



# Latest Treatments for Back Pain

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**Thank you.  
Be Healthy. Be Safe.**

# Who Am I?

# Medical Training

- Medical School: UW-Madison (4 years)
- Neurosurgery Residency (7 years)
- Cleveland Clinic Spine Fellowship (1 yr)
  - Combined training
    - Orthopedic Spine
    - Neurosurgery Spine



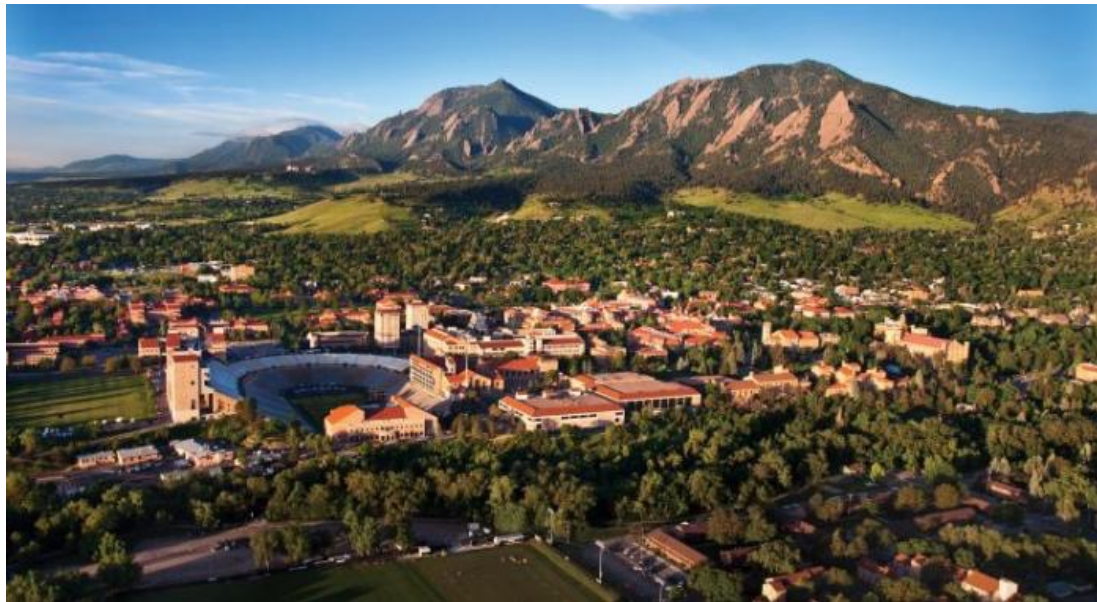
**Cleveland Clinic**



# My Practice

## **Boulder Neurosurgical and Spine Associates**

Partner: 2010-current



# My Office



- 10 Years:
  - >3,850 surgeries
- 18 years:
  - >9,250 surgeries



# My Team



# Teaching / Education



- >100 presentations
- >35 journal publications
- >10 book chapters
- >45 educational courses
  - >850 medical professionals
  - nursing & hospital staff
  - >1,750 spine surgeons (30+ countries)

# Why Are We “Here”?

# Back Pain

- >65 million Americans suffer from back pain each year
- Up to 80% of adults experience low back pain at some point during their lives
  - most episodes resolve spontaneously
- Second most common reason for doctor visits





# Back Pain: Economics

- Leading cause of disability in the US
- Huge socio-economic toll
- Significant drain on health care: annual cost >\$500B
  - Diabetes \$327B
  - HTN \$131B
- Active workforce is affected the most: 45%



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# Most Common Back Pain Conditions



# Back Pain

- Physical loading due to occupation/sports plays a limited role
- **Heredity** / genetics plays a major role
  - high degree of similarity in twins
- The only chemical exposure associated with disc degeneration: **tobacco use**



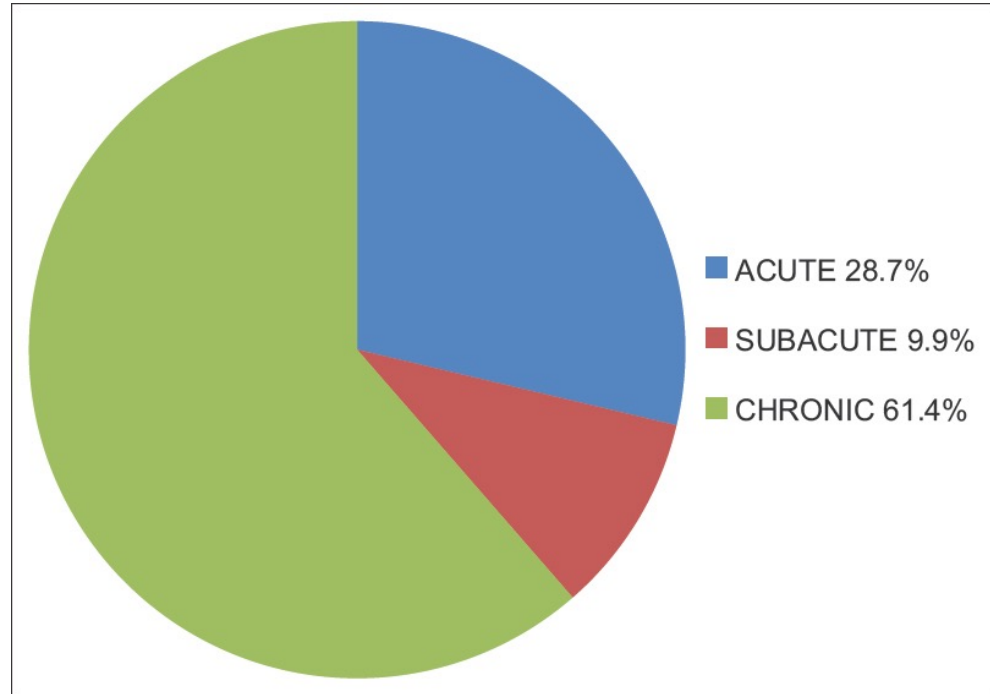
# Back Pain: Types

## Acute Back Pain (~30%)

- sudden, intense
- usually resolves within a few days or weeks

## Chronic Back Pain (~60%)

- deep, dull or aching
- usually lasts >3 months



# Back Pain: Causes

- Degeneration
- Deformity
- Trauma
- Infection
- Tumor
- Inflammation



# Spine Anatomy

## ~33 Individual Bones:

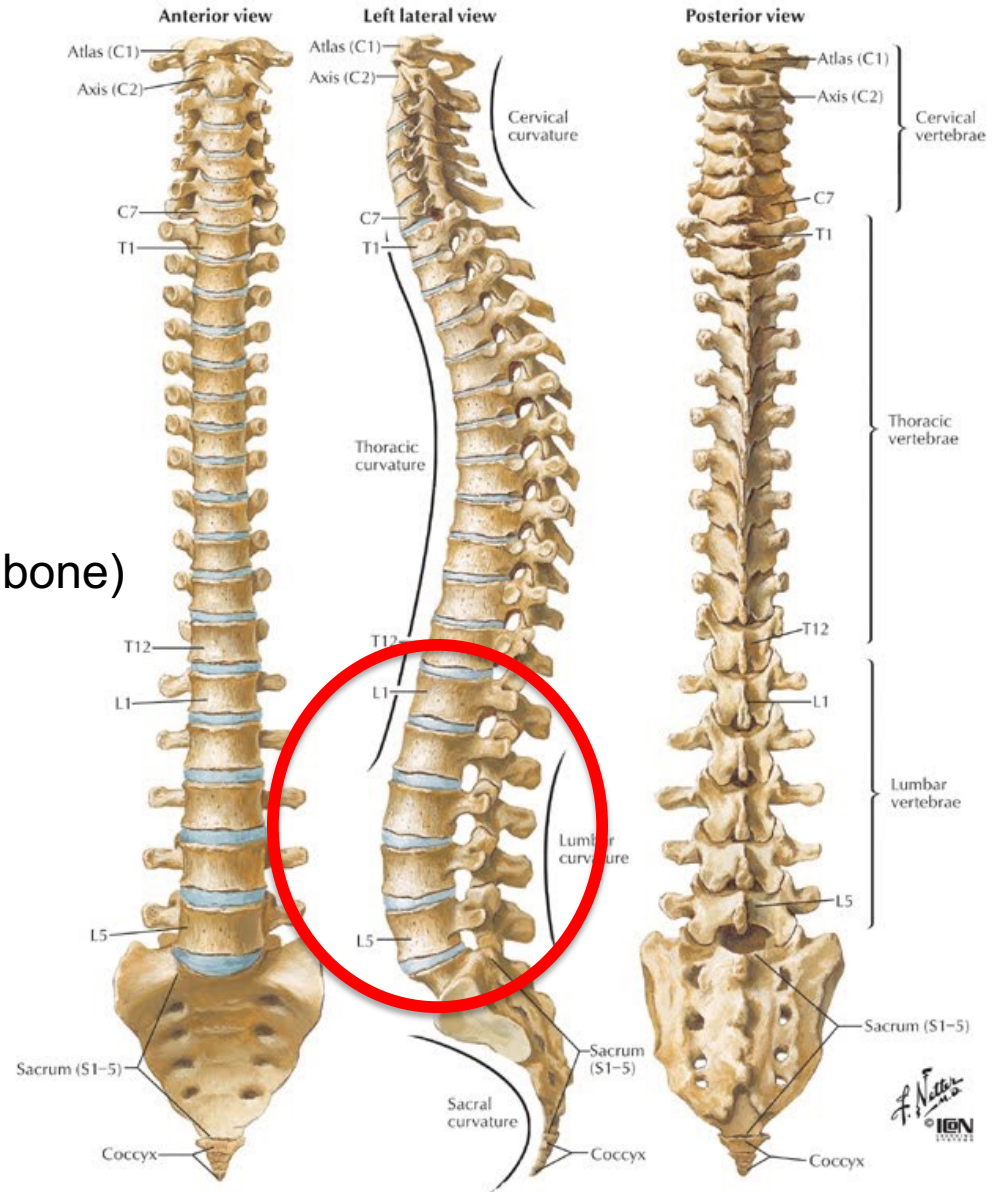
Cervical: 7 vertebrae (C1-C7)

Thoracic: 12 vertebrae (T1-T12)

Lumbar: 5 vertebrae (L1-L5)

Sacrum: 5 (fused) vertebrae (S1-S5)

Coccyx: 4 (3-5) (fused) vertebrae (Tailbone)

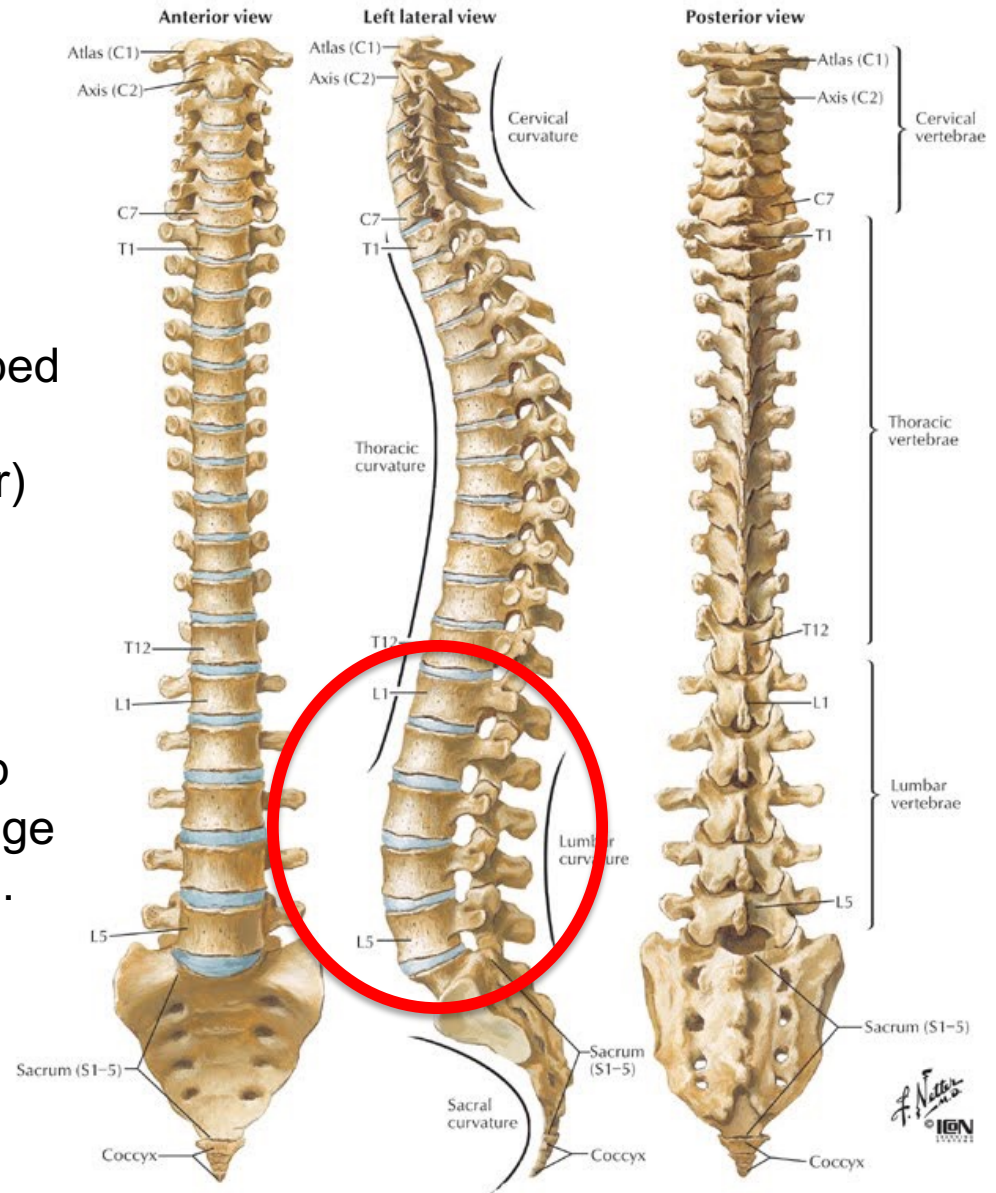


# Spine Anatomy

## Curves:

- The adult spine has a natural S-shaped curve.
- Neck (cervical) and low back (lumbar) regions have a slight concave curve.
- Thoracic and sacral regions have a gentle convex curve.

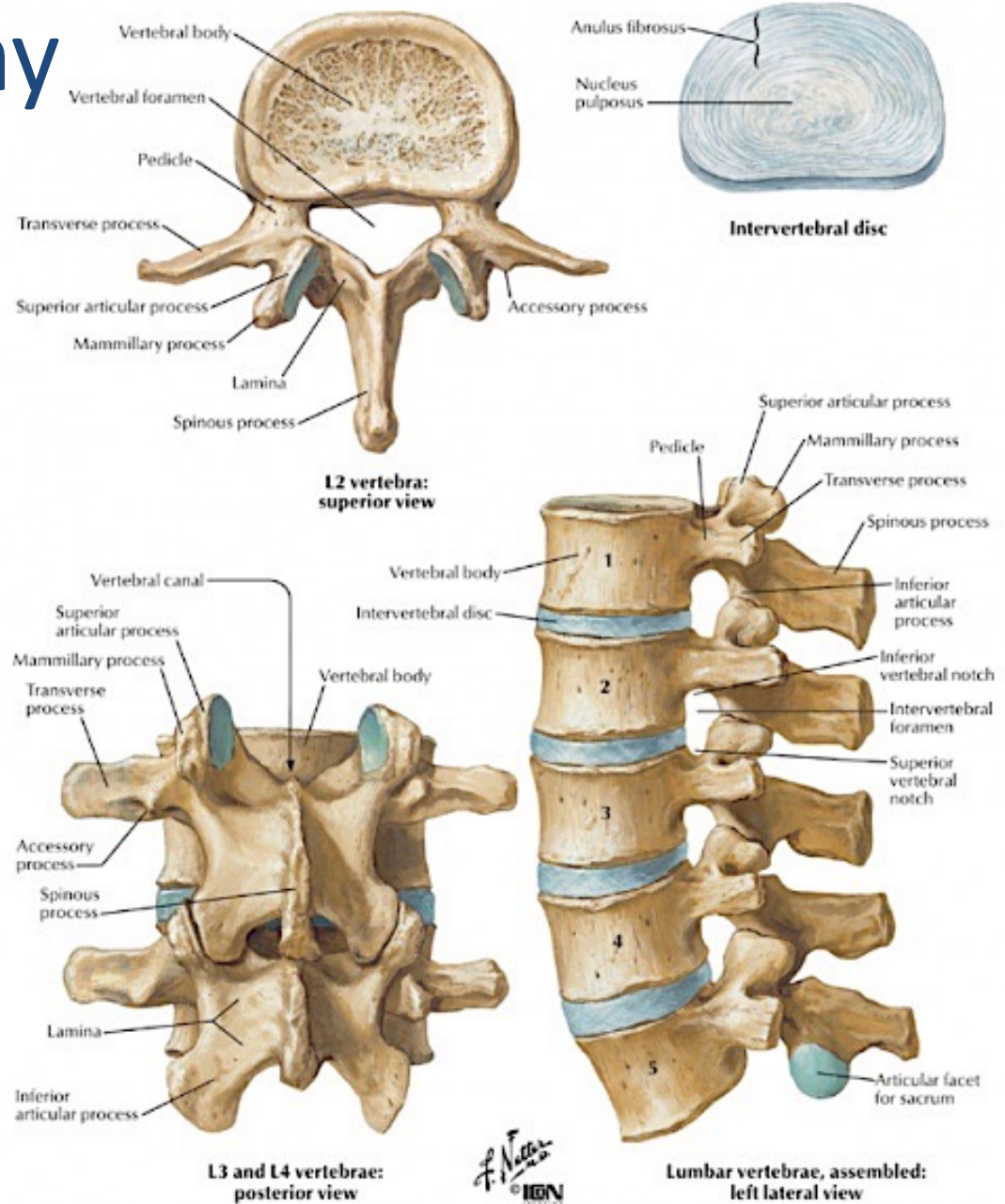
The curves work like a spring to absorb shock, maintain balance, and allow range of motion throughout the spinal column.





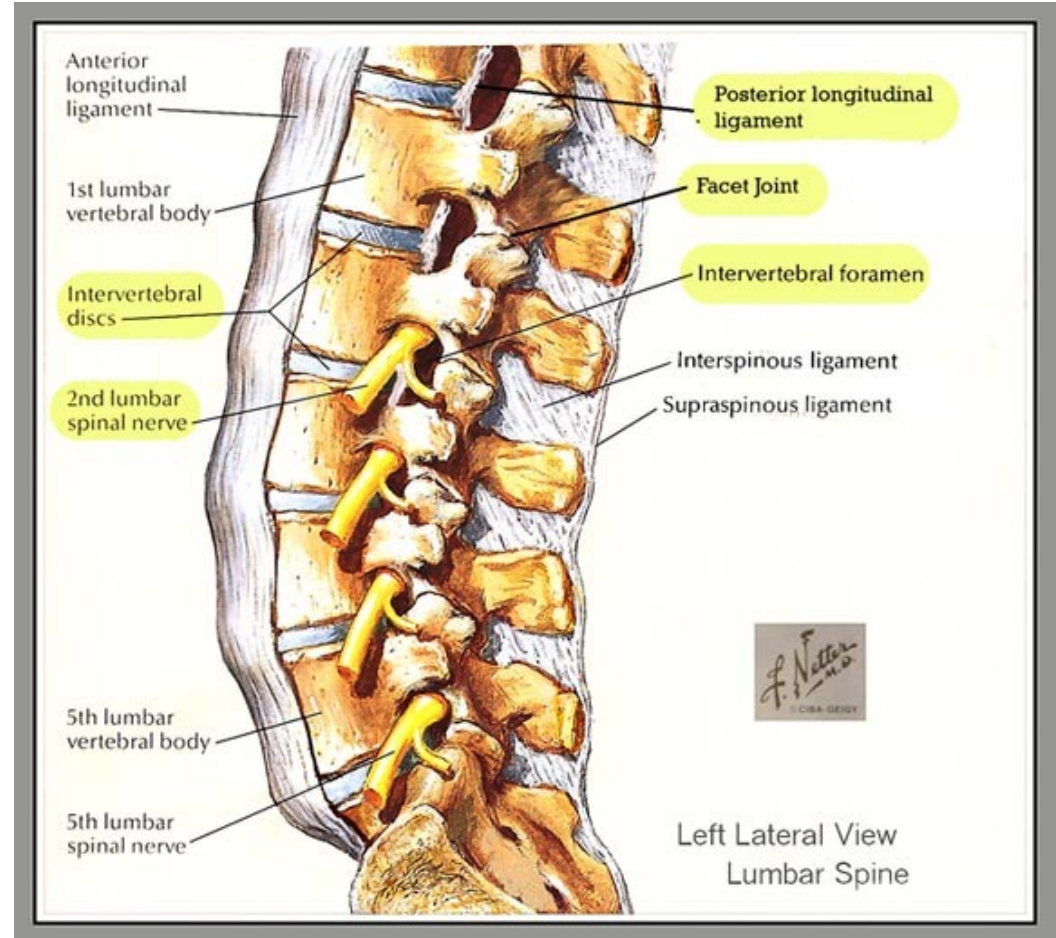
# Spine Anatomy

- Vertebra
- Intervertebral discs
- Facet joints



# Spine Anatomy

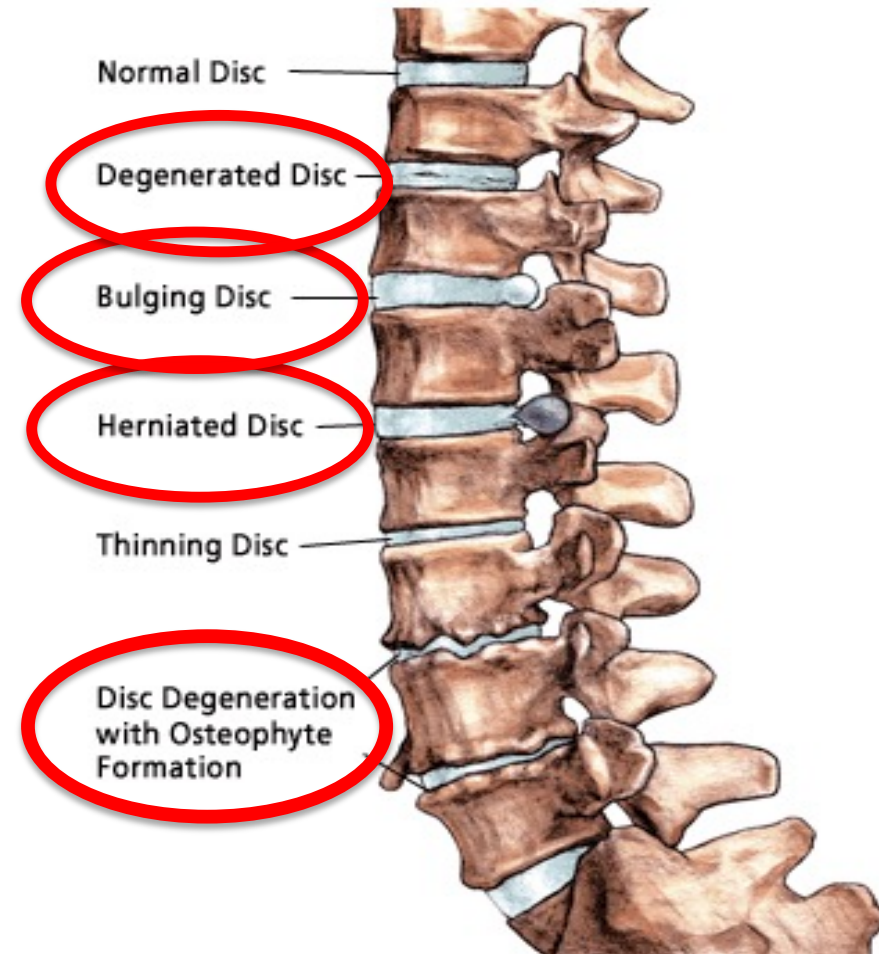
- Vertebra
- Intervertebral discs
- Facet joints
- Spinal nerve
- Epidural space



Any of these structures can be pain generators.

# Most Common Degenerative Spinal Conditions

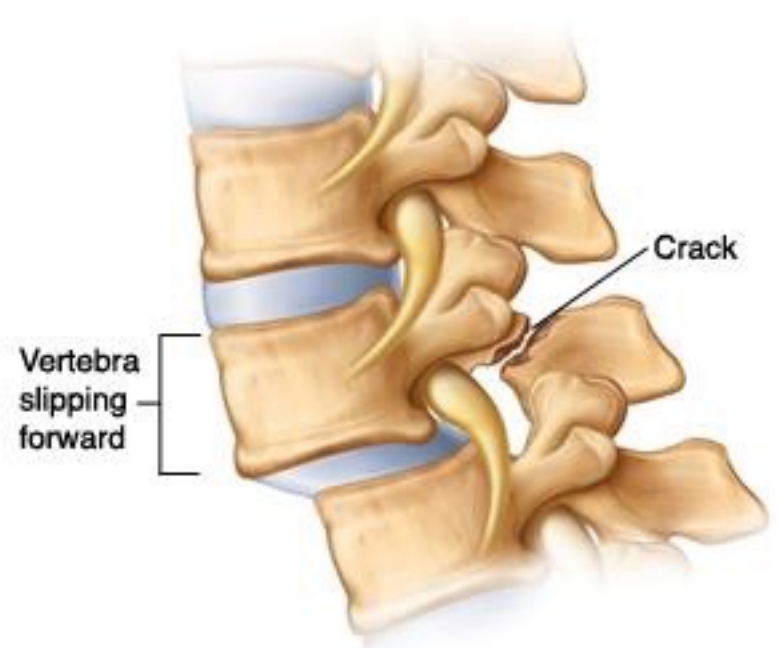
- Disc herniation
- Degenerative disc disease
  - Facet joint osteoarthritis
- Spinal stenosis
- Spondylolisthesis





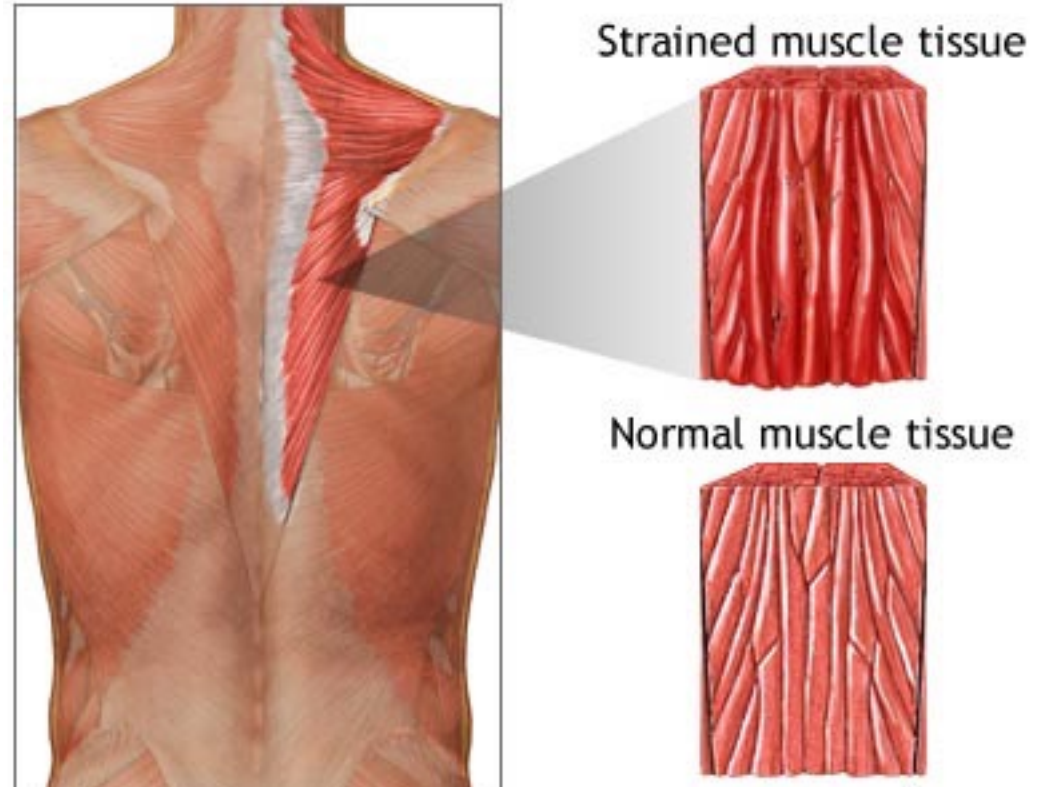
# Most Common Degenerative Spinal Conditions

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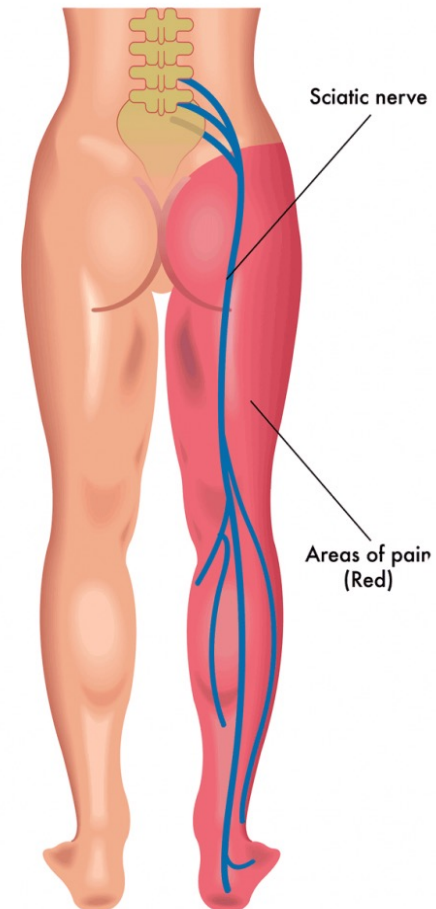
# Muscle Strains (“pulled muscle”)

- The **majority** of back pain is caused by muscle strains
- Usually **heals** with non-operative treatments and time



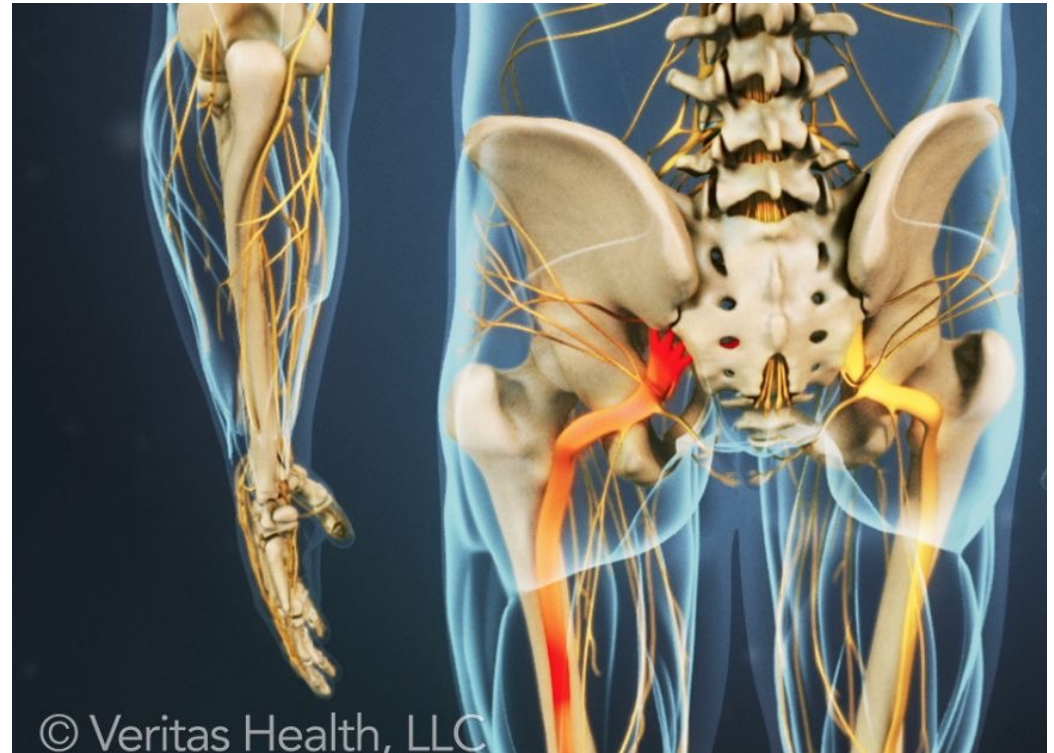
# “Sciatica”: Symptoms

- **Pain**
  - Burning or shooting pain starting in the low back or buttock and radiating down the front or back of the thigh and leg and/or feet
- **Numbness**
  - Sometimes associated with tingling and/or weakness
- **Unilateral symptoms**
  - Typically affects one leg
  - Rarely, both legs may be affected



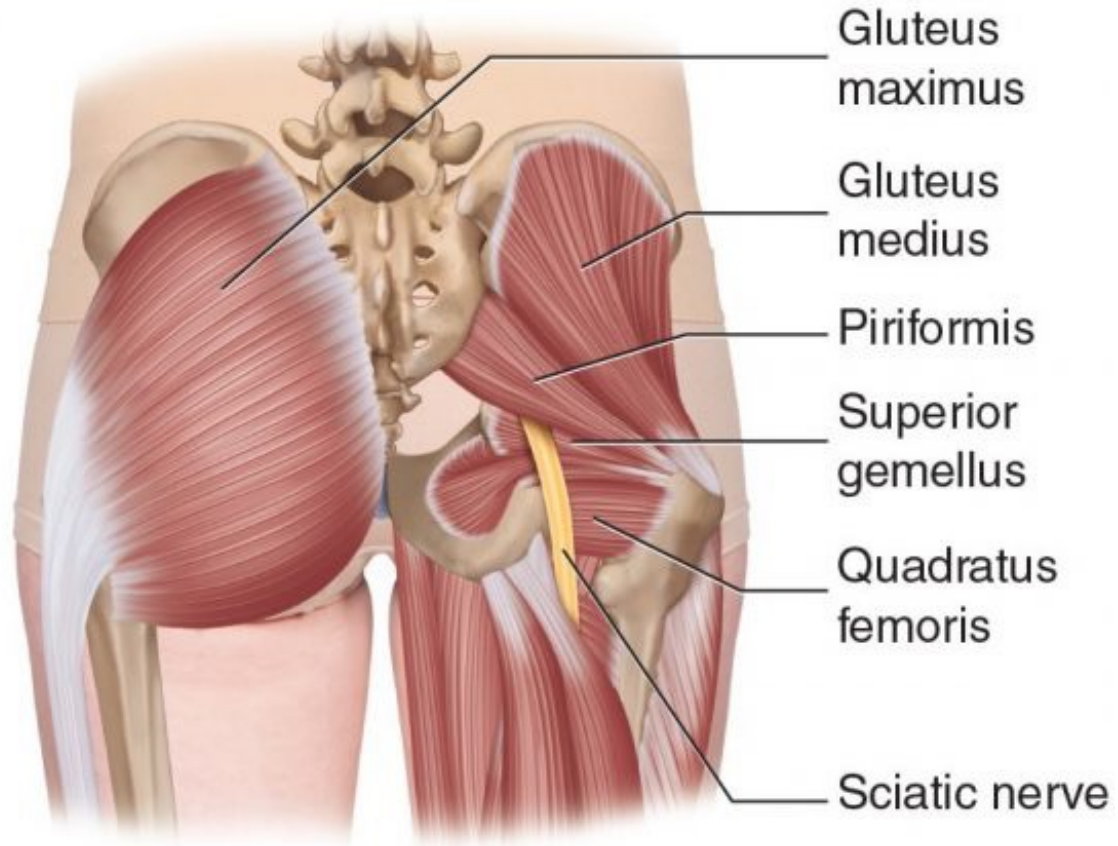
# “Sciatica”: Etiologies

- Piriformis syndrome
- Spinal Stenosis
- Herniated disc
- Spondylolisthesis
- Tumor (Neoplasm)
- Infection



# Piriformis Syndrome

- Muscle that runs above the sciatic nerve
- When the muscle becomes tight: “sciatica” type pain down the leg
- Due to prolonged sitting, car accidents, falls





# Spinal Stenosis

- Normal progression of aging
- Most people do **not** develop symptoms
- Most people do **not** require surgery
- Physical exam is often **normal**
- Weakness and numbness are **not** typical



# Spinal Stenosis: Classic Presentation

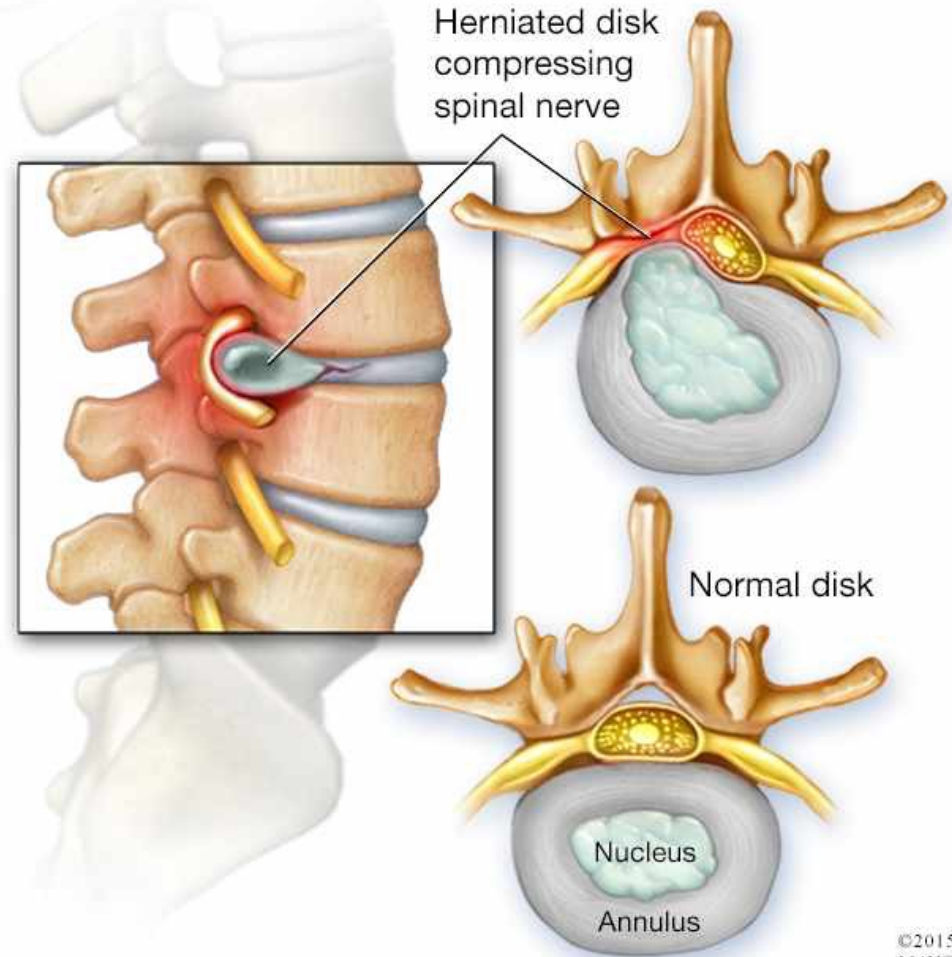
- Buttock and leg pain when walking or standing
- Relieved by sitting or bending over

aka: “grocery cart sign”



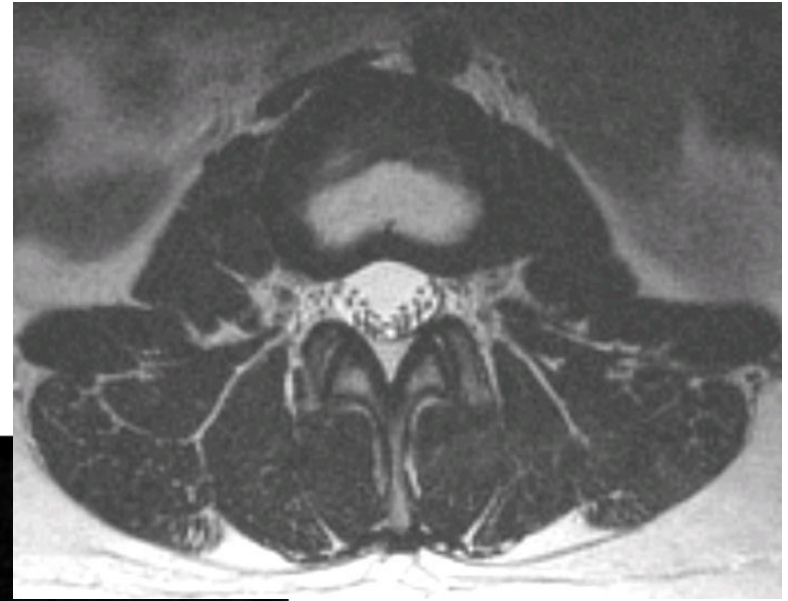
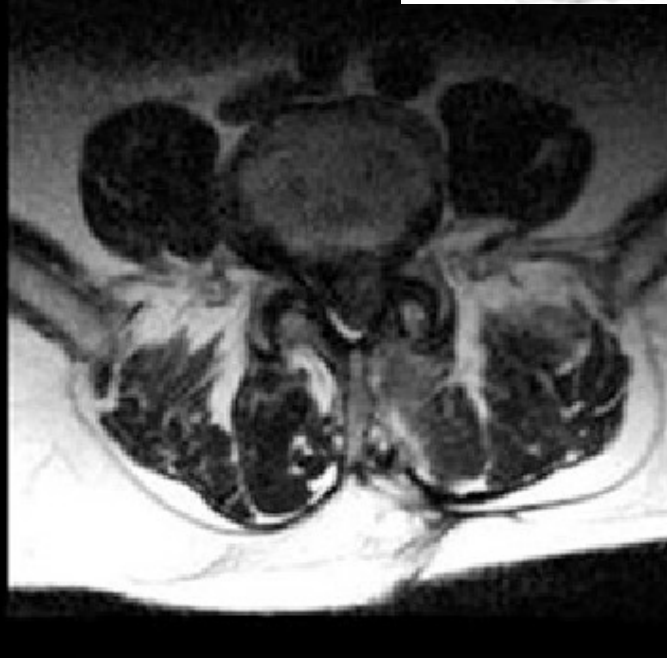
# Disc Herniation

- Disc degenerates due to loss of elasticity and/or injury over time
- The disc can bulge/herniate into the spinal canal and compress the spinal nerve roots
- Severe compression may lead to permanent nerve damage



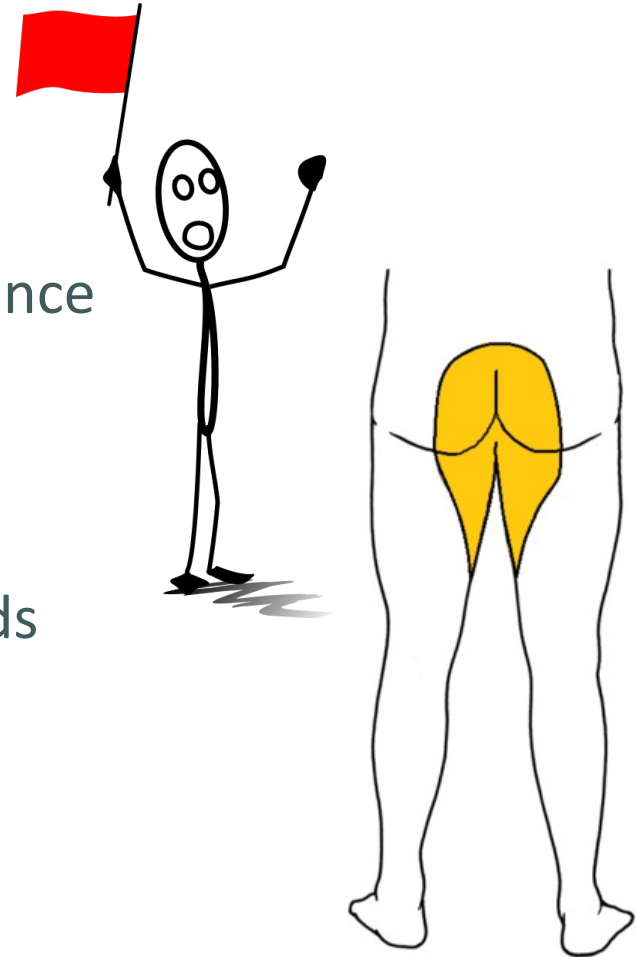


# Disc Herniation: MRI



# Back Pain: Red Flags

- Symptoms:
  - saddle anesthesia
  - bladder or bowel retention/incontinence
  - unexplained weight loss
- History of:
  - cancer, IV drug use, prolonged steroids use, diabetes, HIV
- Recent/ongoing fever/infection:
  - UTI, respiratory, etc.



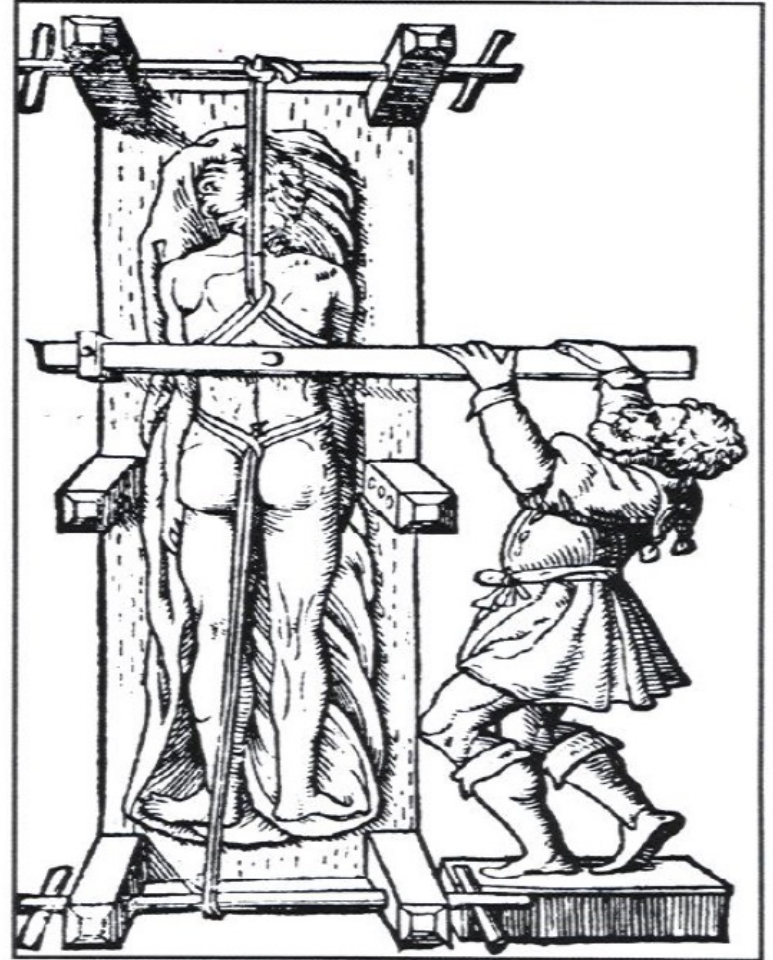
# Treatment Options

## Non-Operative Treatments

- Medications
- Physical therapy (PT)
- Injections

## Operative Treatments

- “Open” traditional surgery
- Minimally invasive surgery (MIS)



# Non-Operative Treatment

## Self-Care / Lifestyle Modification

- Maintain activity as tolerated
- **If** bedrest is necessary, return to normal activities ASAP

## Bed mattress choice

- A medium-firm may be preferred choice
  - randomized trial: 82% experienced improvement in pain-related disability at 90 days vs. 62% assigned to firm mattress

## Spinal support / bracing

- Routine use *not* recommended

# Be Cautious





# Non-Operative Treatment - Medications

## Medications for chronic or subacute low back pain

Drug	Net benefit*	Graded recommendation§	Comments
Acetaminophen	Small	Suggested as first-line therapy• (2B)	Asymptomatic elevations of liver function tests at therapeutic doses.
Antidepressants	Small	Suggested as adjunctive therapy (2B)	Only tricyclic antidepressants have been shown effective for low back pain. No evidence on duloxetine or venlafaxine.
Antiepileptic drugs	Unable to estimate	Suggest not using (2B)	Gabapentin and topiramate evaluated in short-term trials, primarily in patients with radiculopathy.
Non-steroidal anti-inflammatory drugs	Moderate	Suggested as first-line therapy (2B)	May cause serious gastrointestinal and cardiovascular adverse events. Insufficient evidence to judge benefits and harms of aspirin or celecoxib for low back pain.
Opioids	Unable to estimate	Suggest not using as first-line therapy (2B)	No reliable data on risks of abuse or addiction
Skeletal muscle relaxants and benzodiazepines	Unable to estimate	Suggest not using (2C)	The two higher-quality trials evaluated skeletal muscle relaxants not available in the US.

# Non-Operative Treatment - Opioids

- Opioid medications compared with placebo or non-opioid analgesics do **not** significantly reduce pain \*
- Suggested for chronic back pain **only** and for **short-term** use
- **Rarely**, for severely disabled who do not respond to other measures

\*Martell et al, Ann Intern Med 2007

# Non-Operative Treatment - Physical Therapy





# Non-Operative Treatment - Physical Therapy

## Non-pharmacologic therapies for chronic or subacute low back pain

Intervention	Net benefit*	Graded recommendation§	Comments
Acupuncture	Moderate	Suggested (2B)	Efficacy of acupuncture versus sham acupuncture inconsistent.
Exercise therapy	Moderate	Suggested (2B)	
Functional restoration	Moderate	Suggested (2B)	
Interdisciplinary rehabilitation	Moderate	Suggested (2B)	More intense interdisciplinary rehabilitation more effective than less intense interdisciplinary rehabilitation.
Interferential therapy	Unable to estimate	Suggest not using (2B)	
Low-level laser therapy	Unable to estimate	Suggest not using (2B)	Trials evaluated different types and intensity of laser, with inconsistent findings.
Lumbar supports	Unable to estimate	Suggest not using (2C)	
Massage therapy	Moderate	Suggested (2B)	Some trials evaluated minimal or light massage techniques.
Percutaneous electrical nerve stimulation	Unable to estimate	Suggest not using (2B)	
Psychological therapies	Moderate (cognitive-behavioral treatment)	Suggest cognitive-behavioral treatment (2B)	
Short-wave diathermy	Not effective	Suggest not using (2B)	
Spinal manipulation	Moderate	Suggested (2B)	
Traction	Not effective (for continuous traction)	Suggest not using (2B)	
Transcutaneous electrical nerve stimulation (TENS)	Unable to estimate	Suggest not using (2B)	
Ultrasound	Unable to estimate	Suggest not using (2B)	
Yoga	Moderate (for Viniyoga)	Suggested (2B)	Insufficient evidence to judge non-Viniyoga techniques.

## Exercise Therapy

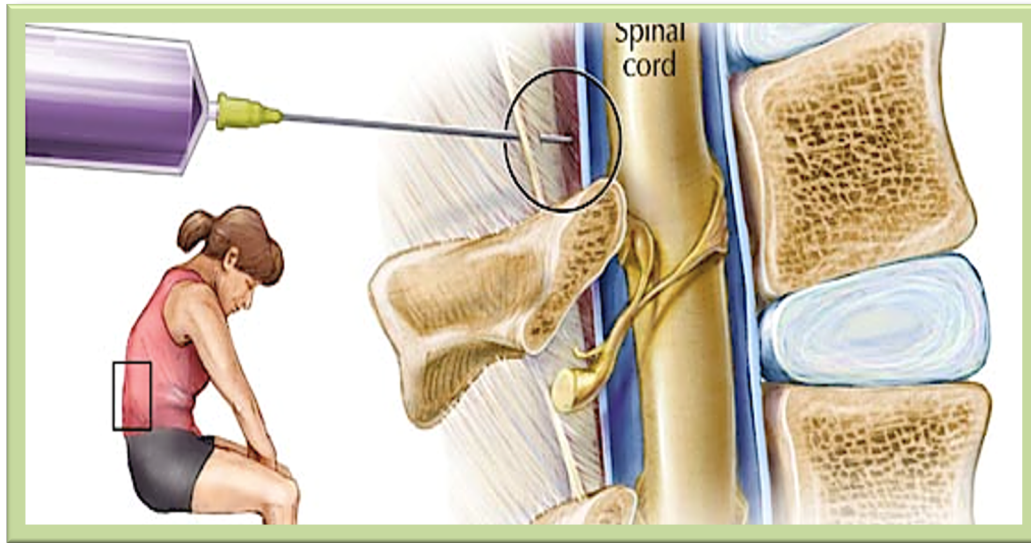
- Core strengthening
- Flexion/extension movements
- General physical fitness

## Spinal Manipulation

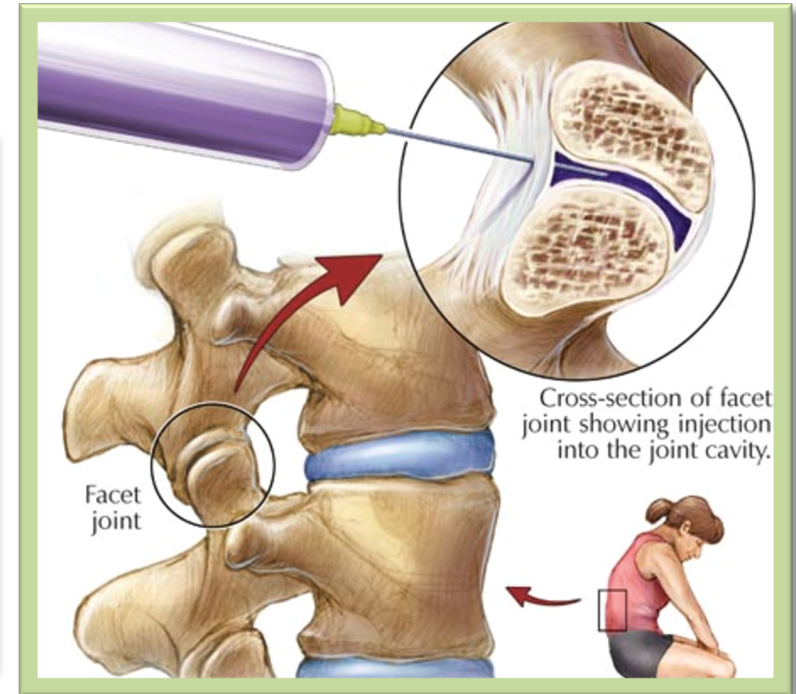
- The risk of serious adverse events (disc herniation) is less than one per one million visits
- Avoid with progressive/severe neurologic deficits

# Non-Operative Treatment – Steroid Injections

Epidural



Facet



# Non-Operative Treatment – Steroid Injections

## What's in a “Steroid Injection”?

- Local Anesthetic
  - Provides an **immediate** effect
  - Usually wears off in a **few hours**
- Steroids
  - Usually starts working in about **2-7 days**
  - Effects can last for **several days to a reasonably long time**

# Non-Operative Treatment – Steroid Injections

## Benefits:

- Reduce inflammation, which in turn should reduce pain
- Decrease in pain should increase function
- Local injections generally well-tolerated
- Less likely to produce serious side effects than other forms of steroid medications
- May help avoid the need for oral steroids, which could have greater side effects
- Don't generally treat the underlying cause of the condition, but they can treat the **symptoms**

# Non-Operative Treatment – Steroid Injections

## Risks:

- In rare instances, the following side effects might occur:
  - Infection
  - Allergic reactions
  - Local bleeding
  - Worsening or prolonged pain
- Excessively frequent, repeated injections can cause the bone, ligaments and tendons to weaken



# Surgery - Timing

- Optimal timing is **not clear**
- No consensus on how long non-operative treatments should be tried
- “Sciatica” usually improves within 3 months in about 75% of patients with non-operative treatment
- Study comparing surgery vs. prolonged non-operative treatment for sciatica (Peul et al, NEMJ 2007)
  - Advantage of early surgery is faster relief of pain and faster perceived recovery time

# Surgery - Indications

## Absolute

- “Cauda equina” syndrome
- Progressive or severe motor deficit

## Relative

- Failure of adequate response to non-operative treatments
- Severe, intractable pain

# Surgical Options

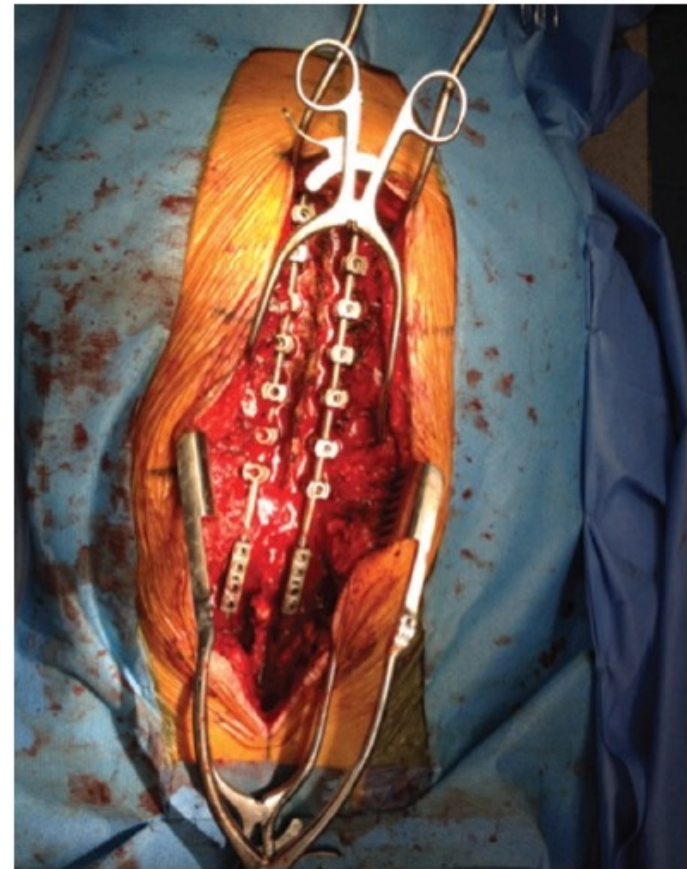
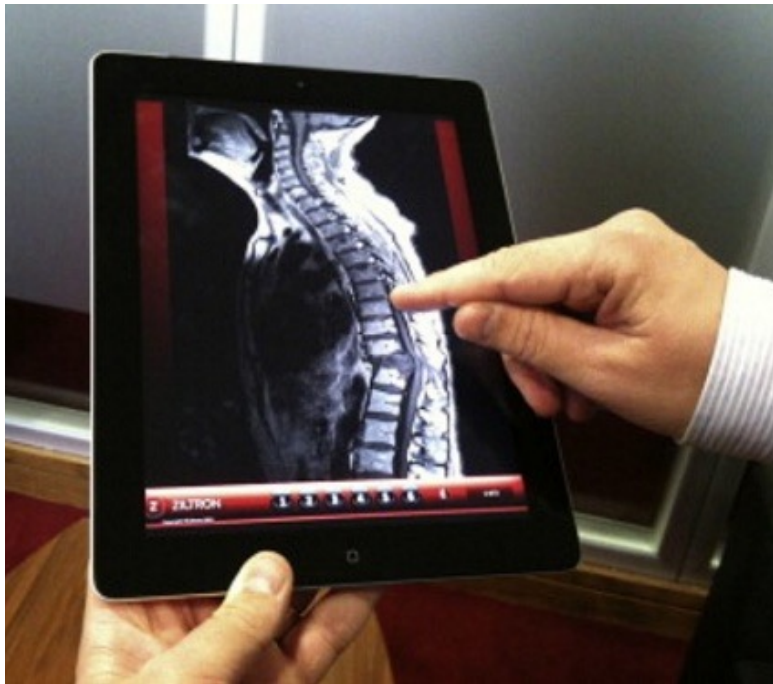
# Surgical (R)evolution: Remote Past

Cut  See



# Surgical (R)evolution: Recent Past

See  Cut





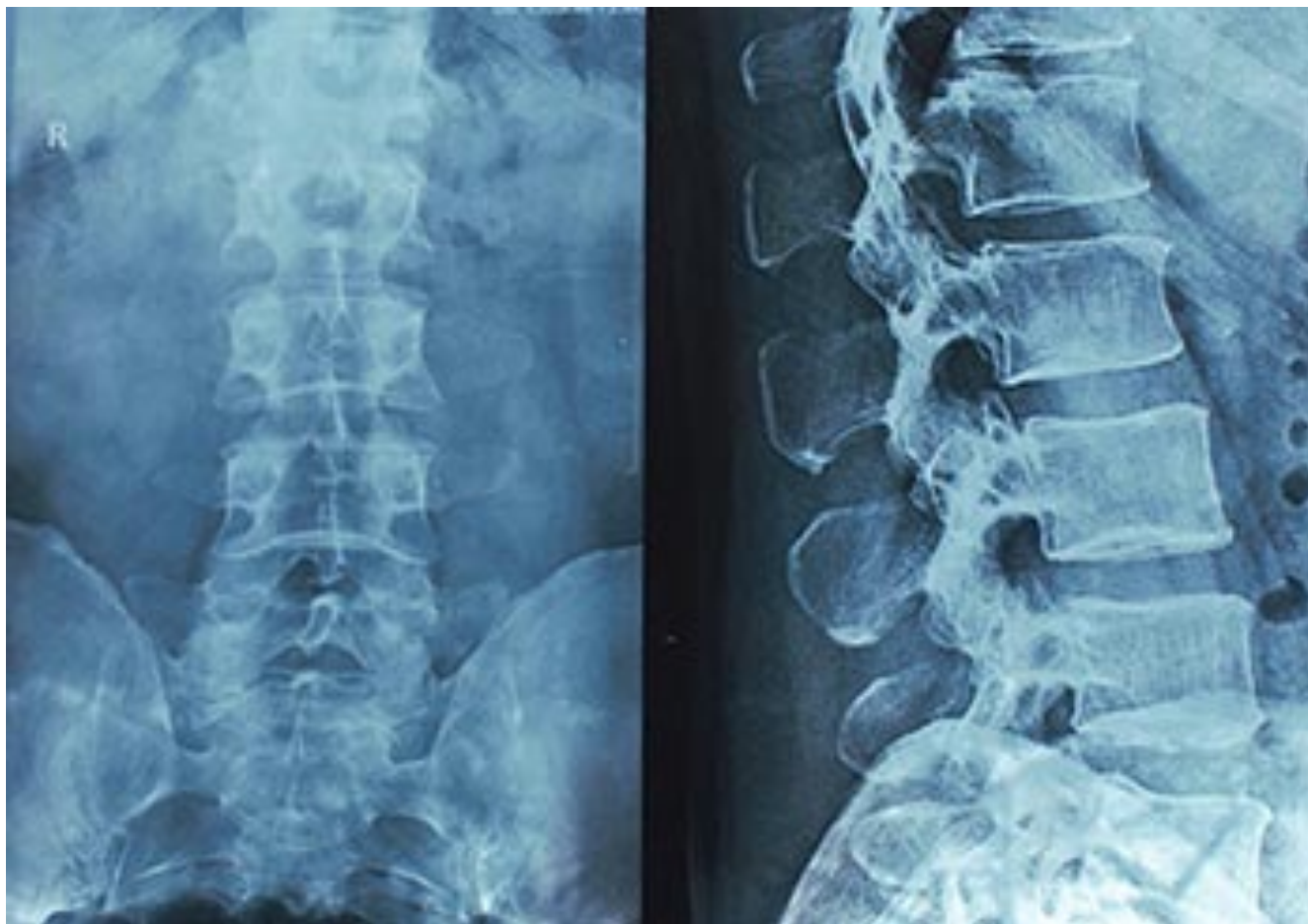
# Surgical (R)evolution: Present



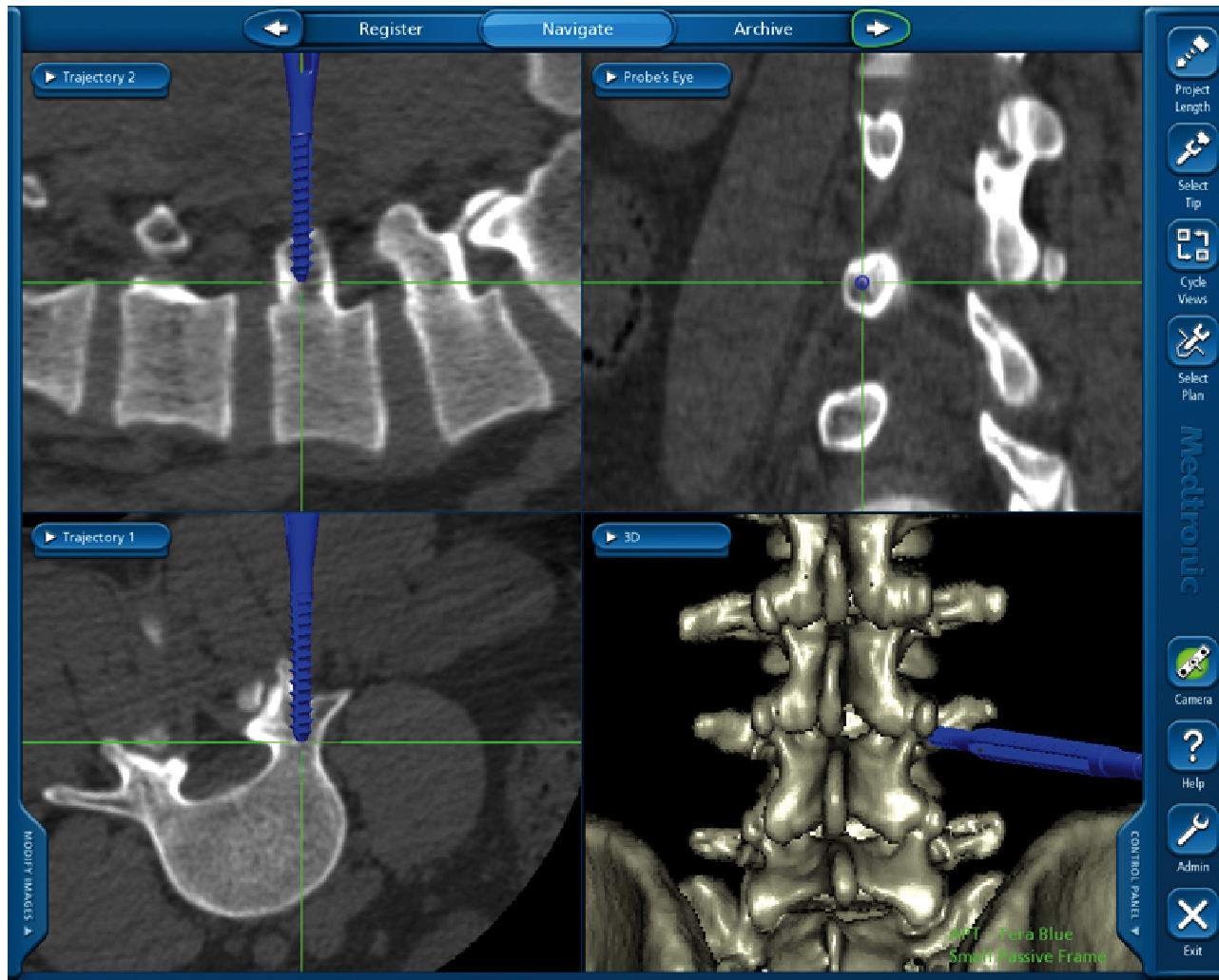
# Intraoperative Image Guidance and Robotic Surgery



# Intraoperative Imaging: Past



# Intraoperative Imaging: Present





# Mazor™ Robotic Guidance

- First 5.0 cases

Dr. Poulter – Indianapolis, IN



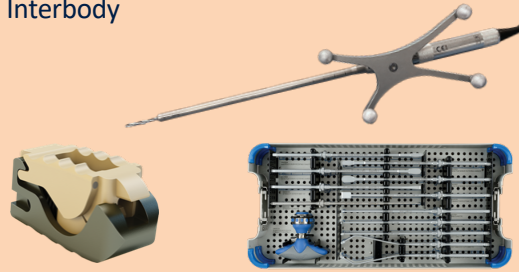
OLIF360 Single-Position Surgery with Midas Rex™ Mazor™, Lateral Disc Prep, and non-navigated Pivox™ Interbody



Dr. Shafa – Minneapolis, MN



TLIF with Midas Rex™ Mazor™ and Elevate™ Interbody



Dr. Rajpal – Boulder, CO



TLIF with Midas Rex™ Mazor™, Stealth-Midas™ Drill, and Capstone™ Interbody





# Mazor™ Robotic Guidance

- Planning



# Instrumentation



Drill

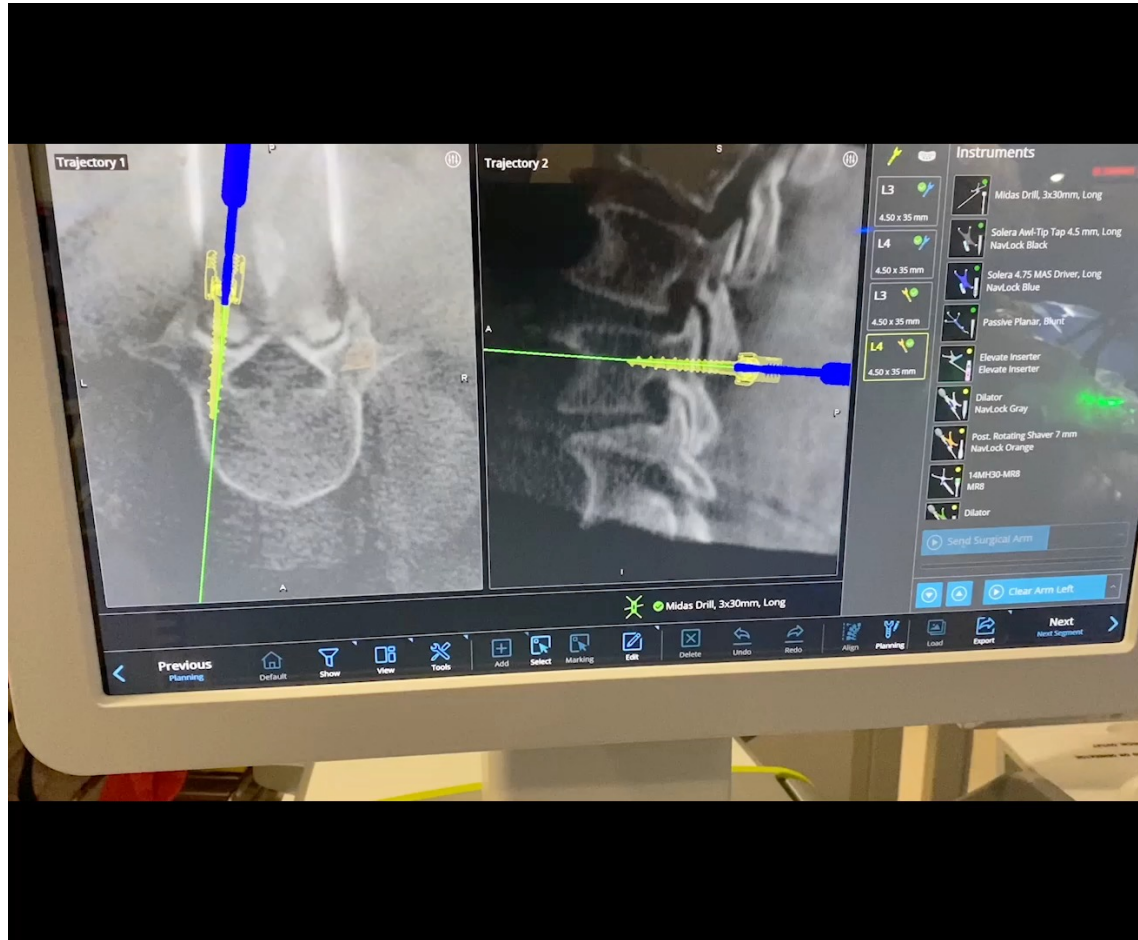


Tap



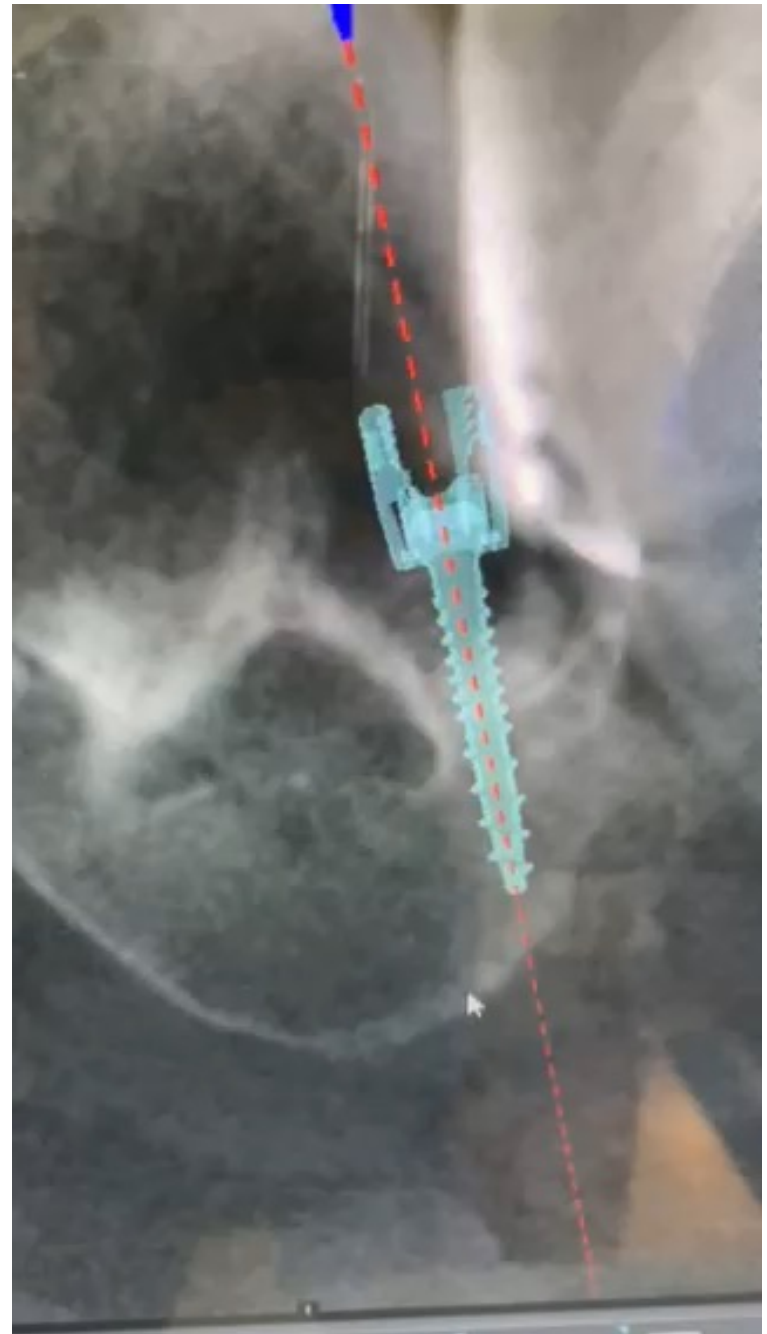
Screw

# Drill





# Instrumentation



# Computer (& Robot) Assisted Surgery

## Allows

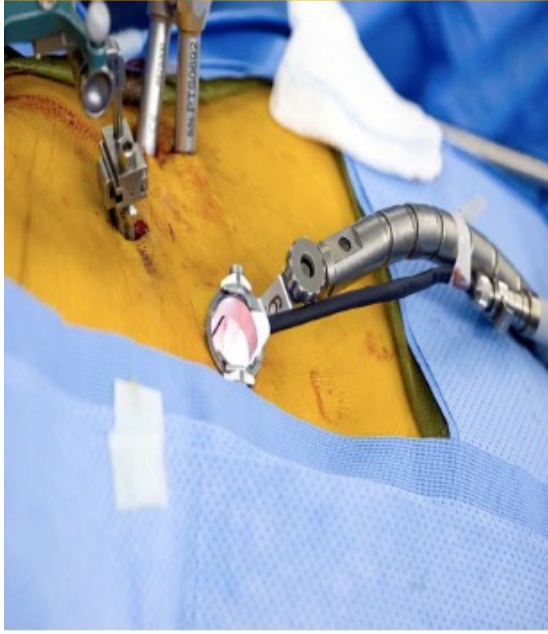
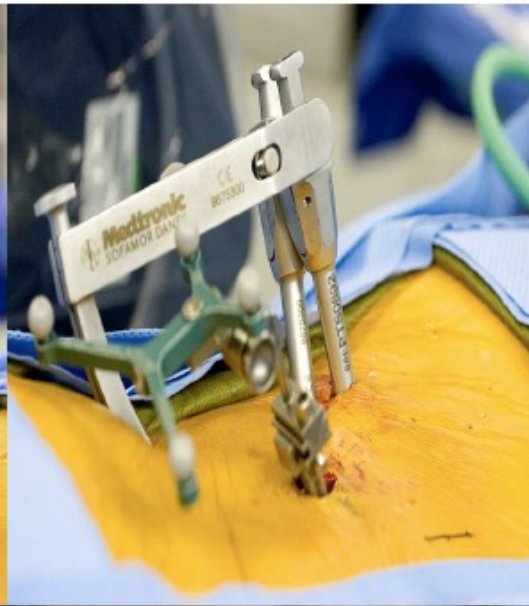
- 3-D visualization and reconstruction
- Real time anatomy and feedback / integration
- Preoperative planning with intraoperative execution
- Predictability
- Greater surgical accuracy
- Minimally Invasive Surgery (MIS)
  - smaller incision
  - muscle splitting instead of muscle cutting



# Computer (& Robot) Assisted Surgery

## MIS Compared to Open Procedures

- Decreased length of stay in the hospital
- Decreased risk of infection
- Decreased blood loss
- Less tissue damage
  - Faster return to work and activities
- Decreased pain



# What Surgery is Right for You?

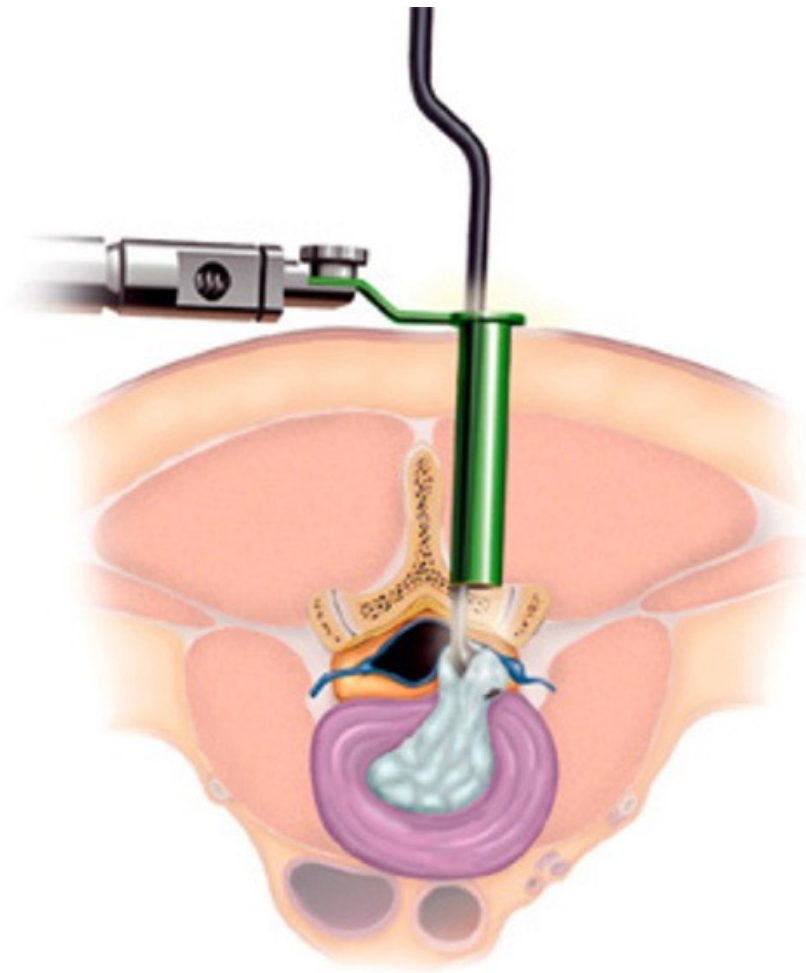
Depends on a number of factors:

- Cause of symptoms
  - fracture, scoliosis, disc herniation, tumor, infection
- Presenting symptoms
  - any neurologic deficits present?
- Age / Overall Health
  - Osteoporosis, heart and lung conditions

## Treatment Goal

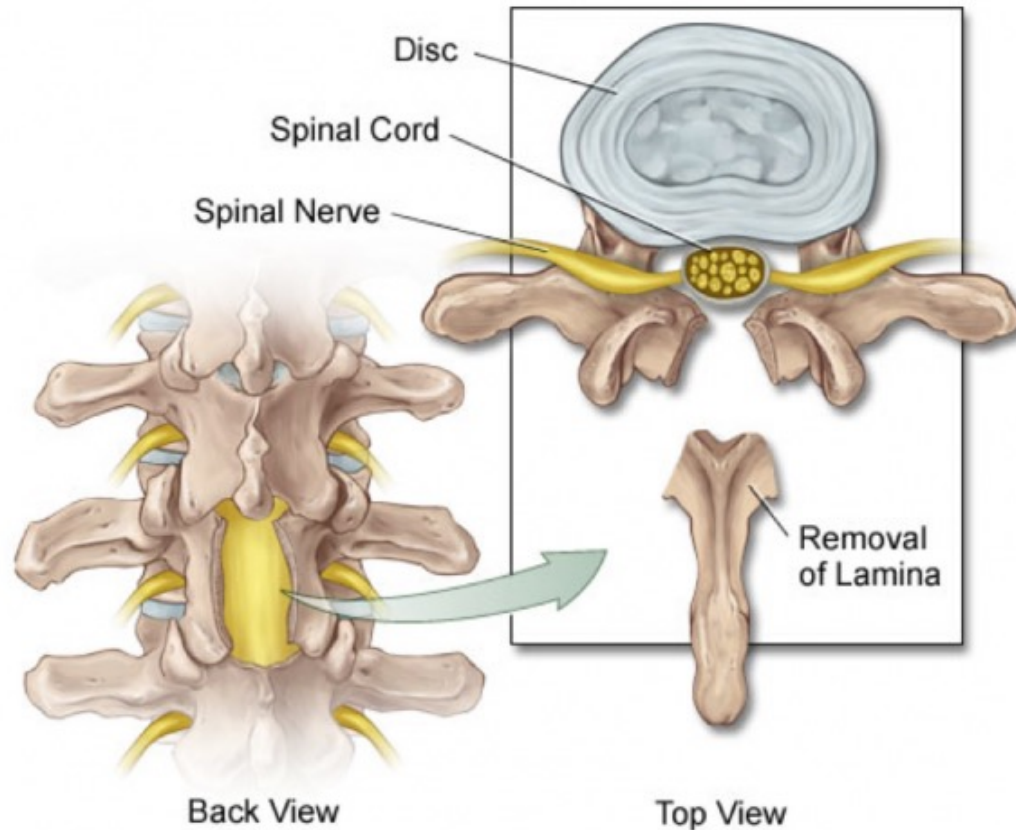
- **Mutual decision between your doctor and you**

# Types of Surgeries



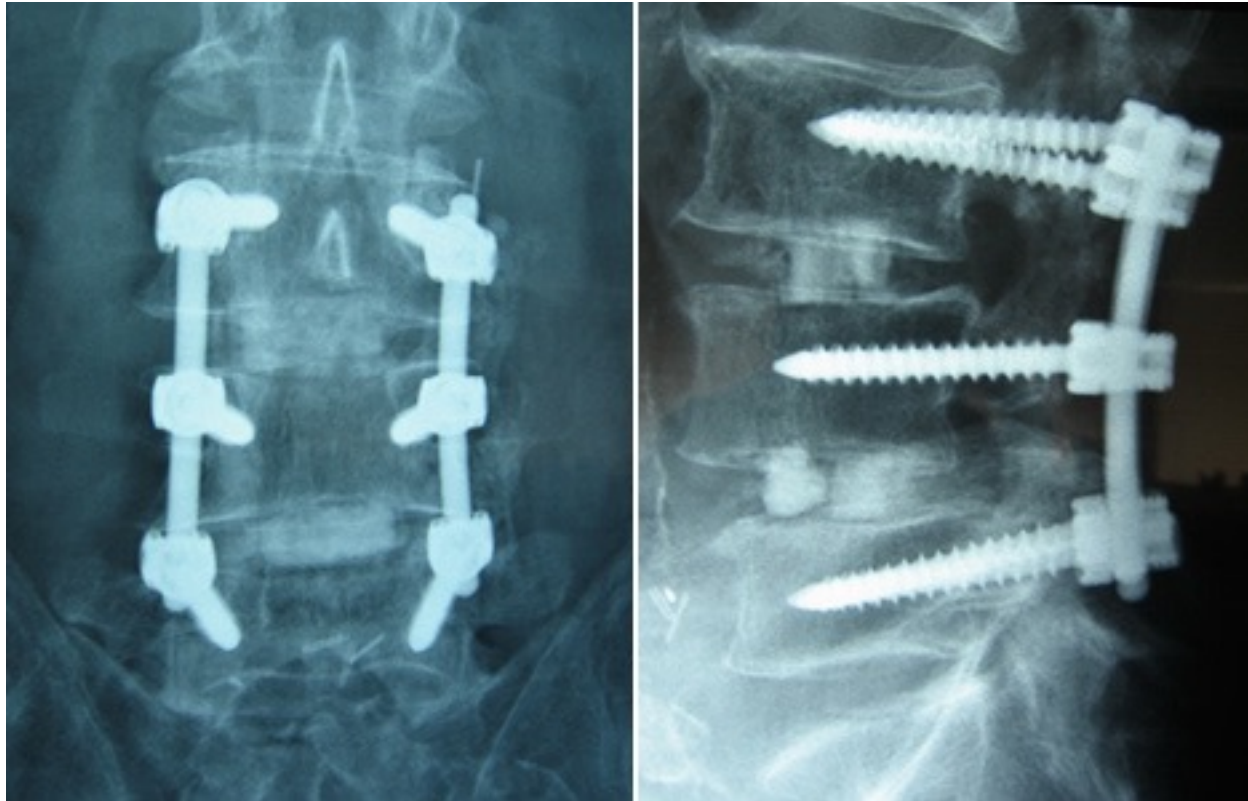
# Types of Surgeries

## Lumbar Laminectomy





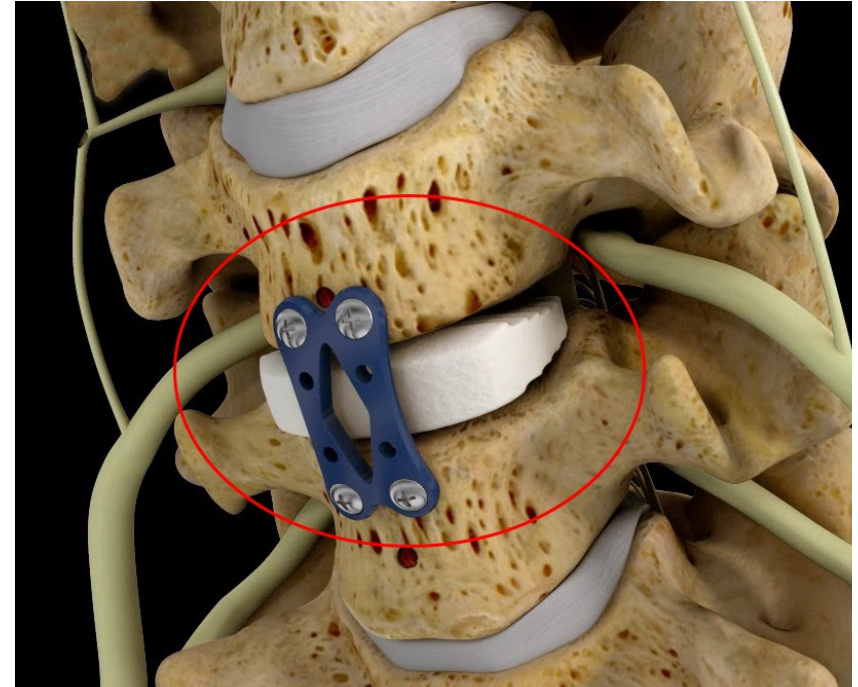
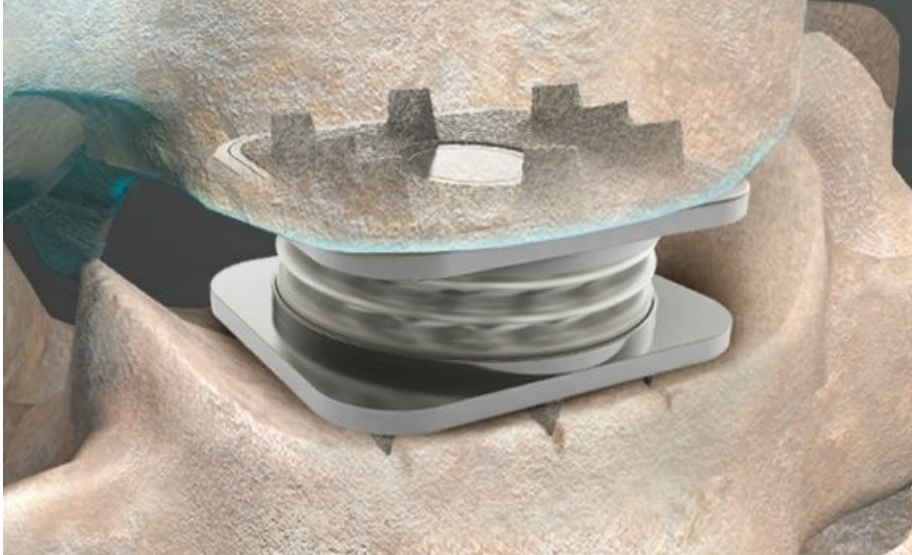
# Types of Surgeries



# Types of Surgeries



# Types of Surgeries



# Our (My) Role

- **Navigate** the patient (you) through the process
- **Help** you make the **right** treatment decision
- **Improve** your pain and condition

## Get Your Life Back!

# Thank You!

# Questions?





# Latest Treatments for Back Pain

Sharad Rajpal, MD

Boulder Neurosurgical & Spine Associates

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