Objectives

- Supratentorial Findings of Spinal Etiology
  - Spine Findings in Supratentorial Disease
- Ischemia
  - Describe etiologies of cord ischemia and cord compression
- Cauda Equina Syndrome
- Spinal Infection
  - Identify typical and atypical imaging characteristics

Case 1

40 YO male with acute LBP, bilateral lower extremity weakness, and incontinence after picking up boxes.

Rule out Cauda Equina Syndrome

What is the cause of this patient’s CES?

Cauda Equina Syndrome

- Constellation of symptoms
  - Lower back pain
  - Sciatica
  - Saddle anesthesia
  - Decreased rectal tone and perineal reflexes
  - Bowel and bladder dysfunction
  - Variable lower extremity weakness
Cauda Equina Syndrome

- Most Common:
  - Multilevel lumbar stenosis
  - Traumatic fracture
  - Disc herniation (2-6% of CES)
  - Neoplasm
  - Infection
  - Idiopathic
  - Tethered cord

54 YO male with acute onset back pain, lower extremity paresis, incontinence while digging

Pathological Fracture

Leptomeningeal Carcinomatosis

Cauda Equina Syndrome

- Rare:
  - Hemorrhage
  - Intravascular lymphomatosis
  - Conus medullaris lipomas
  - Multiple sclerosis
  - AVM
  - Late stage ankylosing spondylitis
  - Neurosarcomatosis
  - Spinal vein/IVC thrombosis

Acute LBP and increasing leg weakness

Spontaneous Intradural Hemorrhage

- Spinal vascular malformation
- Carcinomatosis with vascular/ hemorrhagic primary
- Traumatic LP
- Intrinsic coagulopathy

Failed epidural catheter placement
Case 2

What is the cause of this 43 YO male’s vague neck pain?

A. Muscle strain  
B. Longus colli tendinitis  
C. Fracture  
D. Infection

What would be the next imaging step for left UE weakness?

Diagnosis?
**Discitis-Osteomyelitis**

- CT: Endplate destruction
- MRI: Endplate and intradiscal T2 hyperintensity, T1 hypointensity, enhancement
- Enhancing, heterogeneous enlarged prevertebral muscles
- ± Rim-enhancing prevertebral & epidural abscess
- Anteriorly displaced retropharyngeal space and pharynx

**DWI - Osteomyelitis**

**DWI**

**T1**

**T2**

**CLAW SIGN**

 NORMAL MARROW

 DIFFUSION "CLAW"

 GRANULATION TISSUE AND EDema

 Patil KB, et al AJNR 2014

**Psoas Abscess**

Jan 2  Jan 14
Imaging Psoas Sign

- Psoas T2 hyperintensity
  - Sensitivity 92.1%
  - Specificity 92%
  - AUC 0.92
  - LR+ 11.5, LR- 0.09

- Psoas abnormalities statistically correlated to DOM in postoperative patients
  - T2 hyperintensity (p=0.001)
  - Enhancement (p=0.001)

Lebbesser, et al AJNR 2016

- Psoas muscles originate from TP & anteromedial lumbar discs & endplates
- DOM originates from anterior endplates
- Therefore, psoas may be affected early in infectious process by direct spread

CASE 3

73 YO male with history of diabetes presents with increasing LBP. Recently treated for epididymitis & UTI.

What is the abnormality?

What is the next step?

What is the diagnosis?

Emphysematous Vertebral Osteomyelitis

- Gas-forming organism Klebsiella oxytoca
- Vacuum phenomenon in intervertebral disk space usually confirms DDD
  - Gas, principally nitrogen, collects within areas of negative pressure created by tissue distraction
  - 1-39% of spinal radiographs
- Intervertebral gas often indicator of ischemic necrosis of bone
Emphysematous Vertebral Osteomyelitis

- Rarely, gas-forming organisms may produce radiolucent collections
- Risk factors include alcoholism, diabetes, steroid use and malignancy

CASE 4

Patient presents with loss of motor function and pain/temperature sensation after fall from wheelchair

What is the diagnosis?
What is the diagnosis?

Central Cord Syndrome

- Upper > lower extremity weakness
- Sensory deficit below level of lesion
- Pain/temp and light touch/vibratory
- Motor deficit > sensory
- Neck pain
- Urinary retention
- Most common type of incomplete SCI (~10%)

Spinothalamic tracts
Dorsal column-medial lemniscus
Corticospinal tracts

Hyperextension injury
- Vertebral spurs → anterior compression
- Bulging ligamentum flavum → posterior compression
- AP compressive forces distribute greatest damaging effect on central cord substance

Cervical spondylosis & developmental stenosis may predispose to SCI

SCIWORA / SCIWORET

Lack of evidence for prophylactic decompression of asymptomatic spondylosis

- Murphy DR, et al. Chiropr Osteopat
- Bednarik J et al. J Neurol Neurosurg Psychiatry 2011

CASE 5
After neck manipulation, 33 YO female presents with Horner syndrome, unilateral hemiparesis & dissociated sensory deficits.

What does the yellow arrow show?

Ax T1 FS  Ax DTI

What vascular structure does the yellow arrow show?

Cord  hemisection (Brown-Séquard Syndrome)

• Ipsilateral arm & leg weakness
• Contralateral sensory loss to temp or hyperalgesia
• Minimal or no loss of vibratory sensation & proprioception

What is the cause of the Horner's syndrome?
CASE 6

28 YO male with right-sided stroke-like symptoms.
Diagnostic imaging to "Rule out stroke"

What is the abnormality?
A. Neurocysticercosis
B. Ependymoma
C. Abscess
D. AVM
E. No Clue

Type 2 AVM
- Intramedullary AVM at C4
- Tightly compact arterial & venous vessels
- Younger patients with acute neurologic deterioration
  - Subarachnoid +/- parenchymal hemorrhage, vascular phenomenon, mass effect
- Rebleed rate 10% within 1st month, 40% within 1st year
CASE 7

- 27 YO male presents acute headache, upper back pain, & transient bilateral lower extremity numbness
- History of methamphetamine and SPICE use
- CTA head and neck negative for vascular abnormality

What is the diagnosis?

- Transient bilateral lower extremity numbness \(\rightarrow\) MRI

Radiculomedullary Artery Pseudoaneurysm

- MRI: focal hematoma in upper thoracic spine
- DSA: small radiculomedullary artery pseudoaneurysm

Spinal Artery Pseudoaneurysm

- Spinal artery aneurysm rarely associated with AVM
- Present with SAH & acute back pain
- SAH from rupture of a radiculomedullary artery pseudoaneurysm temporally associated with use of methamphetamine and SPICE

Case 8

Middle-aged gentleman presents to the ED with headache after a "procedure." No history of trauma. CTA head and neck were negative.
What is the cause of this patient’s headache?

Dural Puncture

- Technique:
  - Studies suggest that inappropriate needle position may occur in as many as 30% of lumbar epidural injection procedures performed with either sacral hiatus or lumbar puncture performed without image-guidance
  - Bartynski AJNR 2005
  - Needle size, type; needle tip orientation
  - Patient factors: body habitus, tissue issues

25 YO male with history of renal disease presents with headache and mild upper extremity weakness
What is the diagnosis?

Axial T2

PRES with Spinal Cord Involvement

• Patients with PRES have neurologic signs referable to spinal cord, extreme elevation in blood pressure, MRI lesions that extend to the cervicomedullary junction, or grade IV hypertensive retinopathy

De Havenon Neurology 2014

PRES with Spinal Cord Involvement

• PRES involves predominantly brain white matter; in brain stem & spinal cord, the lesions affect gray matter
• Patients with spinal cord lesions may be asymptomatic or may have sensitive and motor deficits

Case 10

Hypotensive Event - What is the diagnosis?
Delayed leukoencephalopathy
- Hypoxic ischemic injury

Spinal Cord Ischemia
- Obstruction of blood flow associated with cardiovascular compromise
- Premature neonates are vulnerable hypotension
  - Attributed the ischemia to poor auto-regulation of spinal cord blood flow during systemic hypotension secondary to prematurity
- Achondroplasia, patients with Mucolipidosis Type II disease

Case 11
33 YO male with altered mental status

What is the diagnosis? What next step?

CNS Dermoid
- Congenital
  - 40% intramedullary, 60% extramedullary
  - 60% lumbosacral, 20% cauda equina
  - Generally in patients <20 YO
- Ruptured dermoid
  - Aseptic chemical meningitis
  - Headache, seizures, vasospasm, death

CASE 12
75 YO female with acute-onset severe neck pain
What is the diagnosis?

Crowned Dens Syndrome

- Acute onset of pain
- Elevated CRP, slightly leukocytosis
- CT - calcification around dens, cysts, erosions
- Histology - calcium pyrophosphate dihydrate
  - some may be hydroxyapatite
- About ½ do not have CPPD elsewhere
- Fairly common
  - 5% patients with severe non-traumatic neck pain & negative c-spine series or EDD

Crowned Dens Syndrome

- Complications
  - Instability
  - Cord compression
  - Type II odontoid fracture

Calcification Around Dens

- Prevalence of atlantoaxial CPPD crystal deposition ~ 12.5%, positive correlation with age & retroodontoid soft tissue thickening
- One study found only 18% of patients with calcifications by CT were symptomatic
- 50% of patients with peripheral CPPD had calcification around dens

Conclusions

- CES is typically due to disc pathology (*neoplastic*)
- Typical and atypical imaging features of spinal infection
- Cord ischemia etiologies
  - Important to remember vascular anatomy
- The spine may be the etiology of supratentorial findings
- Characteristics of crowned dens syndrome

References
