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Sideline Emergency Management

Benjamin Oshlag, MD, CAQSM
Assistant Professor of Emergency Medicine
Assistant Professor of Sports Medicine
Columbia University Medical Center

NewYork-Presbyterian

Columbia University
Department of Orthopedic Surgery
College of Physicians & Surgeons

Disclosures

Nothing to disclose

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New Orleans Criteria

- Single center, 1429 patients from 1997-99
- CT needed if patient meets one of the following:
  - Headache
  - Vomiting
  - Age >60
  - Drug or alcohol intoxication
  - Persistent anterograde amnesia
  - *Visible trauma above the clavicle* ←
  - Seizure

- 6.5% of patients (93/1429) had intracranial injuries, 0.4% (6/1429) required neurosurgical intervention
- 100% sensitive for intracranial injuries, 25% specific

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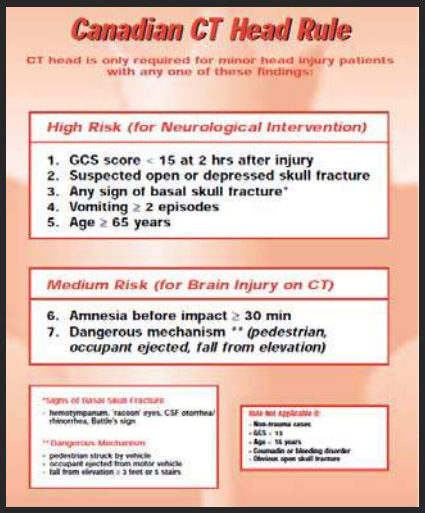
Canadian Head CT Rule

- Prospective cohort study at 10 sites in Canada (N=3121) (2001)
- Apply only to:
  - GCS 13-15
  - Amnesia or disorientation to the head injury event or +LOC
  - Injury within 24 hours
- Exclusion
  - Age <16
  - Oral anticoagulants
  - Seizure after injury
  - Minimal head injury (no LOC, disorientation, or amnesia)
  - Obvious skull injury/fracture
  - Acute neurologic deficit
  - Unstable vitals
  - Pregnant



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Canadian Head CT Rule

- High Risk Criteria (need for NSG intervention)
  - GCS <15 at 2 hours post injury
  - Suspected open or depressed skull fracture
  - Any sign of basilar skull fracture
    - Hemotympanum, racoon eyes, Battle's sign, CSF oto/rhinorrhea
  - >= 2 episodes of vomiting
  - Age >= 65
  - 100% sensitivity

Eye	Motor	Verbal
4 = Spontaneous	6 = Obedient	5 = Oriented
3 = To Voice	5 = Purposeful	4 = Confused
2 = To pain	4 = Withdrawal	3 = Inappropriate
1 = None	3 = Flexion	2 = Incomprehensible
	2 = Extension	1 = None
	1 = None	

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Canadian Head CT Rule

- Medium Risk Criteria (positive CT that usually requires admission)
  - Retrograde amnesia to event >=30 minutes
  - "Dangerous" mechanism
    - Pedestrian struck by motor vehicle
    - Fall >3 feet or >5 stairs
  - Sensitivity 83-100%
- Specificity 39.7%

Eye	Motor	Verbal
4 = Spontaneous	6 = Obedient	5 = Oriented
3 = To Voice	5 = Purposeful	4 = Confused
2 = To pain	4 = Withdrawal	3 = Inappropriate
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NEXUS-II

- Observational study, 13,728 patients from 21 centers (2004)
- 917 with **clinically important injuries**
- Head CT NOT required if NONE of the following present:
  - Age >= 65
  - Evidence of significant skull fracture
  - Scalp hematoma
  - Neurologic deficit
  - Altered level of alertness
  - Abnormal behavior
  - Coagulopathy
  - Recurrent or forceful vomiting
- Sensitivity 98.3% (901/917)

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NEXUS-II

- Clinically important injuries
  - Mass effect or sulcal effacement
  - Signs of herniation
  - Basal cistern compression or midline shift
  - Substantial epidural or subdural hematomas (greater than 1.0 cm in width, or causing mass effect)
  - Substantial cerebral contusion (more than 1.0 cm in diameter, or more than one site)
  - Extensive subarachnoid hemorrhage
  - Hemorrhage in the posterior fossa
  - Intraventricular hemorrhage
  - Bilateral hemorrhage of any type
  - Depressed or diastatic skull fracture
  - Pneumocephalus
  - Diffuse cerebral edema
  - Diffuse axonal injury

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So what do we use?

Table 1. Findings used by 7 clinical decision rules for CT scanning in mild traumatic brain injury.

Clinical Finding	Canadian	NCWFNS	New Orleans	NEXUS-II	NICE	Scandinavian
GCS score	<15 At 2 h	<15	<15	Abnormal alertness, behavior	<15 At 2 h	<15
Amnesia	Retrograde >30 min*	Any	Antegrade	—	Retrograde >30 min	Any
Suspected fracture	Open, depressed, basal	Any	Any injury above clavicles	Any	Open, depressed, basal	Basal, depressed, confirmed
Vomiting	Recurrent	Any	Any	Recurrent	Recurrent	—
Age, y	≥65	—	>60	≥65	≥65†	—
Coagulopathy	—	Any	—	Any	Any†	Any
Focal deficit	—	Any	—	Any	Any	Any
Seizure	—	History	Any	—	Any	Any
LOC	If GCS=14	Any	—	—	—	Any
Visible trauma	—	—	Above clavicles	Scalp hematoma	—	Multiple injuries
Headache	—	Any	Severe	—	—	—
Injury mechanism	Dangerous*†	—	—	—	Dangerous††	—
Intoxication	—	Abuse history	Drug, alcohol	—	—	—
Previous neurosurgery	—	Yes	—	—	—	Shunt

NCWFNS, Neurotraumatology Committee of the World Federation of Neurosurgical Societies; *NICE*, National Institute of Clinical Excellence; —, indicates the item is not considered an indication for CT scanning by author(s) of the rule; *LOC*, loss of consciousness.
*Used to determine medium risk for the Canadian Rule.
†CT scan only if also loss of consciousness or any amnesia.
†Dangerous injury mechanism=ejected from motor vehicle, pedestrian struck by motor vehicle, fall of >3 feet or 5 steps.

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Comparison of the Canadian CT Head Rule and the New Orleans Criteria in Patients With Minor Head Injury, Ian G. Stiell, MD, MSc, FRCPC; Catherine M. Clement, RN; et al, *JAMA*. 2005;294(12):1511-1518. doi:10.1001

So what do we use?

- CCHR and NOC have equivalent high sensitivities for need for neurosurgical intervention and clinically important brain injury
- CCHR has higher specificity for important clinical injuries
- May result in reduced imaging rates.

Table 3. Operating characteristics for the 6 decision rules for CT scanning in mild traumatic brain injury.

	Sensitivity (95% CI)			Specificity (95% CI)	
Strategy	Hematoma	Nonsurgical Lesion	Any Lesion	No Hematoma	No Lesion
Canadian (high-risk only)	0.99 (0.94–1.00)	0.97 (0.94–0.98)	0.97 (0.95–0.98)	0.48 (0.47–0.49)	0.51 (0.49–0.52)
Canadian (medium/high risk)	0.99 (0.94–1.00)	0.99 (0.97–1.00)	0.99 (0.98–1.00)	0.45 (0.44–0.46)	0.47 (0.46–0.48)
Neurotraumatology Committee of the World Federation of Neurosurgical Societies	0.99 (0.94–1.00)	0.95 (0.93–0.97)	0.96 (0.94–0.97)	0.45 (0.44–0.46)	0.47 (0.46–0.48)
New Orleans	0.99 (0.94–1.00)	0.99 (0.97–1.00)	0.99 (0.98–1.00)	0.31 (0.30–0.32)	0.33 (0.32–0.34)
Nexus-II	1.00 (0.97–1.00)	0.97 (0.94–0.98)	0.97 (0.96–0.98)	0.44 (0.43–0.46)	0.47 (0.46–0.48)
National Institute of Clinical Excellence	0.98 (0.93–1.00)	1.00 (0.99–1.00)	0.99 (0.98–1.00)	0.29 (0.28–0.30)	0.31 (0.30–0.32)
Scandinavian	0.99 (0.94–0.99)	0.95 (0.92–0.97)	0.96 (0.93–0.97)	0.50 (0.49–0.51)	0.53 (0.52–0.54)

A Critical Comparison of Clinical Decision Instruments for Computed Tomographic Scanning in Mild Closed Traumatic Brain Injury in Adolescents and Adults, Sherman Stein, MD, Andrea Fabbri, MD, Franco Servadei, MD, Henry Glick, MD, Annals of Emergency Medicine, Vol 53 No 2, 2009

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So what do we use?

Table 4. Number of recommendations for CT scanning, stratified by outcome.

	CT Scan Recommended				No CT Scan Recommended			
Decision Aid	Hematoma	Other Lesion	No Lesion	Total	Hematoma	Other Lesion	No Lesion	Total
Canadian (high risk only)	106	410	3,675	4,191	1	14	3,749	3,764
Canadian (medium/high risk)	106	420	3,912	4,438	1	4	3,512	3,517
Neurotraumatology Committee of the World Federation of Neurosurgical Societies	106	404	3,920	4,430	1	20	3,504	3,525
New Orleans	106	420	4,996	5,522	1	4	2,428	2,433
NEXUS-II	107	410	3,950	4,467	0	14	3,474	3,488
National Institute of Clinical Excellence	105	424	5,130	5,659	2	0	2,294	2,296
Scandinavian	106	402	3,497	4,005	1	22	3,927	3,950

A Critical Comparison of Clinical Decision Instruments for Computed Tomographic Scanning in Mild Closed Traumatic Brain Injury in Adolescents and Adults, Sherman Stein, MD, Andrea Fabbri, MD, Franco Servadei, MD, Henry Glick, MD, Annals of Emergency Medicine, Vol 53 No 2, 2009

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What about the kids?

- Unlike adults, head CTs in children may carry significantly increased risk of lethal malignancy over the life of the patient
  - Risk decreases with age.
    - 1 year old: 1 in 1000-1500
    - 10 year old: 1 in 5000

- >600,000 ED visits/year in US for head trauma in < 18 year-olds
- PECARN rules helps determine which pediatric patients can be safely discharged without head CT.

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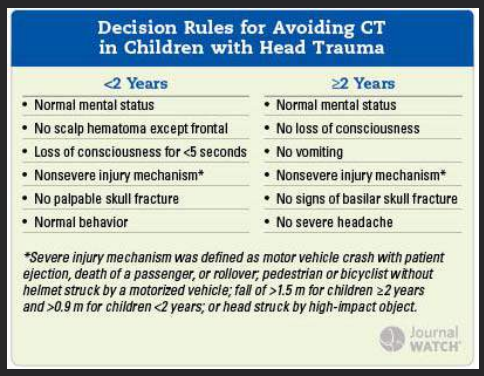
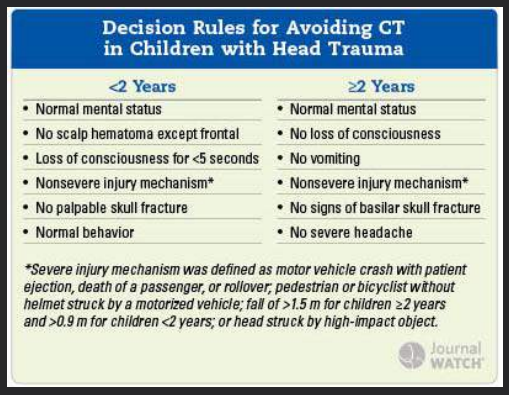
PECARN

- Two arms
  - Children <2
  - Children >2 (up to 18 years old)
- Inclusion:
  - Children presenting within 24 hours of head trauma
- Exclusion:
  - Trivial injury
    - Ground level falls, running into stationary objects, no signs or symptoms beyond scalp abrasions/lacerations
  - Penetrating trauma
  - Brain tumors
  - Pre-existing neurologic disorders
  - Prior neuroimaging before transfer from another facility
- **Clinically important injuries:**
  - **Death from TBI**
  - **Neurosurgical intervention for ICP monitoring, elevation of depressed skull fracture, ventriculostomy, hematoma evacuation, lobectomy, tissue debridement, dura repair**
  - **Intubation >24h**
  - **Hospital admission >2 nights due to CT evidence of TBI**



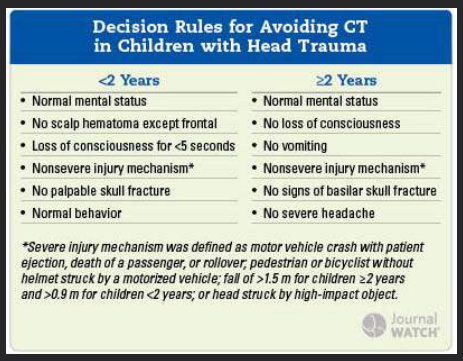
PECARN

- Guidelines for older children:
  - **GCS <= 14** or
  - Signs of **basilar skull fracture** or
    - Raccoon eyes
    - Battle's sign
    - CSF Rhinorrhea
    - Hemotympanum
  - Signs of **Altered Mental Status**
    - Agitation
    - Somnolence
    - Repetitive questioning
    - Slow response to verbal communication
  - **If yes to above, CT recommended**, 4.3% risk of clinically important TBI



PECARN

- If no to above, any of:
  - History of **LOC** or
  - History of **vomiting** or
  - **Severe headache** or
  - **Severe mechanism** of injury
    - MVC with ejection, death of another passenger, or rollover
    - Pedestrian or bicyclist without helmet struck by motorized vehicle
    - Falls >5 feet
    - Head struck by high-impact object



Decision Rules for Avoiding CT in Children with Head Trauma

<2 Years	≥2 Years
• Normal mental status	• Normal mental status
• No scalp hematoma except frontal	• No loss of consciousness
• Loss of consciousness for <5 seconds	• No vomiting
• Nonsevere injury mechanism*	• Nonsevere injury mechanism*
• No palpable skull fracture	• No signs of basilar skull fracture
• Normal behavior	• No severe headache

**Severe injury mechanism was defined as motor vehicle crash with patient ejection, death of a passenger, or rollover; pedestrian or bicyclist without helmet struck by a motorized vehicle; fall of >1.5 m for children ≥2 years and >0.9 m for children <2 years; or head struck by high-impact object.*

Journal WATCH

- If yes, 0.9% of clinically important TBI, **observation recommended over imaging**
- If no, NO CT (risk of clinically important TBI **<0.05%,** generally lower than risk of CT-induced malignancies)

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Head Injuries

Take-home points:

- **Altered mental status, persistent vomiting, and neurologic deficits are RED FLAGS and require emergent evaluation**
- **Athletes with head injuries with no concerning features may be fine with observation and close follow-up, concussion precautions**
- **Athletes with no other injuries who do not need advanced imaging may be ok not going to the Emergency Department.**

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Neck Injuries

- Rule out badness
  - Unstable
- CT vs X-rays vs MRI
- Who do we need to worry about?
- Who do we NOT need to worry about?

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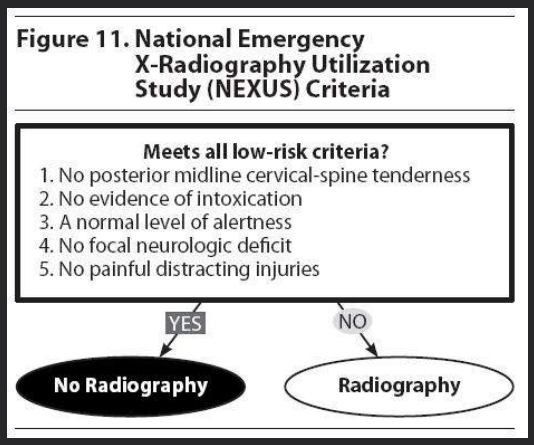
NEXUS

- **Imaging NOT necessary if:**
  - **No midline cervical tenderness**
  - **No focal neurologic deficits**
  - **Normal alertness**
  - **No intoxication**
  - **No painful distracting injury**



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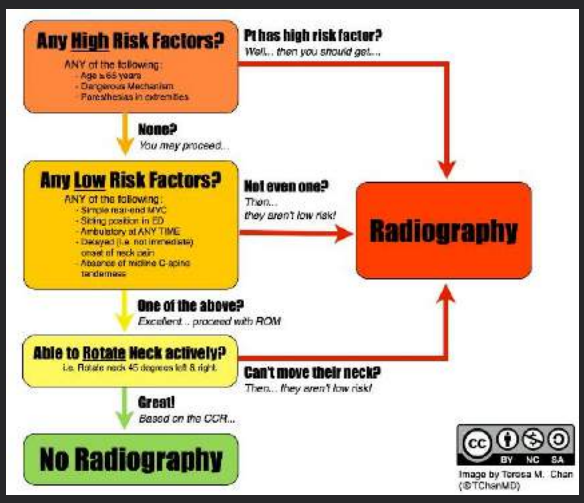
Canadian C-Spine Rule

- C-spine can be cleared if 3 criteria are met:
  - NO high-risk factors
    - Age > 65
    - Dangerous mechanism
    - Paresthesias in extremities
  - ANY low-risk factor
    - Simple rear-end MVC
    - Delayed onset of pain
    - Sitting position in ED
    - Ambulatory at any time
    - Absence of midline c-spine tenderness
  - ROM
    - Able to rotate 45 degrees to left and right



Canadian C-spine Rule

- 100% sensitivity and 42.5% specificity for identifying clinically important c-spine injuries
  - "Clinically important" = Fracture, dislocation, or ligamentous instability which requires stabilization or specialized follow-up
  - Not clinically important
    - Avulsion fracture of osteophyte
    - Isolated transverse process fracture involving facet joint
    - Isolated spinous process fracture not involving lamina
    - Simple compression fracture (<25% vertebral body height)

Neck Injuries

Take-home points:

- Many different indication criteria for both head and neck imaging
  - Designed to reduce unnecessary imaging
  - Aimed at identifying clinically important injuries
- Worrisome characteristics:
  - Midline/spine tenderness
  - Neurologic deficit
    - Bilateral symptoms are NOT a stinger
  - Altered mental status
- Athletes with no concerning findings likely ok for non-emergent evaluation
  - When in doubt, ER for further evaluation/observation
  - Immobilization as practiced likely does not provide much, if any, benefit

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Facial Trauma

Overview

- Anatomy
  - Eyes
  - Nose
  - Mouth
- Exam Techniques
- Common injuries
- Treatment

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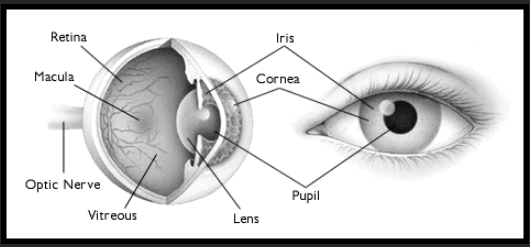
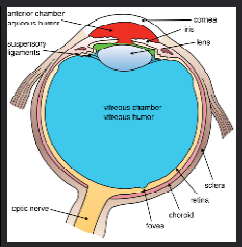
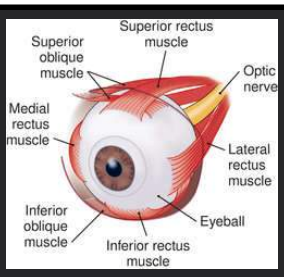
Ocular Trauma

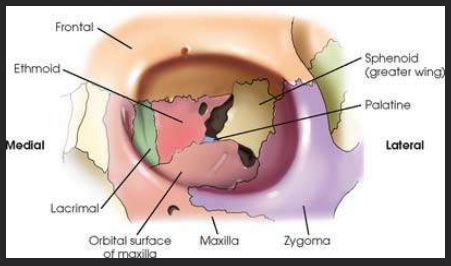
Basic eye anatomy

- Anterior Segment
  - Sclera
  - Cornea
  - Iris
  - Pupil
  - Lens
- Posterior Segment
  - Vitreous
  - Retina
  - Macula
  - Optic Nerve
- Eye muscles
- Orbital bones









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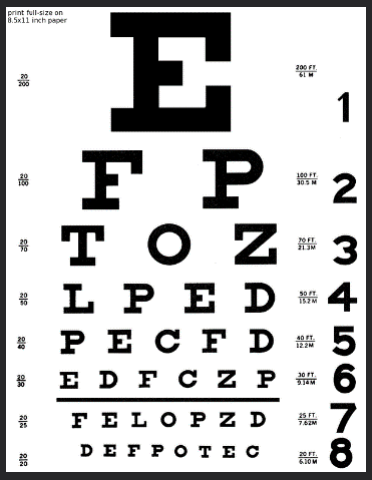
Ocular Trauma

- Exam
  - Visual acuity
  - Visual fields
  - Extraocular movements
  - Pupils
- Signs/symptoms
  - Deformity
  - Pain (at rest or with movement)
  - Vision loss
  - Double vision



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Ocular Trauma

- Injuries
  - Eye
    - Corneal abrasions
    - Subconjunctival hemorrhage
    - Hyphema
    - Foreign bodies
    - Globe rupture
    - Lens dislocation
    - Retinal detachment
    - Vitreous hemorrhage
    - Traumatic iritis

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Ocular Trauma

- Injuries
  - Surrounding structures
    - Orbital fractures
    - Lacerations (lid margin, tarsal plate, nasolacrimal duct)
    - Retrobulbar hematoma/hemorrhage

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Ocular Trauma

Subconjunctival Hemorrhage

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Ocular Trauma

Globe Rupture

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Ocular Trauma

Hyphema

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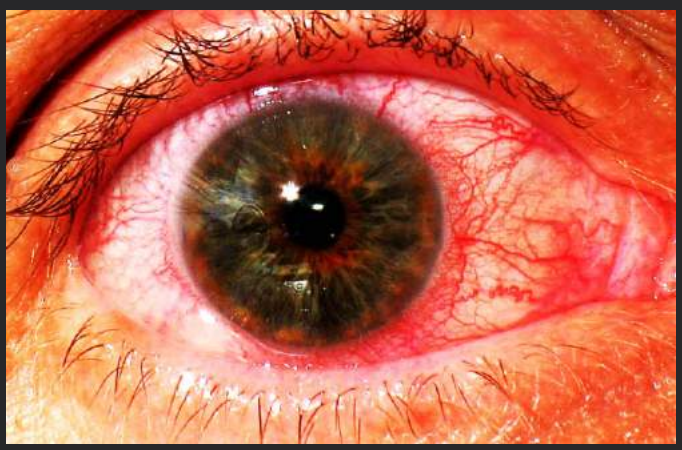
Ocular Trauma



Traumatic Iritis

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Ocular Trauma

Corneal Abrasion (with fluorescein staining)

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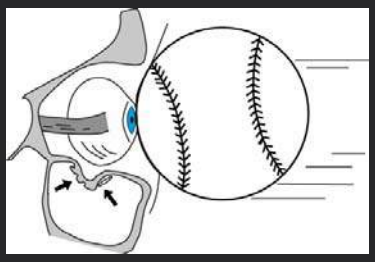
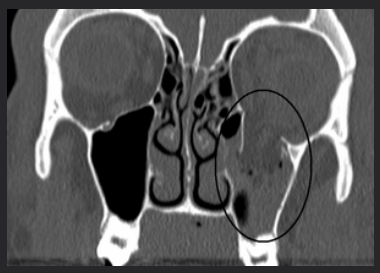
Ocular Trauma

- Blowout fracture





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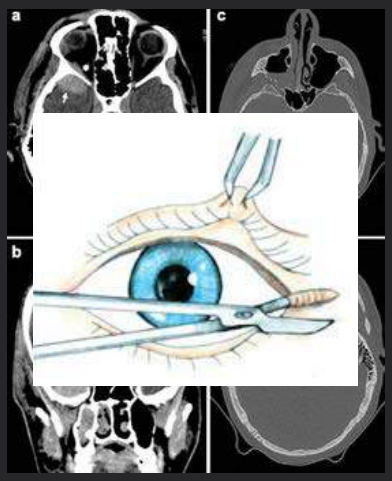
Ocular Trauma



Retrobulbar hemorrhage

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Nasal Trauma

Concerns

- Uncontrolled bleeding

- Anterior vs posterior?

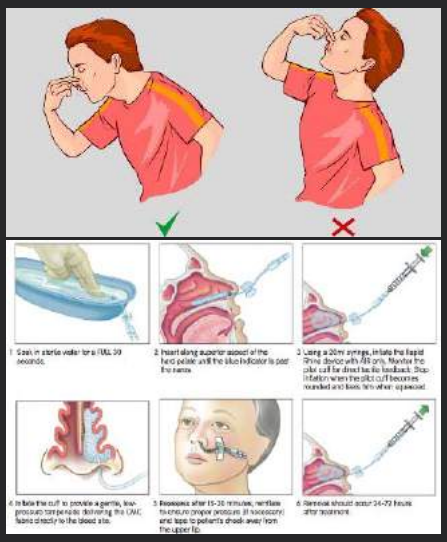
- CONSTANT, direct pressure

- Do not check to see if bleeding has stopped

- Oxymetolazine, Lidocaine with Epinephrine

- Silver Nitrate

- Packing (RhinoRocket, Rapid Rhino)



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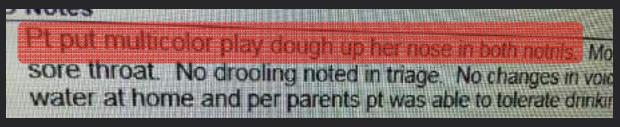
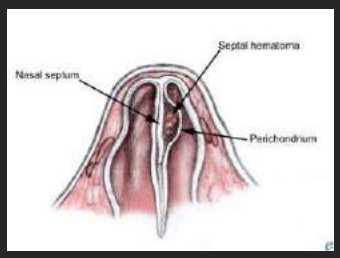
Nasal Trauma

- No airway problem, no problem
- Fracture
  - Need to reduce?
- Do I need to worry about septal hematomas?





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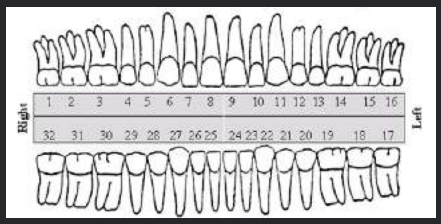
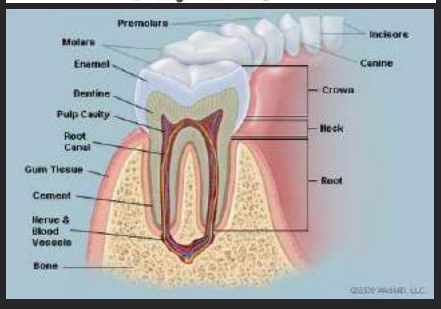
Dental Trauma

- Basic tooth anatomy
  - Which tooth?
  - What part?
- Signs/symptoms
  - Deformity
  - Pain
- Injuries
  - Fractures/avulsions
  - Loose teeth

Complaint	Age
HUMAN BITE TO RIGHT LEG	F32
DENTAL PAIN	M33





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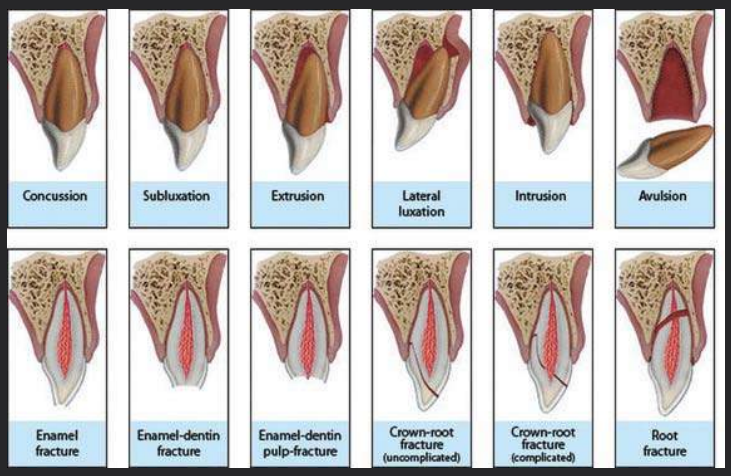
Dental Trauma

- Injuries
  - Avulsion
  - Subluxation
  - Intrusion
  - Extrusion
  - Fracture



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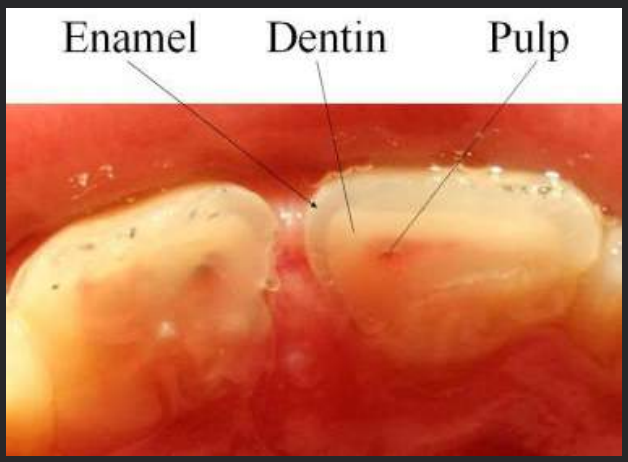
Dental Trauma



Fracture

NewYork-Presbyterian

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