysis: A weakness or fracture between the upper and lower facets of a vertebra. If the vertebra slips forward (spondylolisthesis), it can compress the nerve roots, causing pain.

spondylosis: Degeneration (“drying up”) of the spinal discs associated with early spine arthritis