Spinal Emergencies

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Disclosure

- I have no financial or other conflicts of interest to disclose

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Learning Objectives

- Briefly review anatomy of the vertebral column and spinal cord
- Categorize spinal emergencies into infectious vs. compressive etiologies
- Utilize cases to differentiate between the presentation and diagnosis of the following spinal emergencies:
  - Vertebral osteomyelitis
  - Epidural abscess
  - Cervical myelopathy
  - Cauda equina syndrome
- Describe the management options for the above spinal disorders

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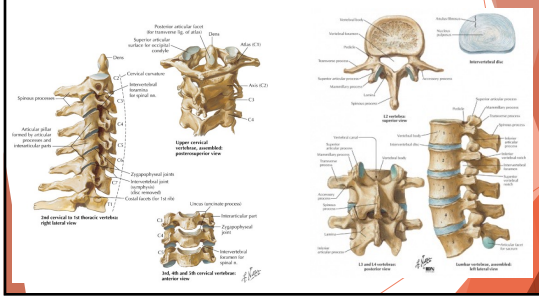
Anatomy – Spinal Column



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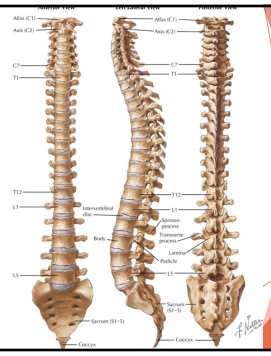
Anatomy – Spinal Column

- 7 cervical vertebrae
- 12 thoracic vertebrae
- 5 lumbar vertebrae
- Sacrum (5 fused vertebrae)
- Coccyx (4 fused vertebrae)



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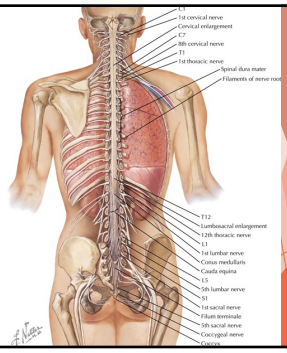
Anatomy – Spinal Cord

- Cord travels caudally from foramen magnum
- Nerve roots exit at each level to provide motor and sensory innervation
- Cord terminates at L1-2 level
- Nerve roots continue distally



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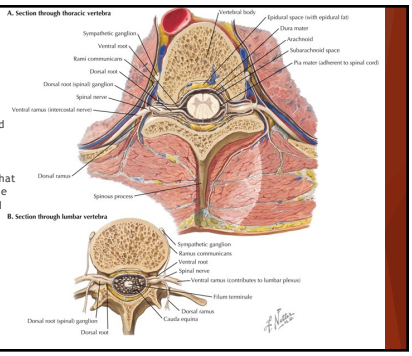
Anatomy – Spinal Cord

- Central canal houses the cord within the dural sac
- Cauda equina - nerve roots that extend from distal cord to the pelvic organs, perineum, and lower extremities



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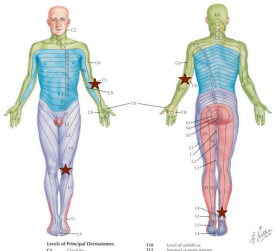
Dermatomes



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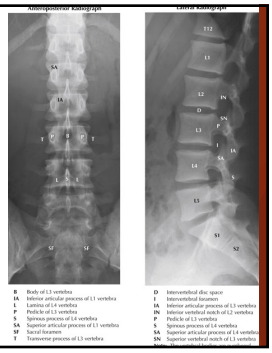
Spinal Imaging - Radiographs



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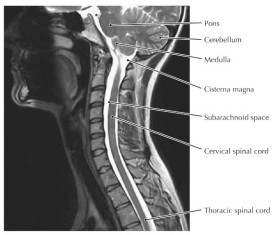
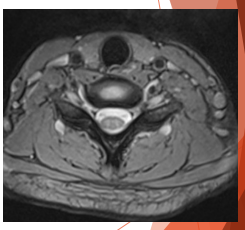
Spinal Imaging – Cervical MRI



A. Sagittal view - Cervical spine



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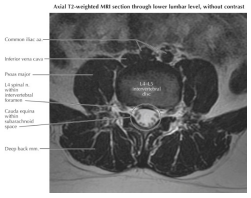
Spinal Imaging – Lumbar MRI

Axial T2-weighted MRI section through lower lumbar level, without contrast



B. Sagittal view - Lumbar spine

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Spinal Emergencies – Categories

- Infectious
  - Vertebral osteomyelitis
  - Epidural abscess
- Compressive
  - Cervical myelopathy
  - Cauda equina syndrome

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Case #1

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Case #1

- "John" is a 69-year-old male with history of longstanding mechanical/ axial low back pain
- He develops right > left lower extremity radicular pain
- Imaging reveals significant lumbar degenerative disc disease, degenerative scoliosis, and foraminal stenosis from L2-S1, but most severe at L2-5

Fig 1

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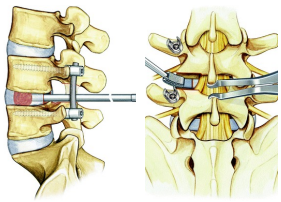
Case #1



- An L2-5 transforaminal lumbar interbody fusion with posterior instrumentation is performed without intraoperative complications
- Post-operative recovery is complicated by intolerance of opioid pain medication

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Case #1

- Patient has a slow recovery and difficulty with activity that is attributed to his poorly controlled pain
- Post-operative x-rays show no acute abnormalities

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Case #1

- At 4 weeks post-op, patient reports worsening midline low back pain
- Now endorses fatigue, night sweats, and feels "feverish"
- By 6 weeks post-op, patient has lost 20 pounds unintentionally

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Case #1

- Additional labs and imaging ordered
- CBC → mild leukocytosis
- ESR, **CRP** → elevated
- Blood cultures → pending
- Radiographs → L5 endplate destruction
- **MRI scan** → bony erosion, vertebral body destruction, abnormal marrow enhancement

Consistent with vertebral osteomyelitis at L4-5

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Case #1 – Vertebral Osteomyelitis

- Inflammation and swelling within the vertebral body, most commonly caused by infection
- Can be insidious and cause slowly progressive but intractable back pain
- Infectious etiology → systemic symptoms
- Plain radiographs can lag behind clinical symptoms
- MRI scan is imaging of choice

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Case #1

- John is taken back to the operating room
  - L4-5 cage is removed
  - Area is debrided
  - Construct is extended to S1 and ilia
- Treatment continued with intravenous antibiotics for at least 6 weeks via PICC

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Case #1 – Vertebral Osteomyelitis (VO)

- VO causes include spinal trauma (iatrogenic or accidental) and hematogenous spread
- Suspicion should be high in patients with longstanding or worsening back pain +/- systemic symptoms
- VO is often insidious in nature, making prompt diagnosis difficult
- Time to diagnosis is typically weeks to months
- Treatment **always** includes IV antibiotics, may include surgery

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Vertebral Osteomyelitis

- Risk:
  - **Age >50**
  - **Spinal trauma or instrumentation**
  - Diabetes
  - Immunosuppression
  - Malnutrition
  - History of IV drug use
- Complications:
  - **Chronic pain**
  - Neurologic sequela
  - **Pseudarthrosis (if applicable)**
  - Death

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Case #2

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Case #2

- "Ben" is a 56-year-old male patient with history of intravenous drug use, clean and sober for 14 years
- Past medical history is positive for:
  - Recurrent MRSA cellulitis
  - Chronic hepatitis C infection, undergoing treatment
  - Type 2 Diabetes, controlled

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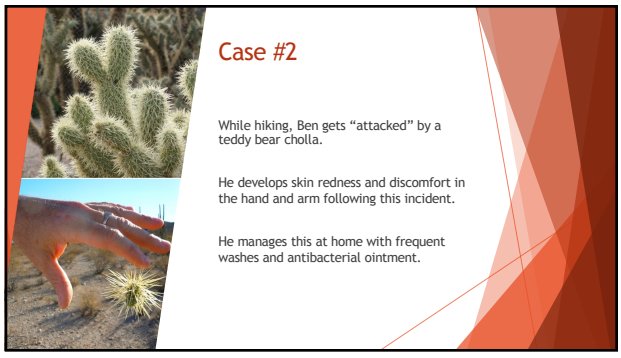
Case #2
While hiking, Ben gets “attacked” by a teddy bear cholla.
He develops skin redness and discomfort in the hand and arm following this incident.
He manages this at home with frequent washes and antibacterial ointment.

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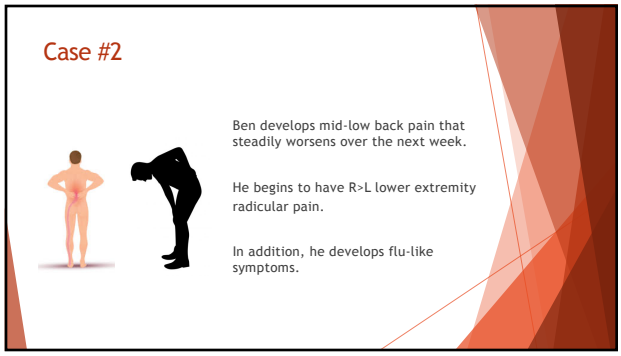
Case #2
Ben develops mid-low back pain that steadily worsens over the next week.
He begins to have R>L lower extremity radicular pain.
In addition, he develops flu-like symptoms.

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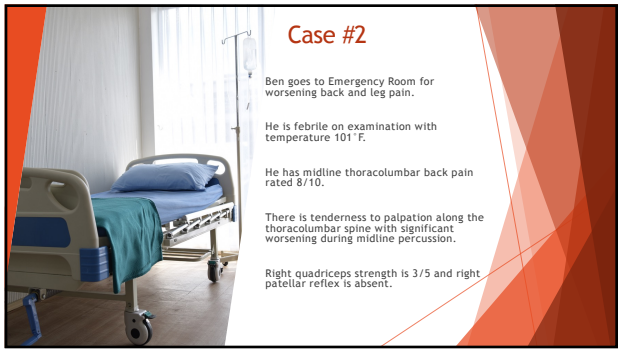
Case #2
Ben goes to Emergency Room for worsening back and leg pain.
He is febrile on examination with temperature 101˚F.
He has midline thoracolumbar back pain rated 8/10.
There is tenderness to palpation along the thoracolumbar spine with significant worsening during midline percussion.
Right quadriceps strength is 3/5 and right patellar reflex is absent.

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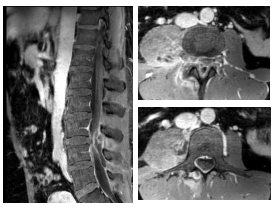
Case #2



Given his PMH and acute onset of severe back pain, lab and imaging studies are ordered:

- CBC → leukocytosis
- ESR, CRP→ elevated
- Plain radiographs → normal
- MRI → epidural fluid collection at L3-4 with central and right-sided foraminal stenosis
- Blood cultures → pending

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Case #2 – Spinal Epidural Abscess

- Collection of infectious fluid above the dura, within the spinal canal
- Causes stenosis or **squeezing** of the cord +/- nerve roots, resulting in new onset back pain and neurologic complaints
- Because this is infectious → systemic symptoms
- Plain radiographs unhelpful; MRI scan is preferred

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Case #2 – Spinal Epidural Abscess (SEA)

Ben is taken to the operating room for surgical treatment:

- Drainage of abscess
- Decompression of spinal foramen and canal
- Culture of the abscess fluid

Additional treatment will include 4-6 weeks of intravenous antibiotics

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Case #2 - Spinal Epidural Abscess (SEA)

- Up to 50% of SEA is caused by hematogenous spread, most commonly from skin/soft tissue infection.
- Subacute presentation may occur from contiguous spread (e.g. neighboring VO)
- Can quickly progress from back pain to radicular pain & weakness, paresis and paralysis.
- Prompt recognition and treatment are necessary to prevent permanent neurologic sequelae.
- Treatment always includes surgical decompression **and** IV antibiotics

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Spinal Epidural Abscess

- Risk:
  - **Age >50**
  - Spinal trauma or instrumentation
  - **Diabetes**
  - **Immunosuppression**
  - Malnutrition
  - **History of IV drug use**
- Complications:
  - Chronic pain
  - **Neurologic sequelae**
  - Pseudarthrosis (if applicable)
  - Death

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Case #3

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Case #3

- "Joanne" is a 65-year-old female patient with history of cervical spondylosis and intermittent, mild neck pain
- She presents to a general orthopedic office for new onset L>R shoulder pain for the last 4 weeks.
- She denies significant neck pain → says she has her "normal" intermittent achy neck pain but this does not bother her much

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Case #3 -

- Bilateral shoulder examination reveals:
  - No visible or palpable bony abnormality
  - No tenderness to palpation
  - Normal range of motion without pain
- Neck examination:
  - Forward head posture
  - Decreased range of motion, most notable in flexion, extension and side bending
  - Consistent with her known diagnosis of cervical spondylosis

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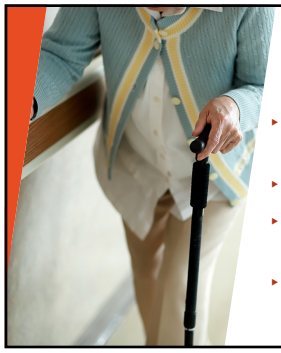

Case #3 -

- The orthopedic PA notes that Joanne's gait is unsteady and she seems unbalanced.
- She is unable to tandem walk.
- She has normal finger-to-nose and heel-to-shin testing, but Romberg is positive.
- Cranial nerves (CN) I-XII are intact.

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Case #3 -

- Further examination shows hyperreflexia throughout upper and lower extremities.
- There is no clonus. Hoffman and Babinski signs are negative.
- Grip strength is 4+/5 bilaterally.
- On further questioning she does admit to dropping things often, decreased fine motor skills (handwriting, knitting) and intermittent numbness in the bilateral hands

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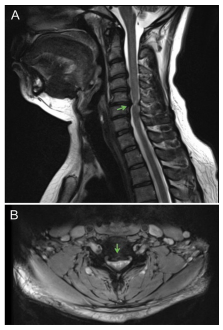

Case #3 -

- Cervical MRI scan is ordered
  - C3-7 degenerative disc disease, central disc bulging and herniation
  - Most significant herniation at C5-6
  - Severe central stenosis at C5-6

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Case #3 - Cervical Myelopathy

- Central stenosis within the cervical spine, causing **squeezing** of the cord
- Usually results in **bilateral** arm pain, paresthesias, and/or weakness
- Upper motor neuron signs present on physical examination
- Gait and balance are often affected

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Case #3 – Cervical Myelopathy

- Joanne declines surgical consult.
- She opts for conservative management with physical therapy and analgesics.
- She is counseled to avoid falls or other potential injurious activities.
- She is counseled to **avoid cervical epidural steroid injections.**

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Case #3 – Cervical Myelopathy

- Joanne follows up in 3 months concerned about worsening weakness and balance.
- She has fallen once since her last visit.
- She denies any severe or significant increase in neck pain.
- Her hands are becoming numb more often.

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Case #3 – Cervical Myelopathy

- Her grip strength is now 2+/5.
- Hyperreflexia persists throughout upper and lower extremities.
- **Ankle clonus is present bilaterally.**
- Hoffman and Babinski signs are **positive**.

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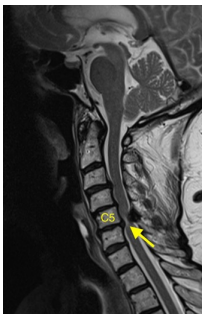

Case #3 – Cervical Myelopathy

- Repeat MRI shows worsened central stenosis with evidence of myelomalacia
- STAT referral to orthopedic spine is made for evaluation and management

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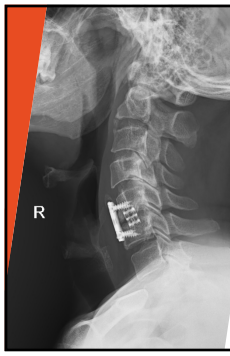

Case #3 – Cervical Myelopathy

- Patient is scheduled for C5-6 ACDF with goal to
  - Decompress the spinal canal
  - Attempt to improve symptoms
- The longer that the spine is compressed → more injury → less chance of complete recovery

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Case #3 – Cervical Myelopathy

- Most commonly results from progressive cervical spondylosis.
- Central canal narrowing and cord compression by osteophytes, facet overgrowth, disc herniations, or combination.
- Causes neurologic deficits – motor and gait abnormalities, upper motor neuron signs.
- Surgical decompression is the only definitive treatment.
- Untreated myelopathy can result in progressive and permanent gait disturbance, upper and lower extremity weakness, sensory loss, and pain.

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Cervical Myelopathy

- Risk:
  - Advanced age
  - Cervical spondylosis
  - Traumatic injury
- Complications:
  - Progressive gait disturbance
  - Permanent loss of balance
  - Progressive or permanent sensory loss
  - Muscle weakness, fine motor skill loss

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Case #4

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Case #4 -

- A 54-year-old female patient was involved in a motor vehicle accident where she was rear ended at high speed.
- Upon impact she felt severe lower back pain and had immediate numbness in the perineal area.

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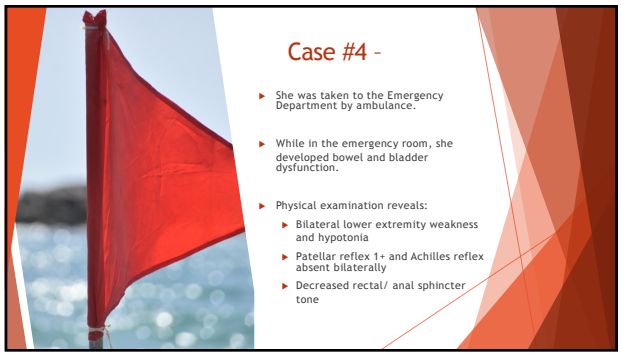

Case #4 -

- She was taken to the Emergency Department by ambulance.
- While in the emergency room, she developed bowel and bladder dysfunction.
- Physical examination reveals:
  - Bilateral lower extremity weakness and hypotonia
  - Patellar reflex 1+ and Achilles reflex absent bilaterally
  - Decreased rectal/ anal sphincter tone

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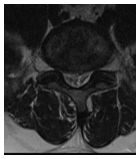
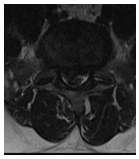

Case #4 -

A STAT MRI scan was done and showed massive central disc herniation.

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Case #4 - Cauda Equina Syndrome

- Severe central stenosis in the lumbar spine resulting from massive central disc herniation
- Usually causes acute onset back pain accompanied by lower extremity signs/ symptoms
  - Weakness
  - Paresthesias
  - Hyporeflexia
- Bowel and bladder dysfunction is common
- MRI scan is study of choice
- *This is a surgical emergency*

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Case #4 – Cauda Equina Syndrome

- She was admitted to the hospital, STAT spine consult was placed for cauda equina syndrome.
- She was scheduled for **emergent** surgical decompression.
- Central cord decompression can be achieved with:
  - Discectomy
  - Laminectomy
  - Fusion
  - Or a combination of the above

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Case #4 – Cauda Equina Syndrome

- After surgery, it took 4-6 weeks for perineal sensation to normalize.
- Neurogenic bladder remained.

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Case #4.5 -

- A 32-year-old male football player is tackled during practice.
- He has immediate lower back pain at the time of the injury and discontinues practice.
- Over the next 24 hours, back pain increases and he develops L>R leg pain and weakness.

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Case #4.5 -

- He presents for evaluation 48 hours after the injury.
- He admits to mild numbness and tingling in the "inside of my thighs; the left one is worse".
- Reports development of erectile dysfunction.
- He denies urinary/fecal retention or incontinence.

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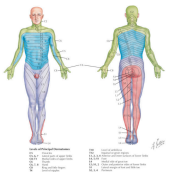
Case #4.5 -



- Gait is antalgic.
- Deep tendon reflexes:
  - Left patellar 1+
  - Left Achilles absent
  - Right patellar and Achilles 1+
- Strength testing:
  - Bilateral quadriceps 4+/5
  - Right gastric-soleus, tibialis anterior & extensor hallucis longus 4+/5
  - Left gastric-soleus, TA, EHL 3/5

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Case #4.5 -

- STAT MRI scan
- Shows large disc herniation causing severe central and left-sided foraminal stenosis at L5-S1
- Incomplete cauda equina

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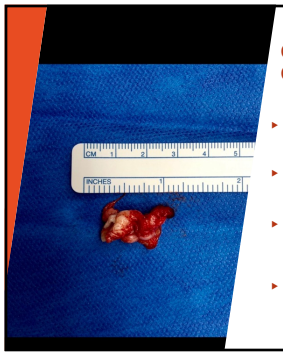

Case #4.5 - Incomplete Cauda Equina Syndrome

- Surgery scheduled for L5-S1 discectomy +/- fusion
- Strength returned to baseline by 7 days post-op.
- Erectile dysfunction and perineal numbness improved within 2 weeks.
- The patient never developed urinary or bowel dysfunction.

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Case #4/4.5 - Cauda Equina Syndrome

- Results from severe compression of cauda equina nerve roots.
- Disrupts impulses to lower extremities, perineum, and organs of the pelvis.
- WILL result in permanent neurologic damage and deficit if not promptly treated with surgical decompression (<24-48 hours is goal).
- Long term sensory, motor, and **urinary** dysfunction is common with delayed treatment, and may result even with timely treatment.
- Often presents acutely, but may also be a more insidious process.

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Cauda Equina Syndrome

- Risk:
  - Large central disc herniation
  - Spinal trauma, heavy lifting
  - History of recurrent herniations
- Complications:
  - Chronic neurogenic bladder
  - Permanent sensory loss
  - Permanent muscle weakness

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Spinal Emergencies: Summary Coming Up!

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Disorder	Risk	Presentation	Imaging	Treatment
Vertebral Osteomyelitis	**Spinal trauma**, recent infection, **older age**, immunocompromise	Almost always in the lumbar spine Back pain +/- muscle spasms, **fevers, chills, weight loss, fatigue, malaise**	X-rays can be nonspecific **MRI scan gold standard**, shows endplate and vertebral body destruction	Intravenous antibiotics +/- surgical mgt.
Spinal Epidural Abscess	**IVDU**, recent infection, older age, **immunocompromise**	Fever, midline pain, **esp. to percussion**, **neuro deficits** common	**MRI scan** - shows epidural fluid collection	**Surgical drainage** and intravenous antibiotics
Cervical myelopathy	Older age, degenerative disc disease	**Poor balance**, bilateral hand or arm **weakness**, **UMN signs**, +/- neck pain	**MRI scan** shows central canal stenosis +/- myelomalacia	**Surgical decompression:** ACDF or laminectomy w/ post. instrumentation
Cauda Equina Syndrome	Acute traumatic back injury Can be degenerative (subacute or chronic)	New onset bilat. leg weakness, saddle anesthesia, bowel or bladder dysfunction	**MRI scan** shows massive (often central) disc herniation with central stenosis in the lower lumbar spine	**STAT surgical decompression**

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Questions?

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