Return to Play Following Spine Injuries and Surgeries

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Learning Objectives

At the end of this session, participants will be able to:

- Recognize and Differentiate Key Spine Pathologies in Athletes
- Apply Evidence-Informed Return-to-Play Criteria
- Implement a Risk-Stratified, Shared Decision-Making Framework

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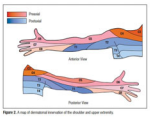
Outline

- Introduction to the topic
- **Review of cervical and lumbar radiculopathy**
- Cervical spine injuries
- Lumbar spine injuries
- **Summary of urgencies/emergencies**
- **Overview of physical exam**



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Neck and back injuries affect all ”athletes”

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Even our beloved Seahawks

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Some Red Flags

- If notice that reflexes appear to be **hyper-**reflexive
- And a recent history of:
  - Gait instability (loss of coordination, frequent falls, tripping)
  - Problems with hand dexterity (difficulty buttoning buttons, handling change, tying shoelaces)
  - Numbness and tingling in hands and/or feet

Consider cervical **myelopathy (spinal cord compression)** --- *a bit more urgent!*

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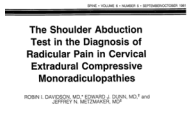
Differentiating shoulder weakness from C5 palsy -> Can be difficult!

Good place to discuss **shoulder abduction test**



The Shoulder Abduction Test in the Diagnosis of Radicular Pain in Cervical Extradural Compressive Monoradiculopathies

Distance from C5 to coracoid process is reduced by shoulder abduction

Less stretch on nerve

With rotator cuff pathology pain would increase with abduction

Improved pain -> **cervical** spine pathology

Worse pain -> shoulder/rotator cuff pathology

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CERVICAL SPINE INJURIES

Cervical strain
Stinger (Burner's syndrome)
Congenital stenosis
Herniated disc
Transient quadriplegia
~~Spear Tacklers spine~~
~~Fractures/Dislocations~~
~~Injuries to the posterior tension band (flexion-compression)~~
~~Injuries to the anterior tension band (distraction-extension)~~

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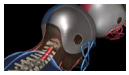
Cervical Spine Injuries



- In the United States, **American football, wrestling, and gymnastics** are the most common sports in which cervical spine injuries are sustained.
- Cervical spine injuries are the most common injury to the axial skeleton in American football players; however, **<1% of cervical spine injuries result in a cervical spine fracture or a spinal cord injury (SCI).**
- **Wide range** from muscle/ligament strain to spinal cord injury resulting quadriparesis
- ***The incidence of severe injuries have dramatically decreased over the past 2-3 decades across all sporting activities due to rule changes, protective gear, and education***

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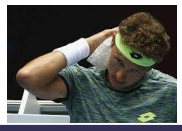
Cervical Strain

- Muscle strains and soft-tissue contusions are the **most common** injuries observed following sporting activity
- **Direct blows** or **rapid eccentric muscle contraction** can cause strains of the muscle.
- Presents with:
  - Localized pain without radiation or neurologic deficit
  - Range of motion limited by pain



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The dreaded … SPINAL CORD INJURY

Approximately **8.7% of all new cases of spinal cord injuries** in the United States are related to **sports activities**. The sports activities that have the highest risk of catastrophic spinal injuries are football, ice hockey, wrestling, diving, skiing, snowboarding, rugby, and cheerleading.

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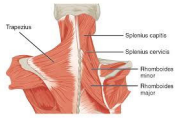
Cervical Strain



- **AP, lateral, and odontoid cervical XRs** should be obtained initially and lateral **flexion/extension** XRs can be used to assess for instability.
- Treatment: **immobilization** and **anti-inflammatories** until pain resolves.
- **Cervical neck collars/braces** can be helpful early on for the first week, but don't provide substantial benefit longer term

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Cervical Strain: Return to play?

This recommendation is fairly uniform.

When **range of motion is painfree**

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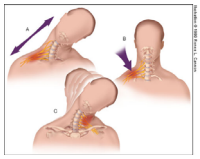
Stinger (Burner's syndrome)

- Sudden **pain +/- paresthesia** in a single extremity that often is nondermatomal and may or may not be associated with **weakness**
- *Transient paralysis with burning sensation that radiates from the shoulder -> fingertips*
- 3 major mechanisms of injury have been proposed:
  - **traction injury** to the **brachial plexus**
  - **direct compression** of the **brachial plexus**
  - compression of the **exiting nerve root** in the neural foramen (Torg-Pavlov ratio <0.8)



Without intervention, **symptoms should resolve in a short amount of time** (within 30 minutes).

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Stinger (Burner's syndrome) – Return to Play?

- Complete **resolution of symptoms** and return of **Full strength** and **full range of motion**

But…

- If **> 3 episodes within a year**; full neurologic workup; do not return to play until cleared
- If other neurologic entities are ruled out, period of **rest** and upper extremity **strength rehabilitation**

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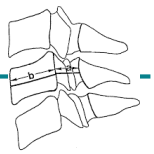
Congenital Stenosis



$$\text{ratio} = \frac{a}{b}$$

- Developmental narrowing (stenosis) cervical canal
- Torg-Pavlov ratio <0.8; canal diameter of < 13mm
- There is much controversy about this radiographic finding.
  - **Higher risk of spinal cord injury** and likely to experience temporary or permanent numbness, weakness, or paralysis if injured.
  - **Not at higher risk for injury, although if injured**, they are at higher risk for permanent neurologic injury, including paralysis and death.

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Congenital Stenosis – Return to Play?

- Often not discovered until after a neck injury
- Most believe that anyone with absolute cervical spine stenosis who has even a transient neurologic deficit or sensory disturbance should seriously consider not participating in contact sports.

- In addition to permanent neurologic injury from SCI, athletes with cervical spinal stenosis also have an increased risk for cervical cord neurapraxia (transient quadriparesis).

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Herniated Disc

- Symptoms vary from radicular pain -> acute onset myelopathy -> transient quadriparesis
- **MRI** is gold-standard for diagnosis
- Substantial disagreement exists in the literature with regards to whether surgical or nonsurgical treatment in professional athletes who have a cervical disk herniation leads to an increased return-to-play rate, **no universally accepted treatment for isolated radicular symptoms**.
- Generally, conservative mgmt is first line for radiculopathy

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It is important to remember…

The prevalence of cervical disk herniation in the asymptomatic population is variable but may be 25% for those younger than 40 years and 60% for those older than 40 years.

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Herniated Disc – Return to Play

- Asymptomatic: okay to return to play
- In all guidelines, symptomatic disk herniation remains an absolute contraindication to athletic participation.
- If underwent discectomy and fusion (ACDF): **solid fusion**, full neck **range of motion**, and a **normal neurologic examination**
- 2-level ACDF: relative contraindication
- 3-level ACDF: absolute contraindication

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Transient Quadriplegia

- Pain, burning, tingling bilaterally (local compression/contusion of the spinal cord)
- Upper and/or lower extremities with variable motor deficits; can affect breathing
- Brief compression of the cord creates a 'postconcussive' effect on the cord
- Those with cervical stenosis may be predisposed to transient quadriplegia.
- Symptoms are temporary with complete recovery usually occurring within15 minutes, but in some recovery may take up to 48 hours

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Transient Quadriplegia – Return to Play

Complicated…

Based on pathology

Disc herniation: Per previous slide – Yes (possibly)

Congenital/Degenerative stenosis: NO!

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How to manage if they show up in clinic?

- Neck pain
- Radicular
- Myelopathic

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Neck pain

Most likely soft-tissue related: ***Cervical strain***

- **AP, lateral, and odontoid cervical XRs** should be obtained initially and lateral **flexion/extension** XRs can be used to assess for instability.
- Treatment: **immobilization** and **anti-inflammatories** until pain resolves.
- **Cervical neck collars/braces** can be helpful early on for the first week, but don't provide substantial benefit longer term

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Radicular

- 1st line: NSAIDs, steroid Medrol dose pack, physical therapy
- *Generally recommend against chiropractic care for radiculopathy*
- 2nd line: consider PM&R/physiatry consult for further management
- 2nd line: epidural steroid injection
- If presenting with **motor weakness**, 1st line algorithm can be accelerated and referral to PM&R/physiatry +/- spine surgeon
- Generally will not consider surgery unless: pain/sensory deficits and have failed a course of conservative treatment for > 6 weeks. Potentially consider surgery if motor deficit is present.

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Myelopathic

Common features of clinical presentation

- Gait instability (loss of coordination, frequent falls, tripping)
- Problems with hand dexterity (difficulty buttoning buttons, handling change, tying shoelaces)
- Numbness and tingling in hands and/or feet

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Myelopathic

- **History**
  - Worsening problems with balance
  - Difficulty using hands (feeling clumsy)
- **Physical Exam**
  - Difficulty walking a straight line
  - Difficulty with rapid movements of the hands
  - Hyper-active reflexes

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Myelopathic

TREATMENT OPTIONS

Cervical spine MRI →

- Non-operative treatment
  - Observation (only in very mild cases)
- Operative treatment
  - Only way to take pressure off the spinal cord is with surgery
  - There are MANY different ways to do this

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Cervical Surgery – Return to Play Summary

- **1- to 2-level ACDF:** RTP permitted with solid fusion, full painfree ROM, and normal neuro exam (typically 3–6 mo). 1-level: well supported in contact athletes (~73–80% RTP). 2-level: relative contraindication in collision sports (shared decision-making).
- **1- to 2-level CDR:** Limited but emerging data; preserves motion and avoids fusion-related ASD risk. RTP with full painfree ROM and normal neuro exam (~3 mo). Generally avoid contact sports until further long-term data – remains controversial. NHL/Rugby/MMA -> 3-6 months.
- **Posterior cervical foraminotomy:** Motion-preserving, no fusion required. Earliest and highest RTP rates of any cervical procedure (often 6–8 wk). Favorable for athletes with foraminal stenosis or posterolateral soft disc herniation.
- **Posterior cervical fusion (multilevel):** Absolute contraindication to collision/contact sports. May return to non-contact activities once fused with full ROM and normal neuro exam (~6–12 mo).
- **Cervical laminoplasty:** Performed for myelopathy/multilevel stenosis. Strong relative contraindication to contact/collision sports given underlying pathology. Non-contact activities once neurologically stable with full ROM (~6 mo).

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Cervical Surgery RTP – Guiding Principles

- **Three universal criteria before any clearance:** (1) painfree full cervical ROM, (2) normal neurologic exam, (3) radiographic evidence of healing/stability (solid fusion when applicable).
- **Number of levels matters more than the procedure name.** Strongest evidence supports RTP after 1-level procedures. 2-level: relative contraindication in collision sports. 3+ levels of fusion: absolute contraindication for contact/collision athletes.
- **Sport type drives the threshold.** Collision (football, rugby, MMA, hockey) carries the highest scrutiny. Non-contact sports (golf, swimming, tennis) generally have far more permissive timelines and outcomes.
- **Underlying pathology matters as much as the surgery.** Myelopathy, congenital stenosis, cord signal change, or any prior transient quadriparesis carries restrictions independent of how successfully the surgery healed.
- **Shared decision-making is the standard.** No universally accepted RTP guideline exists; recommendations vary by surgeon, sport, and league. Counsel athletes on evidence, residual risk, and reinjury; then decide together.

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LUMBAR SPINE INJURIES

Lumbar strain
DDD
HNP
Cauda Equina
Spondylolysis
~~Fractures~~

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Lumbar strain

- Injury in the lower back where the **ligaments, tendons or muscles** have been over-stretched/pulled.
- Wide range of symptoms:
  - Sudden lower back pain
  - Spasms
  - Sore to deep palpation

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Lumbar strain

Workup
- **History** – most important
- Physical exam
  - *Pain with palpation of muscles / soft tissues*
- Xrays (*questionable*)
  - *To rule out additional injury*
- MRI usually not necessary
  - *If no concerning neurologic symptoms*

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Lumbar strain

Treatment
- Rest/Short period of immobilization
- **want to be active & avoid bedrest**
  - Anti-inflammatories (ibuprofen, naproxen)
  - Muscle relaxers
  - Ice or heat (whichever feels better)
  - Massage
  - Stretching
  - Physical therapy and regular aerobic exercise

Operative treatment "never" necessary!

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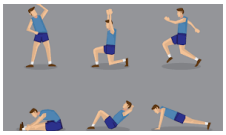
Lumbar strain – Return to Play

Can return to full activities when **symptoms subside** and **full range of motion** is regained



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Degenerative Disc Disease (DDD) – Flare Up

- **Moderate, continuous low back pain.** Pain may spread to the buttocks, groin, and upper thighs. This pain typically feels achy, dull, and can range from mild to severe.
- **Occasional pain flare-ups.** Back pain may intensify for several days or weeks then return to a more moderate level. Flare-ups happen as the disc continues to degenerate and the spine gradually stabilizes.
- **Local tenderness.** Local soreness is caused by inflammation and muscle tension surrounding the degenerated disc.
- **Leg pain.** Neurological symptoms including numbness, weakness, or sharp, shooting pains in the buttocks, hips, and/or back of the leg may be felt if the disc space collapses enough to pinch a nerve root exiting the spine.
- **Giving out symptoms.** A feeling of sudden weakness or instability can happen as the disc becomes weaker, creating a sensation that the low back will "give out" with sudden movements.

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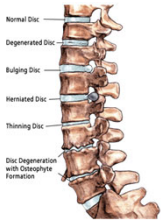
Degenerative Disc Disease

- Complex interplay between **environmental** and **genetic** factors
- **Decrease in nutrient supply**
  - Negatively impacts the disc maintaining the ECM
  - Limits ability of the disc to respond to load or injury
- **Genetic** Factors
  - Twin studies show that up to 70% of DDD linked to genetics
  - Polymorphisms affect genes which contribute to IVD structure, catabolic pathways and pro-inflammatory pathways
- **Environmental** Factors
  - **Obesity**: BMI>25 risks factor for radiographic DDD at young age
  - **Cigarettes:** Decreased blood flow at the vertebral endplate, activation of muscarinic receptors located at the endplate, twin studies show powerful negative effect of cigs



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Degenerative Disc Disease

- History and Physical exam may be vague
  - Ultimately, ruling out other etiologies of symptoms
- **X-rays:** These can show a decrease in disc height or bone spurs (osteophytes), rule out other osseous pathology
- **MRI:** generally confirms disc degeneration ("black disc" on T2); assess for neurologic involvement
- **CT:** not indicated, unless unable to obtain MRI (if necessary)

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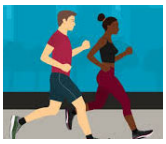
Degenerative Disc Disease

Essentially all non-operative!
Physical Therapy
Medications: NSAIDs, muscle relaxants
Lifestyle modification
- Smoking Cessation
- Weight loss

CBT
Yoga?
Alternative Pain Medications
- CBD?



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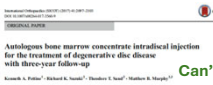
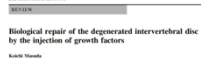
Degenerative Disc Disease


Autologous bone marrow concentrate intradiscal injection for the treatment of degenerative disc disease with three-year follow-up


Review Article
Stem Cell Therapy for Degenerative Disc Disease


Biological repair of the degenerated intervertebral disc by the injection of growth factors

Can't we just re-grow the disc?

Humans: NO!
Animals: ??


The Spine Journal
Intradiscal injection of simvastatin results in radiologic, histologic, and genetic evidence of disc regeneration in a rat model of degenerative disc disease


Platelet-rich plasma effects on degenerative disc disease: analysis of histology and imaging in an animal model


Intradiscal Injection of Hematopoietic Stem Cells in an Attempt to Rejuvenate the Intervertebral Discs

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Degenerative Disc Disease – Return to Play

Can return to full activities when **symptoms subside** and **full range of motion** is regained.

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Herniated Disc

General Symptoms:
- Back pain (discogenic vs. degenerative)
- Referred buttock pain
- Leg pain (often unilateral)
- Pain **worsened w/ flexion**
- Weakness
- Bladder disturbances
  - recurrent UTI present in up to 10% due to autonomic sphincter dysfunction

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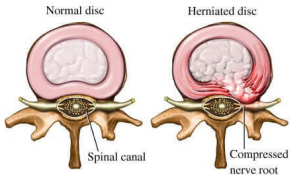
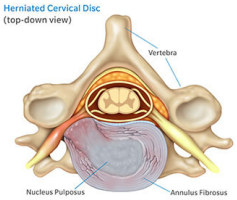
Herniated Disc





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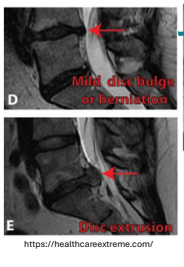
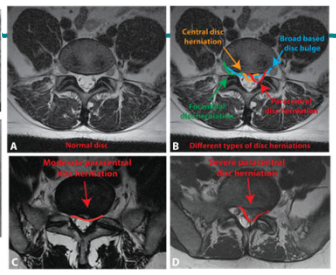
Herniated disc



https://healthcareextreme.com/



The progressive degeneration of a disc, or traumatic event, can lead to a failure of the annulus to adequately contain the nucleus pulposus

This is known as herniated nucleus pulposus (HNP) or a herniated disc

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Herniated disc

- **Back flexion vs. Extension** (Kemp test)
  - Herniated disc: worse back pain and radicular symptoms in flexion
  - Degenerative stenosis: worse back pain and radicular symptoms in extension
- **Straight leg raise** (tension sign) – seated or supine
  - Herniated disc: may reproduce leg symptoms 30-70 deg of hip flexion
  - Degenerative stenosis: no impact on symptoms
- **Valsalva**
  - Herniated disc: may reproduce leg symptoms
  - Degenerative stenosis: no impact on symptoms

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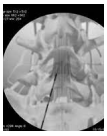
Herniated Disc

1st line: rest, physical therapy, anti-inflammatory medications
- **85%** of lumbar disc herniations improve w/out surgery 6 weeks-3 months
- Medications: NSAIDS, steroid taper pack, +/- muscle relaxer
- Physical Therapy: extension-based exercises, +/- traction, +/- chiropracter

2nd line: steroid injections
- When medications/therapy fails
- I like to wait at least 6 weeks
- Results are incredibly variable



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Herniated Disc

In general, there are 2 forms of surgery:
(can be performed open or with minimally-invasive techniques)

1) Decompression-only
   1) Discectomy/Microdiscectomy
   2) Laminectomy/Laminotomy
2) Decompression + fusion
   1) Indications vary --- but need to correlate symptoms with specific anatomic features (instability, orientation of facet joints, amount of foraminal collapse, etc…)

I want to re-iterate one more time…
BLACK DISCS ARE NOT AN INDICATION FOR SURGERY!!

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Herniated Disc – Return to Play

This varies widely, although most can return to full activities within 6-8 weeks.

If no surgery: similar protocol to previous conditions

If surgery (discectomy): often 6-8 weeks

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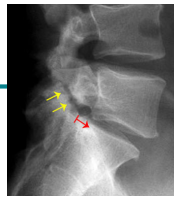
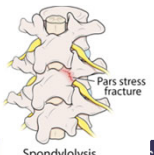
Spondylolysis

Spondylolysis
- Common source of back pain in adolescent population
- Complete **fracture of the pars interarticularis**
- Risk factors and causes vary widely
- Oblique XRs or CT scan helpful
- 15% will progress to *spondylolisthesis*
- Most younger patients improve without surgical intervention
- Surgery: pars repair, fusion





Spondylolysis

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Spondylosis – Return to Play

- For the **conservative treatment** of lumbar spondylolysis, some investigators recommend between **4 and 12 weeks of rest and immobilization**

- At **6–12 months after a pars repair**, return to play at pre-injury level is possible, but after **fusion for spondylolysis and spondylolisthesis there is a less predictable course of returning to contact sports**.

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Lumbar Surgery – Return to Play Summary

- **1- to 2-level lumbar microdiscectomy:** Highest and earliest RTP rates of any lumbar surgery (~75–90% in elite athletes; often **6–12 wk**). Painfree extension, full ROM, normal neuro exam, and core strength restoration are the standard criteria.
- **1- to 2-level lumbar laminectomy:** RTP feasible with painfree ROM, normal neuro exam, and reconditioning (typically **3–6 mo**). Counsel on theoretical instability risk in collision/heavy-axial-load sports; published athlete data are limited.
- **1-level lumbar fusion:** RTP possible after solid fusion, full painfree ROM, and normal neuro exam (typically **6–12 mo**). Lower RTP rates and longer timelines than discectomy. Relative contraindication in collision sports – shared decision-making.
- **2+ level lumbar fusion:** Generally an absolute contraindication to collision/contact and high-axial-load sports. Non-contact recreational activity may be reasonable once fused with full ROM and normal neuro exam (~9–12 mo).
- **Lumbar disc replacement:** Motion-preserving alternative to fusion. Limited athlete data; RTP with full painfree ROM and normal neuro exam (~6 mo). Generally avoid contact/collision sports given device-related and adjacent-segment concerns.

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Lumbar Surgery RTP – Guiding Principles

- **Three universal criteria before clearance:** (1) painfree full lumbar ROM (especially extension), (2) normal neurologic exam, (3) restored core/lumbopelvic strength; plus solid fusion when applicable.
- **Decompression outperforms fusion for RTP.** Microdiscectomy has the strongest and earliest RTP data in elite athletes. Fusion timelines are longer, RTP rates lower, and contact-sport return less predictable; especially with multilevel constructs.
- **Sport demands drive the threshold.** Repetitive axial loading (linemen, weightlifting), torsion (golf, throwing), and collision are the high-scrutiny categories. Non-contact endurance and skill sports generally have permissive timelines.
- **Reherniation and adjacent-segment disease are the dominant risks.** ~5–15% reherniation after microdiscectomy, with most events early. Multilevel fusion shifts risk to ASD, particularly relevant in younger high-demand athletes.
- **Shared decision-making is the standard.** No universal RTP guideline; recommendations vary by surgeon, sport, and league. Counsel on residual risk, reinjury, and career trajectory – then decide together.

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Emergency/Urgency

"I'm having difficulty controlling my bladder"
"I just pooped, and I didn't really notice it"

Cauda Equina Syndrome?

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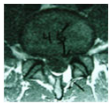
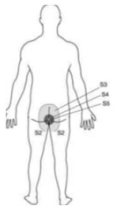
Cauda Equina Syndrome

- Cauda equina syndrome is caused by ***severe compression*** of the nerve roots in the thecal sac of the lumbar spine, most commonly due to an acute lumbar disc herniation
- Presumptive diagnosis is made by characteristic presenting symptoms:
  - saddle-like paresthesias
  - Loss of bladder/bowel function
  - Progressive weakness in the lower extremities
- confirmed with emergent MRI.
- Treatment involves **surgical decompression within 48 hours**





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Cauda Equina Syndrome

Why is it so important to catch this early?

- studies have shown improved outcomes in bowel and bladder function and resolution of motor and sensory deficits when decompression **performed within 48 hours of the onset of symptoms**
- residual bladder deficits may persist despite successful decompression
- bladder function may continue to improve up to 16 months post-op
- motor recovery may continue up to 1 year post-op

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One more time … watch for Cervical Myelopathy

- **"I'm having problems with my balance"**
  - Gait instability (loss of coordination, frequent falls, tripping)
- **"My hands and fingers don't feel like they are working like normal"**
  - Problems with hand dexterity (difficulty buttoning buttons, handling change, tying shoelaces)
- **"I feel numbness/tingling in everywhere"**
  - Numbness and tingling in hands and/or feet

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Cervical Myelopathy

- **History**
  - Worsening problems with balance
  - Difficulty using hands (feeling clumsy)
- **Physical Exam**
  - Difficulty walking a straight line
  - Difficulty with rapid movements of the hands
  - Hyper-active reflexes

Check a **cervical and/or thoracic spine MRI** – assess for spinal cord compression that may be otherwise asymptomatc

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Spine Physical Exam

Overall Plan for Spine Exam:

1) Inspection
2) Palpation
3) Movement
4) Neurologic examination
   - Sensory
   - Motor
   - Reflexes
5) Special Tests

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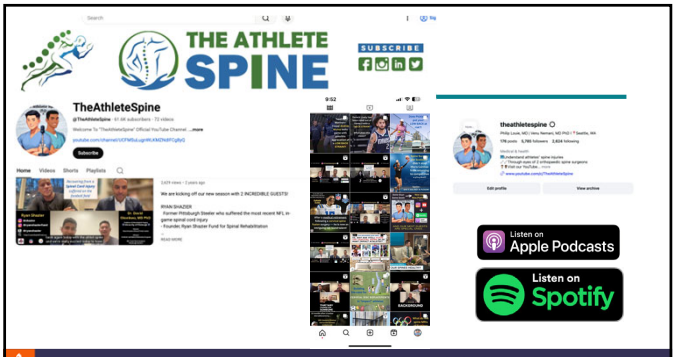

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Thank You!

Questions?

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