



## Minimally Invasive Lumbar Microdiscectomy

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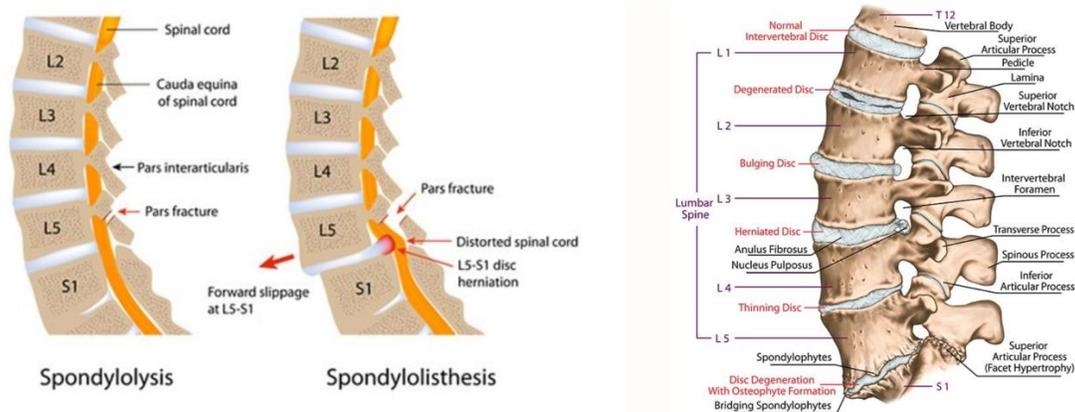
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### **Introduction**

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 microdiscectomy 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 vertebrae.



**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

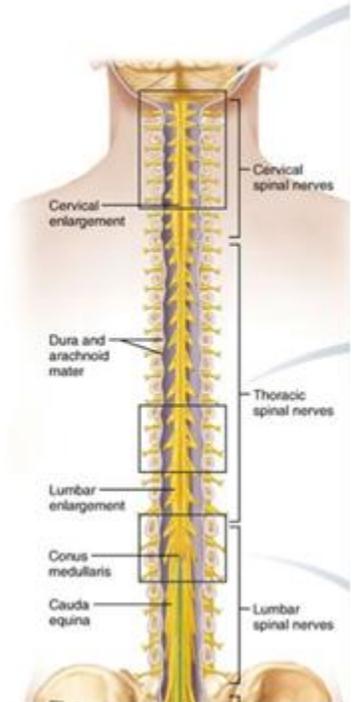
nerve roots. In the lumbar spine (low back), there is no large central nerve (spinal cord). There are only nerve roots.

**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.



Nerve root level	L3	L4	L5	S1
Pain location	Medial thigh	Medial foot	Between 1st and 2nd toe	Lateral foot
Stress test	R-SLR	R-SLR	SLR, C-SLR	SLR, C-SLR
Sensation ("X")	Medial thigh	Medial foot	Between 1st and 2nd toe	Lateral foot
Strength	Hip flexion	Knee extension	Big toe/ankle dorsiflexion	Ankle plantar flexion
Reflex	—	Patellar	—	Achilles

**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?***

Occasionally, the bones can bump into each other because the discs fail to function as shock absorbers. In that case, the bony contact causes back pain.

### ***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 joints 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 psychiatry, 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

Each surgery can be more or less invasive. In this case, I recommend a microdiscectomy to treat the spinal stenosis. A microdiscectomy is a type of decompression.

### ***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?***

I have a YouTube channel with microscope videos of a microdiscectomy (<https://youtu.be/yezmv-IOHQM>) and a laminectomy (<https://youtu.be/3ggITglVoXM>).

### ***What is a microdiscectomy?***

A microdiscectomy is an operation performed on the back of the spine to remove the bone covering the spinal canal. The purpose of a microdiscectomy is to increase space for the nerves by removing the part of the disc that compresses the nerves. Microdiscectomy is one of the oldest and most performed spinal surgeries. Microdiscectomy does not



involve the placement of screws or implants into the spine. When done properly, microdiscectomy does not make the spine unstable or prone to future injury.

## PROCEDURE

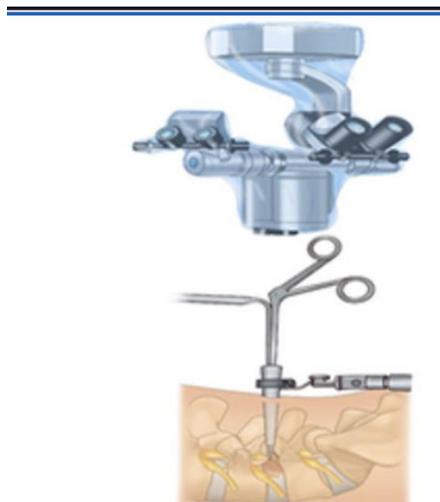
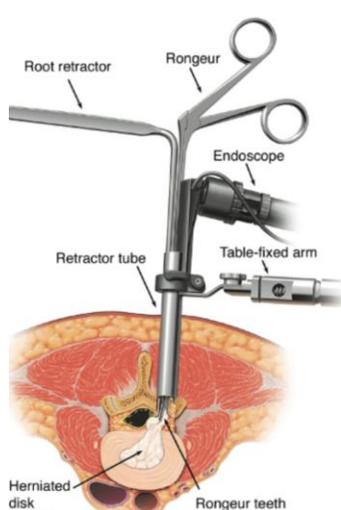
### ***Will I have an incision?***

Yes. You will have a small incision on the middle of your low back. The skin incision is about 2 inches per level of surgery in most people. The incision varies depending on the person's size, their weight, and the specific problem that I intend to remove.



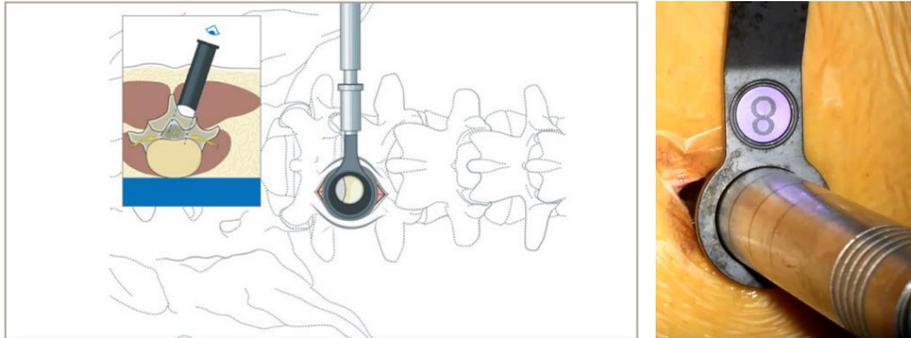
### ***Do you Use A Camera or Is This Surgery Arthroscopic?***

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.



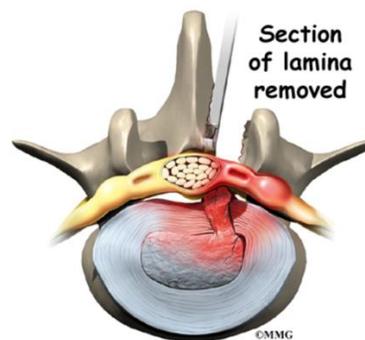
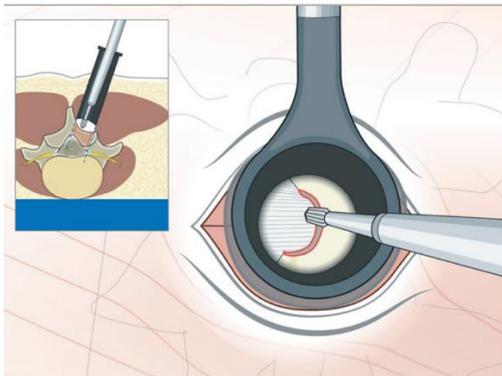
### ***What happens then?***

I move aside the muscles and ligaments aside to expose the spine. I do not cut the muscles. In many cases, I place a tube to create a path through the muscles without cutting the muscles directly.



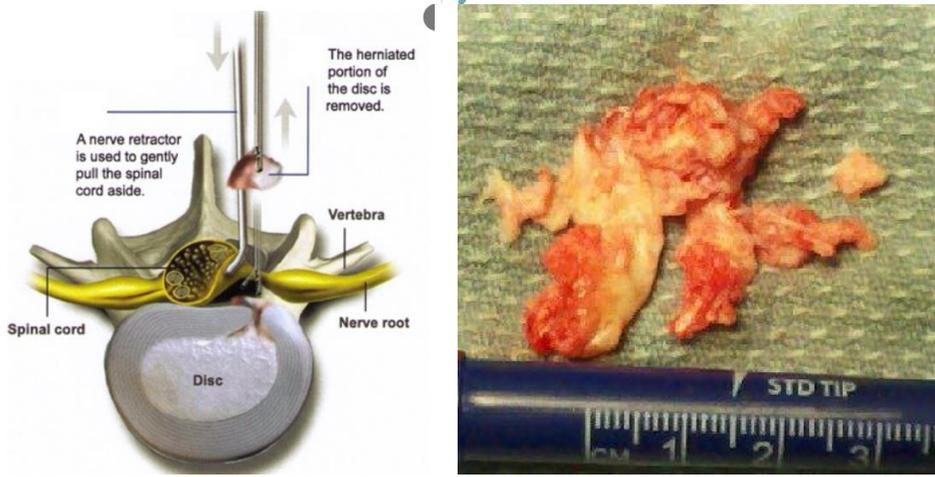
### ***Will you cut my bone?***

Yes. Once the muscle is moved aside, I will see a small section of bone covering the spinal canal called the lamina. The bone removed is the only bone that is removed during this operation. The bone removal, called a laminoforaminotomy or a laminotomy or a foraminotomy, creates additional room for the nerves. The additional room can be helpful in the case of a recurrent herniation.



### ***How Do You Remove The Disc?***

Once I have cleared out enough room, then I will gently pull the nerves over to be able to see the disc directly. Then, I will make a small incision in the disc. Then I will remove the herniated disc.



### ***Will you remove the entire disc?***

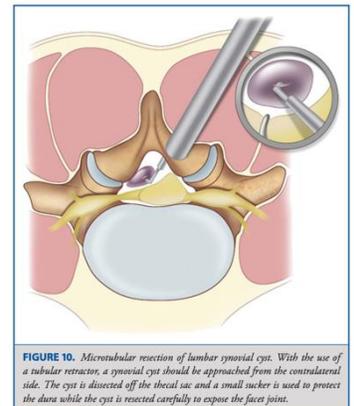
No. I only remove the portion that is herniated. I do not remove the remainder of the disc other than the herniated portion.

### ***Will you remove bone spurs and osteophytes?***

Yes. I will cut off or grind off bone spurs that compress the nerves. In fact, sometimes the disc itself is “calcified” and is essentially a hard bone spur.

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

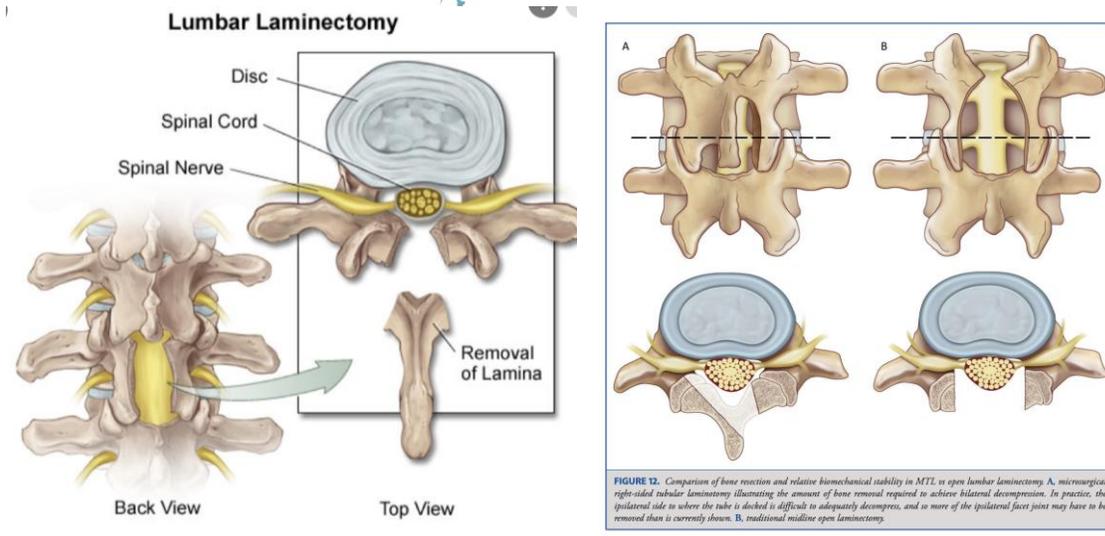
A cyst is a pocket of fluid from a joint on the spine. The cysts are benign and are not cancerous. If they are present, I will remove the cysts.



**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 a laminectomy?***

A laminectomy is a slightly larger clearing of bone than a traditional microdiscectomy. The difference is subtle and subjective. For all practical purposes, the terms are interchangeable. The amount of bone that has to be cleared away is dictated by the size of the disc herniation, bone spur, or cyst that has to be treated. The recovery from a laminectomy and microdiscectomy is identical.



### ***How Do You Cut Away The Bones?***

Very carefully. 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.

 <p><b>POWER</b></p> <p>The ultrasonic tool provides the ability to make large challenging osteotomies with ease without compromising safety. The speed to which the device cuts through bone allow users to maintain short operative times while improving the efficiency of the procedure.<sup>7</sup> All of which is done with the confidence that critical structures will be preserved.<sup>4</sup></p>	 <p><b>BONE PRESERVATION</b></p> <p>Ultimate control and precision, combined with a thin kerf, allow for cuts and maximize performance while preserving healthy bone. The BoneScalpel can preserve a greater percentage of autograft bone with each cut, when compared to standard techniques.<sup>8</sup></p> <p><small>Bone graft material reduction as a result of using the BoneScalpel in posterior lumbar fusions., Jensen, Presented at NASS 2017</small></p>	 <p><b>SAFETY</b></p> <p>The ultrasonic tool utilizes a non-rotational linear movement that provides tissue sparing effects giving users the confidence to go where they would otherwise be unable to go. Users can achieve greater resections in the vicinity of vital structures.<sup>4</sup></p>
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“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 I Have a Drain?***

No

### ***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. In most cases, they are sutured and repaired without a problem. Occasionally, I will ask patients to lie flat to take the pressure off the repair for a period.



***How often do dural tears occur?***

Dura tears about 10-20% of the time in patients with spinal stenosis.

***Can that membrane tear after surgery even if it did not tear in the operating room?***

Yes! If you cough, sneeze, or lift something heavy, it can tear and start weeping fluid. If that happens you will get headaches. If that happens please call me.

***Does anything make me more likely to have a tear occur?***

Yes. If you have spinal stenosis for a long time, severe pressure on the nerves, several injections, a CT myelogram, previous surgery or scar tissue, or other congenital conditions can cause it to tear.

***Will the laminotomy space close again?***

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

***Do you put cages, plates, screws, or rods?***

No

***Is this a fusion?***

No

***Is there bone graft?***

There is no bone graft.

***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. The nerves are encased within a thin membrane called dura. I do not see the nerves directly.

***Can I have an MRI after surgery?***

Yes. No metal is implanted into your body.

***Will I go off in the airport?***

No.

***How Long Does the Surgery Take?***

The surgery takes about 1 hour



### ***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.

### ***How long will I stay in the hospital?***

Following this surgery almost all patients will go home on the same day.

### ***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. You will have a small incision on the skin. The entire procedure is performed under magnification and/or a microscope. If possible, I will remove as little bone as possible.

### ***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 lumbar spine surgeries. Every move and intervention is carefully monitored. If there is the slightest hint of a problem, I will intervene.

### ***Who operates the neuromonitoring technology? How do you do that and perform surgery at the same time?***

There is a neurophysiologist present who sets up the monitoring equipment (it is like an EKG). There is another doctor (a neurological in most cases) who reviews the computer information and is in constant communication with me throughout the surgery. The technology enables us to identify neurological problems before they become permanent.



### ***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](mailto: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.

### ***How Much Motion Will I Lose?***

This is not a fusion. You are not intended to lose motion.

### ***How much disc will you remove?***

Less than a square centimeter in most cases. I only remove the part that is herniated.

### **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. Microdiscectomy is, overall, more effective for the treatment of leg pain. At 8-10 years approximately 70% of patient are satisfied with the results of microdiscectomy 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 improve 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.

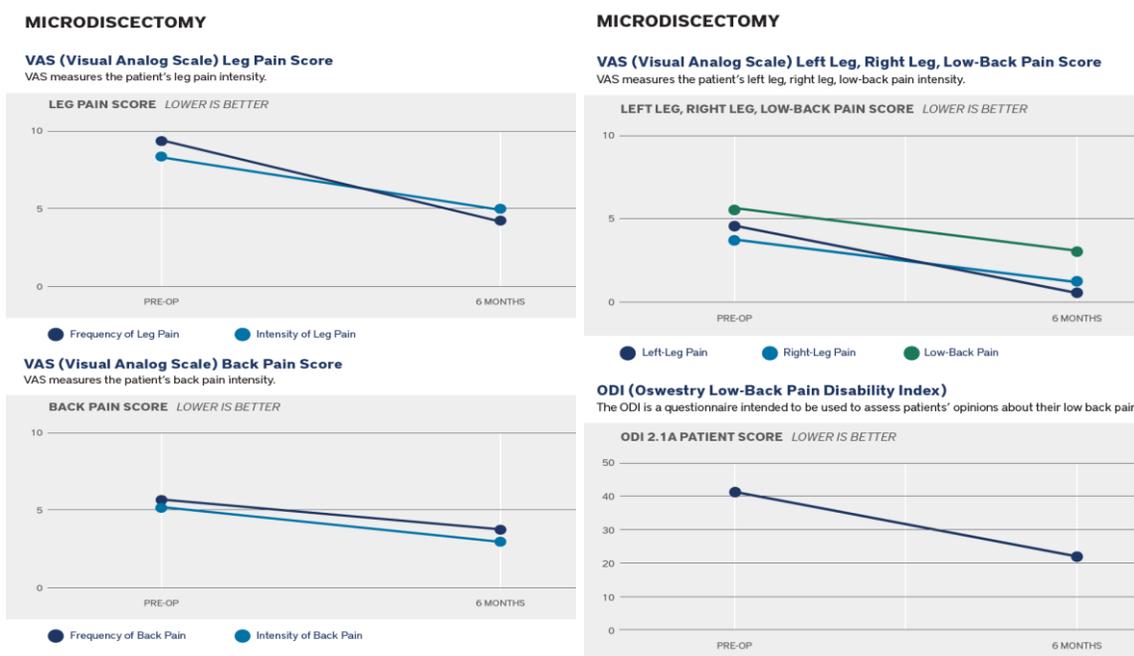
#### ***Do statistics guarantee that a specific amount of improvement for me?***



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 microdiscectomy?***

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 microdiscectomy in our hands.



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=IDH>

### ***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.

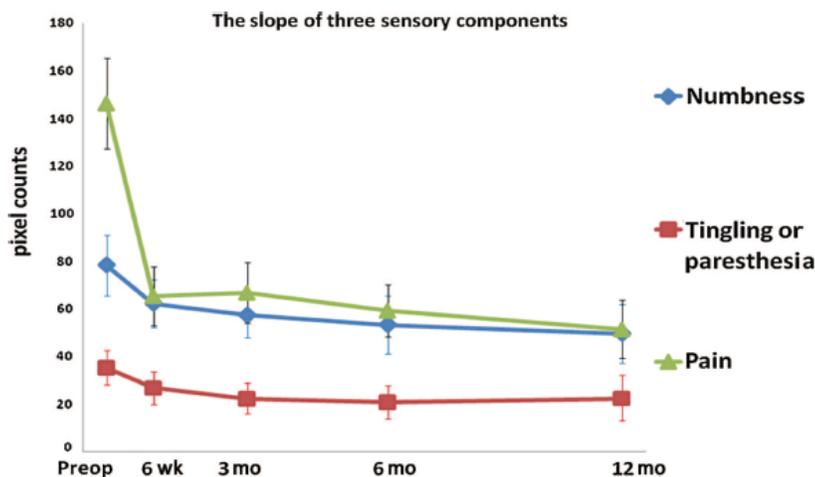
### ***When can I expect numbness to improve?***

Numbness can take 6-12 months to improve. People often have numbness even after surgery for months. In particular, the tips of the fingers are the farthest point from the spine. Thus the feet and toes are often numb even after surgery.

### ***How Long Will The Numbness Last? How Fast Does It Heal?***

The literature suggests that nerves heal 1mm per day. Therefore, if your leg is 800mm long (about 30 inches), the recovery will take 800 days.

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.



**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.

### ***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.

### ***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 such new transient symptoms that occurs after lumbar microdiscectomy is a drop foot, which is weakness lifting the foot and ankle.

### ***What If I Have More Numbness After Surgery?***

You may experience more foot numbness after surgery than that which you had before surgery.



***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. Over half of 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.

***Does surgery reverse nerve damage that has already occurred?***

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. They will function like your primary care doctors in the hospital.

### ***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 **97-99<sup>th</sup> 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 medication 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

### ***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 bones and help to confirm that the bones have not shifted following the surgery.

***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.

### ***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.

***When does the IV come out?***

Your IV will be removed as soon as we are reasonably certain it will no longer be required for medications and hydration.

***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 narcotic 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.

***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).



### ***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](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, Surgical Precert, (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.

### ***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 microdiscectomy surgery?***

Some complications that can occur after anesthesia include blindness, shoulder injury, brachial plexus injury, anesthesia reaction, transfusion reaction, and even death. Some patients may need a special type of intubation such as indirect laryngoscopy (Glide scope) or awake fiber optic intubation.

### ***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.

### ***Can the disc herniation happen again?***

The most common complication is recurrent disc herniation. Recurrent herniation happens about 30% of the time.

### ***Can you patch the lining of the disc to prevent more herniations?***



There are a few experimental devices available to patch the hole in the annulus to prevent additional disc leakage. However, they are not widely accepted as being safe and effective. I do not believe that there is enough data to support their use. The lining of the disc will not support sutures. There is no good literature on stem cell injections to repair the disc.

***What can you do surgically to prevent more disc herniations?***

I would have to remove the entire disc and fuse the level or perform an artificial disc replacement.

***What are the specific complications of a microdiscectomy?***

Some complications that specifically occur after a microdiscectomy 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.

***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).

***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 (1 in 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](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.

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

I really worry about bleeding (a hematoma) that can affect the spinal cord (epidural hematoma).

### ***What can you do surgically to prevent more disc herniations?***

I would have to remove the entire disc and fuse the level or perform an artificial disc replacement.

### ***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 microdiscectomy, about 20-30% of patients develop a recurrence. You are most likely to develop a recurrence during the first six weeks after surgery.

#### **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/>



### ***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.
- Resume physically demanding work

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 spur. 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 5<sup>th</sup> lumbar or 1<sup>st</sup> 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