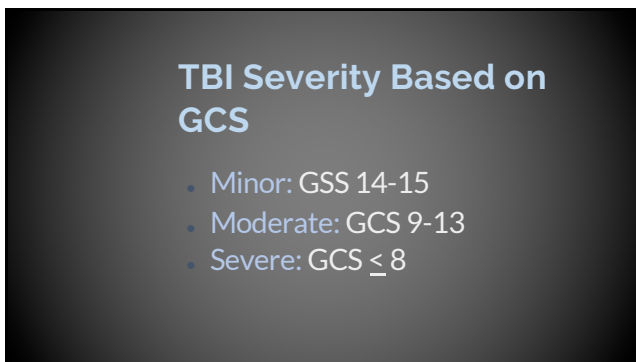


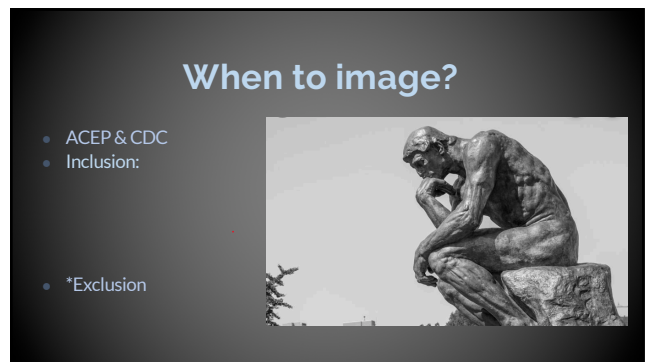
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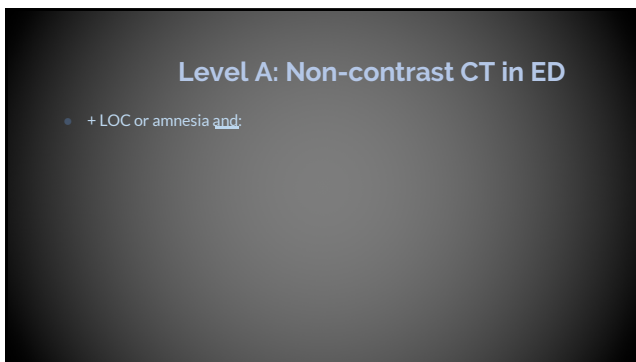
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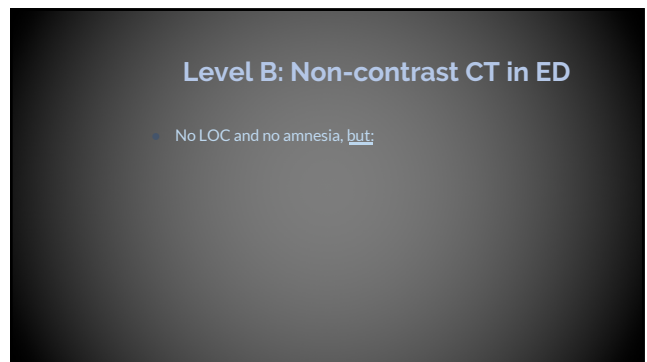
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6

## PECARN

7

## Concussion

- \_\_\_\_\_  
in neurologic function following head injury
- +/- amnesia
- HA, dizziness, nausea
- \_\_\_\_\_

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## Skull Fractures

- \_\_\_\_\_
  - Pain and hematoma
  - Rarely clinically significant
  - Evaluate for underlying injury
- \_\_\_\_\_
  - Crepitus
  - Inward displacement, may require surgery
- \_\_\_\_\_
  - Defect in overlying skin
  - Antibiotics

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## Epidural Hematoma

- Blood b/t skull and dura
  - Lens shaped, biconvex
  - Crosses midline
  - Does NOT cross suture lines
- Direct blow
  - Temporal, parietal skull fracture
  - Middle meningeal artery
  - LOC → lucid interval → coma
  - Surgical decompression

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## Subdural Hematoma

- Blood b/t dura and arachnoid
  - Crescent shaped, biconvex
  - Crosses suture lines
  - Does NOT cross midline
- Rapid acceleration-deceleration
  - Bridging veins
  - Elderly, alcoholics, children < 2
  - Headache, AMS
  - Medical vs. surgical management
    - Midline shift, neurologic deterioration

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## Traumatic Subarachnoid

- Blood b/t arachnoid and pia
  - Focal and diffuse blood in cortical sulci pattern
  - Blood in CSF and meningeal intima
  - Small subarachnoid vessels
  - Headache, photophobia, AMS

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### TSAH Induced Vasospasm

- Post-traumatic vasospasm
  - Common (48 hours - 2 weeks)
  - Worsened outcome
  - Further ischemia
- \_\_\_\_\_

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### Cerebral Contusion

- Parenchymal contusion, direct brain injury
  - Sudden acceleration and deceleration
  - Coup, contrecoup injury
- Variable symptomology
  - May have focal deficits
  - Sx may be delayed (edema)
- \_\_\_\_\_

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### Intracerebral Hematoma

- \_\_\_\_\_
- Variable symptomology

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### Diffuse Axonal Injury

- Severe AMS disproportionate to CT findings
  - Prolonged coma (days to weeks)
- Sudden acceleration and deceleration, rotational movements
- CT: \_\_\_\_\_
- MRI > CT

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How do you calculate cerebral perfusion pressure?

CCP = \_\_\_\_\_

MAP = \_\_\_\_\_

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### Symptoms of Elevated ICP

- HA
- N/V
- Seizure
- Lethargy
- \_\_\_\_\_ (3)
  - HTN,
  - bradycardia,
  - irregular RR

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### Cushing Response

- Triad
  - \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
- Potentially lethal rise in ICP
  - \_\_\_\_\_

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### ICP Management

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### ICP Management

- Osmotic agents
  - Mannitol
  - Hypertonic saline

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### Herniation Syndromes

- Subfalcine/cingulate
- Transtentorial/central
- Uncal
- Cerebellar/upward
- Tonsillar

22

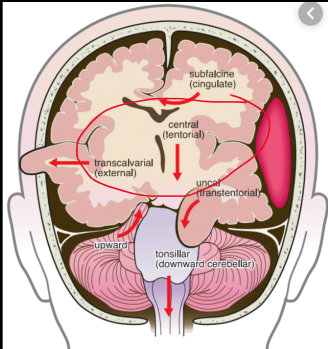
### Subfalcine/Cingulate Herniation

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_ under falx cerebri
- Can lead to downward pressure on brainstem
- PE finding: \_\_\_\_\_



23

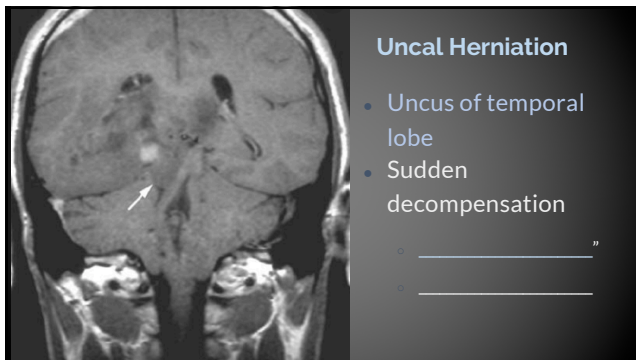
### Central/Transtentorial Herniation



- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

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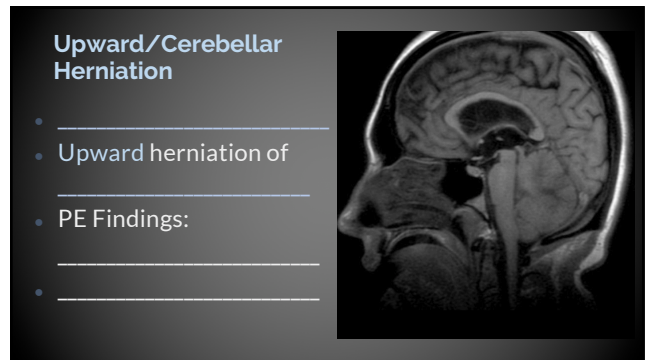




### Uncal Herniation

- Uncus of temporal lobe
- Sudden decompensation
  - \_\_\_\_\_
  - \_\_\_\_\_

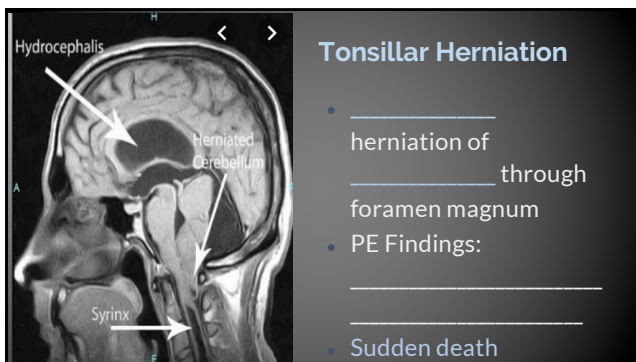
25



### Upward/Cerebellar Herniation

- \_\_\_\_\_
- Upward herniation of \_\_\_\_\_
- PE Findings: \_\_\_\_\_
- \_\_\_\_\_

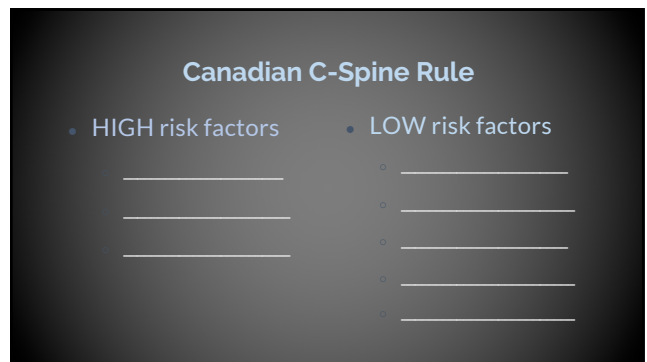
26



### Tonsillar Herniation

- \_\_\_\_\_ herniation of \_\_\_\_\_ through foramen magnum
- PE Findings: \_\_\_\_\_
- Sudden death

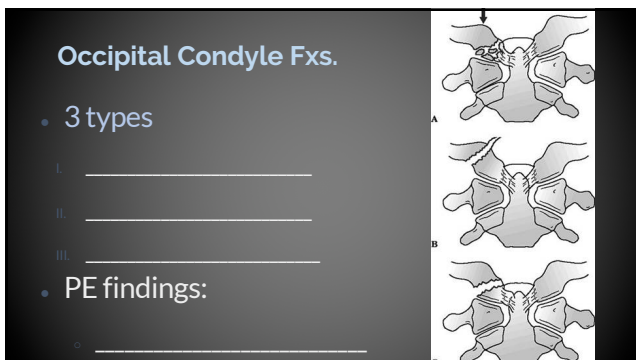
27



### Canadian C-Spine Rule

- |                     |                    |
|---------------------|--------------------|
| • HIGH risk factors | • LOW risk factors |
| _____               | ○ _____            |
| _____               | ○ _____            |
| _____               | ○ _____            |
|                     | ○ _____            |
|                     | ○ _____            |

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### Occipital Condyle Fxs.

- 3 types
  - I. \_\_\_\_\_
  - II. \_\_\_\_\_
  - III. \_\_\_\_\_
- PE findings: \_\_\_\_\_

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### Atlanto-Occipital Dislocation

- \_\_\_\_\_
- \_\_\_\_\_

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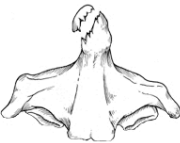
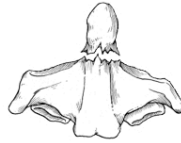
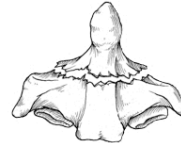
## Jefferson Fracture

- Mechanism: \_\_\_\_\_
- \_\_\_\_\_
- Pushes lateral masses apart
- Generally \_\_\_\_\_



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## Odontoid Fractures

Type I	Type II	Type III
[Stable]	[Unstable]	[Unstable]
		
Avulsion of the tip	Fracture at junction of odontoid and body of C2 <small>(most common)</small>	Fracture at base of dens

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## Hangman Fracture

- \_\_\_\_\_
- Body of \_\_\_\_\_ displaces anteriorly on \_\_\_\_\_
- Judicial hangings
- MVC



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## C3 – C7

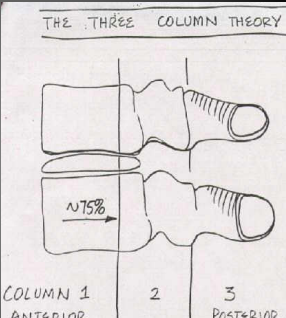
**MIDDLE COLUMN:**

- Facets, lots of bony overlap - Radiologically Complex.
- spinal canal
- facet joints
- pedicle
- transverse process
- neural foramina
- joint capsules
- ligaments
- posterior disc

\* An injury (bone or soft tissue) involving 2 of 3 columns is potentially unstable.

\* Unstable injuries threaten "THE NERVE IN THE MIDDLE!"

THE THREE COLUMN THEORY



COLUMN 1      2      3  
ANTERIOR                      POSTERIOR

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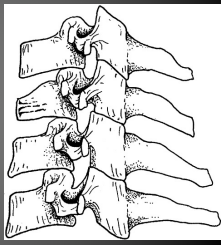
## Anterior Subluxation

- \_\_\_\_\_ strain
- Interspinous or posterior longitudinal ligament
- Anterior soft tissue swelling
- Fanning: \_\_\_\_\_
- Posterior widening of the intervertebral space

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## Wedge Fractures


- Result of compression b/t 2 vertebral bodies
- Simple: no associated ligament damage
- \_\_\_\_\_
- + Ligament damage
- \_\_\_\_\_



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### Flexion Teardrop Fracture

- \_\_\_\_\_ vertebral body - separated and displaced
- Complete disruption of ligaments
- \_\_\_\_\_



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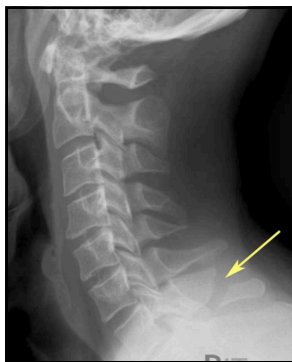
### Bilateral Facet Dislocation

- Hyperflexion \_\_\_\_\_ dislocates superiorly and anteriorly into the intervertebral foramen of the vertebra below
- Disruption of \_\_\_\_\_
- Articular mass of one vertebra • Neurologic deficits

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### Clay Shoveler's Fracture


- \_\_\_\_\_
- \_\_\_\_\_
- Abrupt flexion of the neck with contraction of lower neck muscles
- Direct trauma



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### Pillar fracture


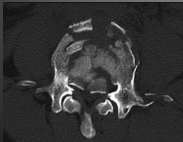
- Isolated \_\_\_\_\_ or \_\_\_\_\_ fracture through the \_\_\_\_\_



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### Burst Fracture

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

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### Hyperextension Dislocation

- Complete tear of anterior longitudinal ligament and intervertebral disk
- Disruption of posterior ligamentous complex
- \_\_\_\_\_

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### Extension Teardrop Fracture

- True \_\_\_\_\_ fracture
- \_\_\_\_\_
- Anterior longitudinal ligament avulses fragment
- Usually lower cervical spine
- MVC
- \_\_\_\_\_ in extension

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### Unilateral Facet Dislocation

- Flexion and rotation
- Articular mass and inferior facet on one side of the vertebra is anteriorly dislocated
- \_\_\_\_\_ the vertebral body AP diameter
- Discordant rotation above and below involved level
- "Bow Tie" or "Bat wing" appearance of the overriding locked facets

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### Unstable C-spine Fractures

Jefferson: C1 burst  
 Bit: bilateral facet dislocation  
 Off: odontoid (type II and III)  
 A: atlanto-occipital dissociation, any fx/dislocation  
 Hangman's: bilateral C2 pedicle  
 Thumb: teardrop (flexion)

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### Spinal & Neurogenic Shock

#### Complete Spinal Cord Injury

Complete loss of motor and sensory function below the spinal cord injury.

**Paraplegia**

#### Incomplete Spinal Cord Injury

Partial or random preservation of motor or sensory function below the spinal cord injury.

**Tetraplegia**

**Cervical Nerves:** Diaphragm, Deltoids, Biceps, Wrist extensors, Rotates arm, Triceps, Bends fingers

**Thoracic Nerves:** Spread fingers, Chest muscles, Abdominal muscles, Muscles in the back

**Lumbar Nerves:** Hip muscles, Thigh muscles, Knee muscles, Foot muscles

**Sacral Nerves:** Bladder and bowels, Sexual function

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### Spinal & Neurogenic Shock

Spinal shock	Neurogenic shock
<ul style="list-style-type: none"> <li>• _____</li> <li>• _____</li> <li>• _____</li> <li>• _____</li> </ul> <p>Return of bulbocavernosus reflex</p>	<ul style="list-style-type: none"> <li>• _____</li> <li>• _____</li> <li>• _____</li> <li>• _____</li> </ul>

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### Spinal Cord Syndromes

- Anterior
  - "Car has motor in front and GPS in back"
  - Front-end car crash, anterior cord damage
  - \_\_\_\_\_ paralysis
  - Sparring of \_\_\_\_\_

**Anterior cord syndrome.** Redrawn from Ignatavicius and Workman, 2002.

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### Central Cord Syndrome

Results from cervical spinal injuries. Greater motor impairment in upper body compared to lower body. Variable sensory loss below the level of injury.

**Key:**

- Normal Function
- Impaired Motor Function
- Impaired Sensory Function

### Spinal Cord Syndromes

- Central
  - "Centenarian clipped his chin, now with cape-like neurologic distribution"
  - \_\_\_\_\_
  - \_\_\_\_\_ > \_\_\_\_\_
  - \_\_\_\_\_ extremity motor deficit

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### Spinal Cord Syndromes

#### Brown-Sequard

- "Hot knife cuts muscle and half of cord, and the opposite side can't feel the hot knife"
- \_\_\_\_\_ motor paralysis
- \_\_\_\_\_ loss of pain/temperature sensation

### Brown-Séquard Syndrome

Example level: cervical spinal injury

Below injury level, motor weakness or paralysis on one side of the body (hemiparaplegia). Loss of sensation on the opposite side (hemi-anesthesia).

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Thank you for your time and attention...

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