

THE
2026-27

Emergency Medicine
&
Acute Care
UPDATE

*A 20-hour Course focused on Key Clinical Topics in
Emergency Medicine and Acute Care*



AMERICAN EDUCATIONAL INSTITUTE, INC.

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David R. Victor, JD
CEO

Dear Registrant:

You practice in one of the most demanding and unpredictable environments in medicine. While staying clinically current is essential, it is just as critical to refine your ability to recognize subtle presentations, avoid diagnostic pitfalls, and act decisively when seconds matter. ***The 2026–27 Emergency Medicine and Acute Care Update*** has been designed with that mission in mind.

In this course you will receive 20 hours of instruction from national experts in emergency medicine, pediatrics, critical care, and related specialties. The lectures address a broad range of acute care topics, including high-risk presentations, pediatric emergencies, diagnostic challenges, and evidence-based imaging and management strategies. You will also explore key issues in clinical decision-making, resuscitation, and patient communication, with an emphasis on improving outcomes and reducing diagnostic error in the acute care setting.

To help you assess your comprehension, we have provided brief self-evaluations that may be taken either before or after the corresponding presentations. These tests are included in this syllabus and can be easily identified by the black edges of the pages on which they appear.

As always, I am eager for your feedback. Please take the time to complete the evaluation questions presented on screen for each lecture, and feel free to reach out directly to our faculty with questions or comments.

Finally, I encourage you to take advantage of the diversity of your colleagues enrolled in this course. Emergency physicians, primary care providers, physician assistants, nurse practitioners, and nurses all bring unique perspectives. Discussing these complex issues with peers from different disciplines will enrich your learning experience and broaden your approach to acute care.

Thank you for your participation, and please accept my best wishes for a safe, enjoyable, and rewarding trip.

Cordially,

AMERICAN EDUCATIONAL INSTITUTE, INC

David R. Victor, Esq.
CEO

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COURSE OBJECTIVES



After completing *The 2026-27 Emergency Medicine and Acute Care Update* you should have acquired the knowledge that will better enable you to better:

- Differentiate primary from secondary **headaches** and recognize clinical features that require urgent diagnostic evaluation.
- Understand **communication strategies** to effectively de-escalate and manage emotionally charged interactions with parents in pediatric healthcare settings.
- Review a structured method for **interpreting head CTs and identifying emergent pathology** in acute care settings.
- Recognize common **cognitive biases in clinical practice** and apply debiasing strategies to reduce diagnostic error and medicolegal exposure.
- Evaluate and localize **neuro-ophthalmologic** findings to distinguish urgent neurologic conditions from benign causes in the emergency setting.
- Identify and manage **urgent pediatric neurologic conditions**, including seizures, ataxia, encephalitis, demyelination, and stroke.
- Review tools and guidelines that support appropriate and consistent use **of imaging in the emergency department**.
- Examine the pathways to **leadership in emergency medicine** and the role of professional organizations in shaping physician identity, advocacy, and career sustainability.
- Recognize and evaluate serious **neurologic symptoms in pregnant or postpartum women** and identify appropriate diagnostic and treatment approaches.
- Better understand clinical strategies for diagnosing and managing **common pediatric respiratory emergencies**, including croup, bronchiolitis, pneumonia, and asthma.
- Improve recognition and management of **acute respiratory failure** while applying evidence-based strategies for safe intubation and mechanical ventilation.
- Apply evidence-based decision making to the appropriate use **of vascular imaging modalities** in emergency department patients.
- Apply a structured approach to evaluate and manage patients presenting with **coma or severely altered mental status**.
- Identify, evaluate, and manage **pediatric overuse injuries** using evidence-based prevention and rehabilitation strategies.
- Evaluate common **medical myths and misconceptions** using current evidence and clinical reasoning.
- Assess risk factors for **violence in healthcare environments** and implement strategies to identify, prevent, and manage aggressive behavior.
- Recognize patterns of isolated and grouped **cranial neuropathies** and apply localization strategies to guide appropriate diagnosis.
- Recognize and address **unhealthy alcohol use in emergency settings** using validated screening tools and brief interventions.
- Recognize clinically significant **drug–drug interactions** and determine appropriate strategies to prevent adverse outcomes.
- Recognize subtle but clinically significant **musculoskeletal injuries** frequently overlooked on initial radiographs and apply imaging strategies to avoid missed diagnoses.

All learning objectives above address IOM/ACGME core competencies.

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FACULTY DISCLOSURES



The individuals listed below have control over the content of *The 2026-27 Emergency Medicine and Acute Care Update*. None of them have a financial relationship with an ineligible company.

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Billy J. Allen, president, American Educational Institute

Michael P. Zintsmaster, MD, clinical content director, American Educational Institute

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Emily Rose, MD, FAAP, FAAEM, FACEP, faculty member

Robert J. Tubbs, MD, faculty member

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Leslie S. Zun, MD, MBA, FACEP, FAAEM, faculty member

Brian S. Fuehrlein, MD, PhD, faculty member

The following faculty members of *The 2026-27 Emergency Medicine and Acute Care Update* have a financial relationship with an ineligible company:

David M. Yousem, MD, MBA, faculty member, consultant for TrueLearn, Elsevier &
Medicolegal Expert Witness

All lectures presented by speaker with relevant financial relationships have been peer reviewed. All speakers with finance relationships have attested that clinical recommendations they make are evidence-based and free of commercial bias.

All relevant financial relationships have been mitigated prior to the start of this activity in accordance with the ACCME standards.

FACULTY

Jonathan A. Edlow, MD

Jonathan A. Edlow, MD, of Lancaster, Virginia, is a Professor of Medicine and Emergency Medicine at Harvard Medical School. He lectures nationally and internationally on topics such as stroke, TIA, subarachnoid hemorrhage, and various causes of weakness and dizziness. He is an internationally renowned expert on neurological emergencies. Dr. Edlow's specialty areas include ED quality assurance, ED physical layout and facilities redesign, physician professional development, and the creation and implementation of clinical practice guidelines. For the past 15 years, Dr. Edlow has contributed to the international development of emergency medicine in a variety of countries, participating in educational, quality assessment, and emergency care systems consulting projects. Practicing medicine since 1981, he is board-certified in both emergency medicine and internal medicine. In addition to being well-published in peer reviewed literature, Dr. Edlow has written a book on stroke, as well as two award-winning books for the lay public; one about the history of Lyme disease titled *Bull's Eye: Unraveling the Medical Mystery of Lyme Disease*, and the second titled *The Deadly Dinner Party: 15 True Medical Detective Stories*.

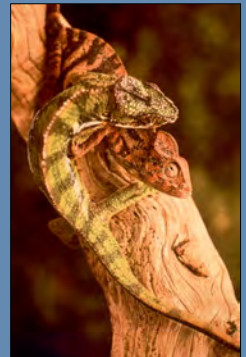
You may contact Dr. Edlow with your questions or comments at jedlow@bidmc.harvard.edu.

Secondary Headaches: Red Flags, Pitfalls, and High-Risk Diagnoses

Jonathan A. Edlow, MD

Secondary Headaches: Red Flags, Pitfalls, and High-Risk Diagnoses

Jonathan A. Edlow
Department of Emergency Medicine
Beth Israel Deaconess Medical Center
Professor, Harvard Medical School



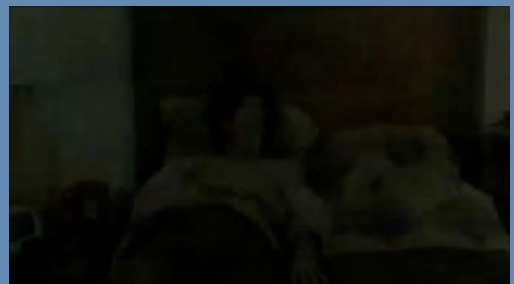
“Cannot Miss” Diagnoses

- **Masses**
 - Abscess & empyema
 - Tumor & cysts
 - Pituitary apoplexy
 - Hematoma
- **Infectious/inflammatory causes**
 - Meningitis
 - Encephalitis
 - Brain abscess
 - Epidural empyema
- **Vascular causes**
 - SAH
 - RCVS
 - Stroke & arterial dissection
 - CVST
 - Hypertensive crisis/PRES
- **CSF pressure-related**
 - Pseudotumor cerebri
 - Spontaneous intracranial hypotension
- **Miscellaneous**
 - CO poisoning
 - Giant cell arteritis
 - Narrow angle glaucoma

Which Patients Should Be Evaluated in the Emergency Department for a Secondary Cause of Headache ?

Can Response To Analgesics Help Diagnostically?

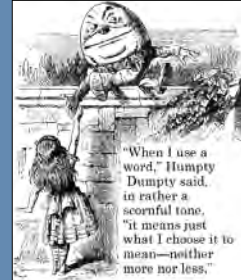
Favorable Response to Analgesics



While It Is Important to Adequately Treat Pain, a Good Response to Analgesics Does **NOT** Predict a Benign Etiology of a Headache

Pope; 2008; Headache and the ACEP 2008 Clinical Policy on headache

“Meow” means “woof” in cat
(George Carlin, comedian)



Be skeptical about words that patients (or clinicians) use
They may be wrong and bias us

When is a headache not just a headache?

When is a “head feels funny” a symptom to worry about?

When is a migraine (or sinus HA) not just a migraine (or sinus HA)?

Worrisome factors:

All patients with a new neurological exam findings including altered mentation

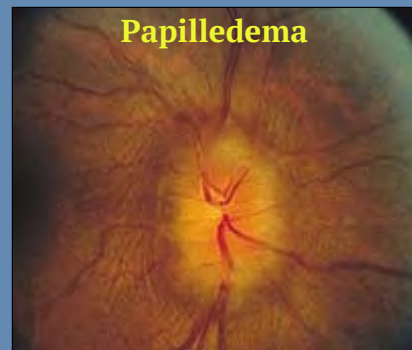
Exam Elements That Non-Neurologists Frequently Omit

Fundus examination

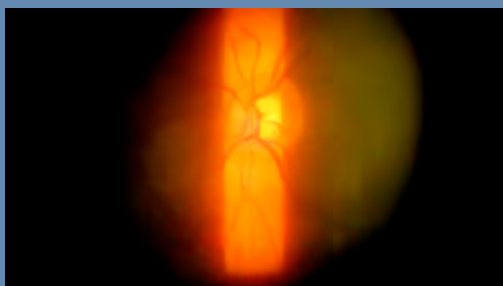
Visual fields & acuity

Gait testing

Papilledema



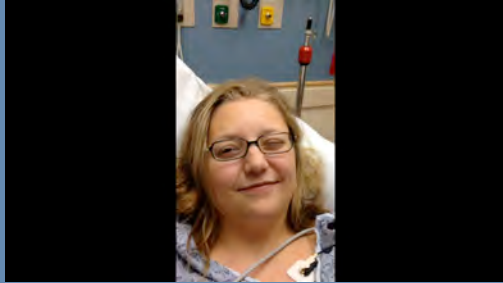
Venous Pulsations



Measure the Opening Pressure

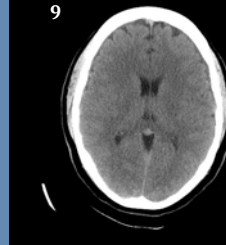


HA “Plus” Diplopia

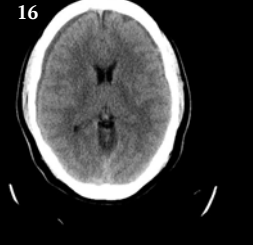


Positional Headache

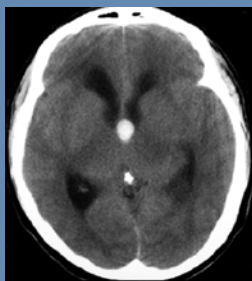
ED visit #1 January 9



ED visit #2 January 16

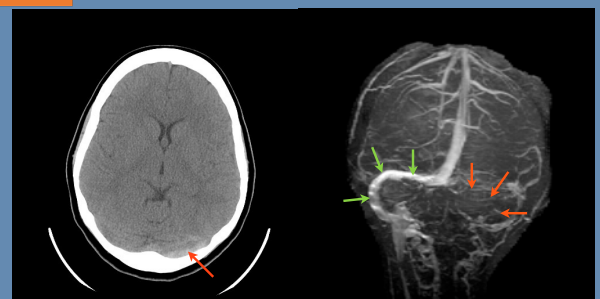
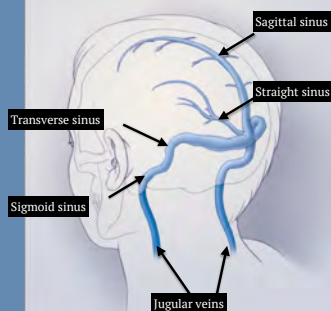
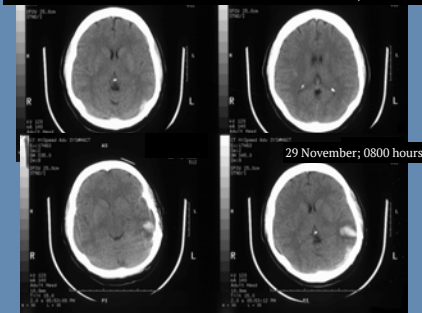


Another Case of Positional Headache

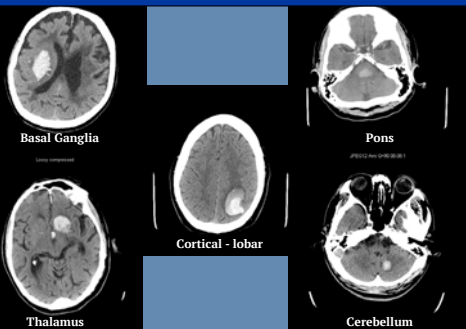


The Two-Visit “Migraine”

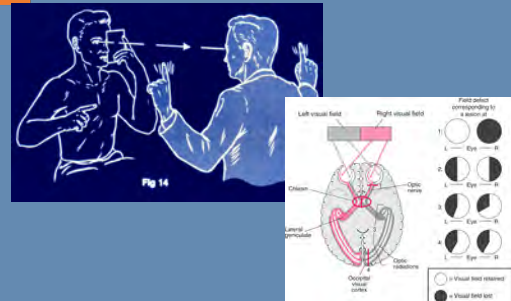
28 November, 1900 hours



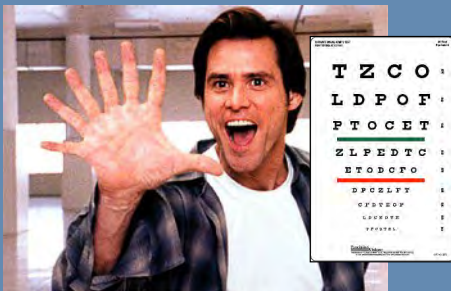
None of These Patients Had Headache!



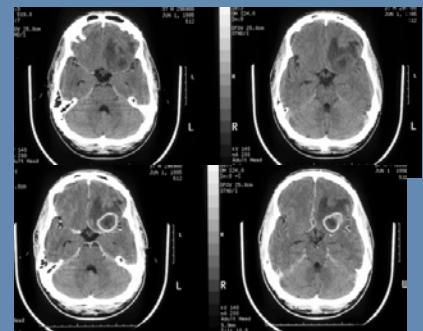
Visual Field Testing



How Many Fingers?



Limitations of the Physical Exam



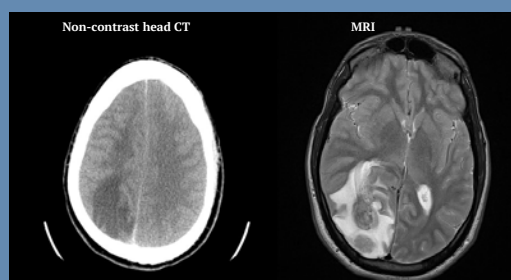
Frontal Lobes Are “Non-Eloquent”



Limitations of CT



Same Patient 3 Weeks Later



Brain Abscess

- Usually some identifiable source on history (of either bacteremia or sinus/ear infection)
- Fever & leukocytosis are often absent
- MRI is more sensitive than CT but CT is often positive (findings may be subtle)
- LP is risky and only *rarely* provides *diagnostically useful* information



Worrisome factors:

- Change in existing pattern
- Epidemiological context
- Immunocompromised
- Past systemic cancer
- Pregnant or postpartum
- Thunderclap onset
- New onset in the elderly
- Associated fever
- Head trauma (even minor in the elderly)

Change in Existing Pattern

- Increased frequency
- Increased severity
- Unusually long duration
- Change in the quality of the headache
- New or changed associated symptoms
- Not responding to medications as in the past

Change in Pattern New Symptoms



When is a migraine not just a migraine?

Cervical/Cranial Arterial Dissection

970 Dissections

Clinical factor	Carotid dissection (n=668)	Vertebral dissection (n=302)
Headache	70%	71%
Thunderclap headache	3.6%	9.2%
Neck pain	52%	70%
Ischemic stroke	52%	70%
Horner's syndrome	50%	0

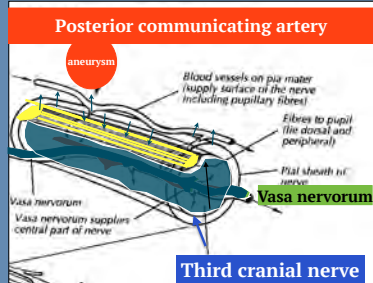
von Babo; 2013; Stroke

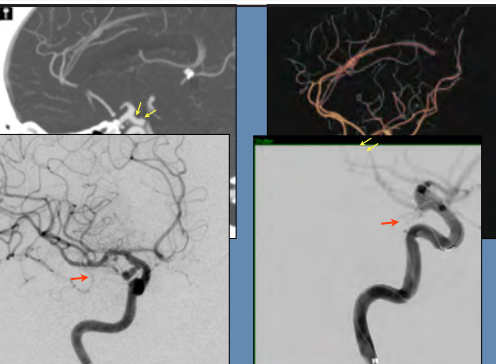
Change in pattern

Did not respond to zolmitriptan + diplopia

When is a migraine not just a migraine?

Section of 3rd nerve showing relation of the posterior communicating artery to the superficially located pupillary constrictor fibers





Epidemiological Context



When is "head feels funny" a symptom to worry about?

Epidemiological Context



PRES

Posterior Reversible Encephalopathy Syndrome

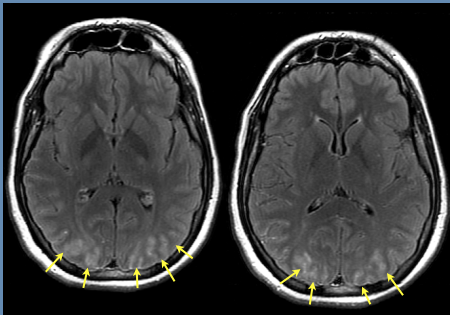
- Symptoms develop over hours, usually heralded by seizure in a context (pregnancy/ESRD, others)
- **Seizures** in 80-90%, usually at presentation
 - Usually generalized, nearly always accompanied by other symptoms (seizure "plus")
- **Headache** (gradual, bilateral, dull, rarely thunderclap) later in course
- **Visual symptoms** common - blurred vision, scotomata, diplopia, hemianopsia, cortical blindness (fundoscopic exam usually normal)
- **Altered mental status** (may or may not be due to NCSE)
- Elevated blood pressure in ~ 70-80%

Pregnant/Post-Partum HA

- Primary HA syndromes still the most common
- CVST - most common postpartum
- PRES
- RCVS - recurrent TCHs more common postpartum
- Low-pressure HA
 - Usually from neuraxial anesthesia (post-dural puncture)
 - Dural tears can occur spontaneously labor-related pushing
 - Rarely complicated by SDH
- Pituitary apoplexy

Edlow; 2013; Lancet Neurology

PRES - Imaging (FLAIR)



Hypertensive Encephalopathy

- Severe hypertension **with acute end-organ damage**; this does **NOT** include isolated headache
- The specific pressure is not the important marker

Treatment of Hypertensive Crisis

- Parenteral agents (nicardipine, clevidipine, labetalol)
- Do not lower BP > 25% of peak
- Do not lower BP < diastolic of 100-110 (depending on the pre-morbid BP)

Mode of Onset - Thunderclap Headache ?

Abrupt onset (within seconds-minute(s))

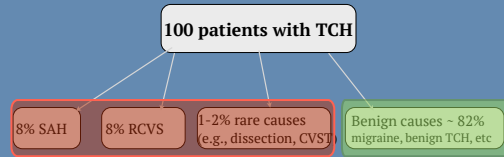
Intensity (reaches maximal in minutes)

Duration (variable: hours to days - **self limited**)

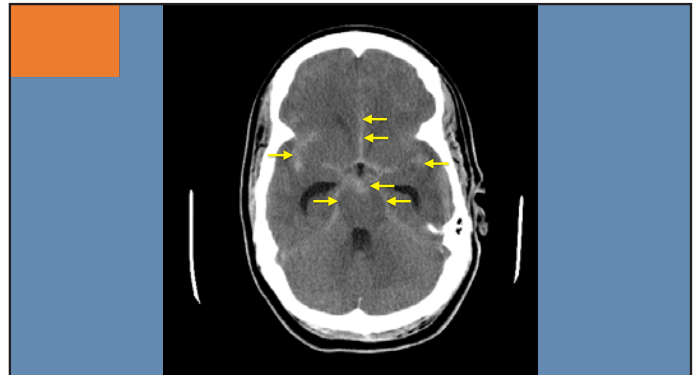
Quality (unusual, unique compared to prior HAs)

Location (unimportant: focal or generalized)

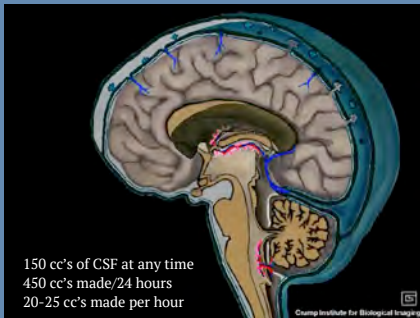
TCH - How Often Is It Caused by a Serious Problem?



Because of the significant overlap in clinical presentations, diagnostic testing is *always* indicated in patients with TCH



Circulation of CSF



RCVS

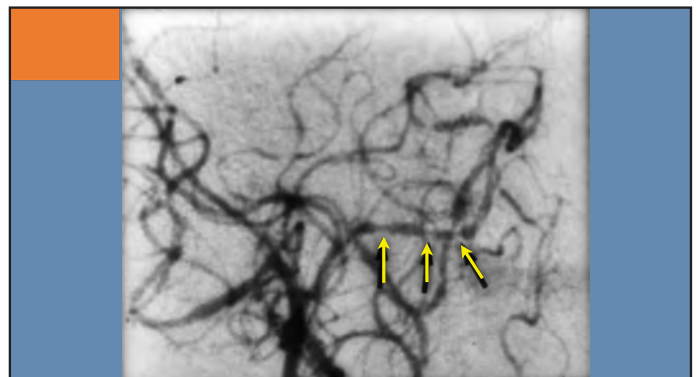
Reversible Cerebral Vasoconstriction Syndrome
(Formerly Called Call-Fleming Syndrome)

- In 2 ED series of patients with TCH, 8-9% incidence
- Multiple TCHs, frequently misdiagnosed
- Headaches tend to be short duration (1-3 hours)
- Frequent RCVS triggers
 - Pregnant/postpartum
 - Drugs - marijuana, vasoactive & immunosuppressive drugs
 - Sexual activity, hot/cold exposure (bathing/showering)

Ducros; 2015; Lancet Neurology

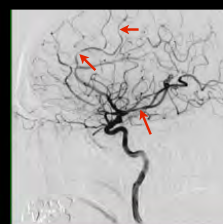
RCVS

- Imaging and CSF usually normal; unless complicated by ischemia or bleeding
- Diagnosis by cerebral angiography ("string of beads")
- Angiography often negative in 1st week
- Treat with Ca channel blockers; usually it's "reversible", but a significant minority have serious complications (stroke, seizures)

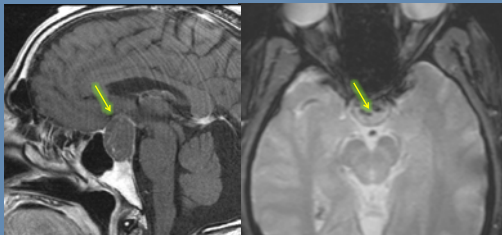


At presentation

4 weeks later
(without any treatment)



Headache + Pituitary apoplexy + "Bumping Into Things"



Sagittal T1 post-contrast injection showing enlarged sella lifting optic chiasm

Axial susceptibility showing punctate low signal foci suggestive of hemorrhage

Johnston; 2015; J Clin Neuroscience

Age + Minor Trauma



Age + Mild Confusion (No History of Trauma)



Carbon Monoxide Poisoning

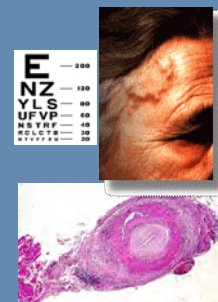
- Isolated headache at low CO levels
- "Flu-like syndrome"
- Tachycardia
- Context
 - Winter season
 - Clustering of cases
- Falsely reassuring O2 sat and PaO2!**
need to measure COHb levels



Weaver; 2009; NEJM

Ocular Causes: Giant Cell Arteritis

- Giant cell arteritis
 - Age > 60, female preponderance
 - Symptoms (PMR, jaw claudication, scalp tenderness, visual symptoms)
 - Signs (vision, retina, temporal artery tenderness & nodules)
 - ESR and (or CRP), platelet count
- Treatment
 - Empiric** steroids
 - Steroid effect & timing of temporal artery biopsy



Steroids for Giant Cell Arteritis Dose? Route? Timing?

- In patients without visual symptoms, give 1st dose of prednisone PO (60-80mg) in the ED
- In patients **with** visual symptoms, the other eye becomes affected
 - In 24h in 36% of cases*
 - Within a week in another 36% of cases*
 - Expert opinion is to give 0.5-1gm of IV methylprednisolone
- Will steroids affect the temporal artery biopsy results?
 - NO!!** not for 14 days^

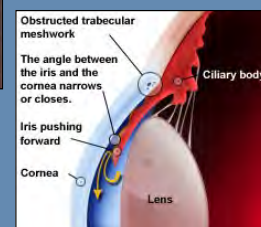
* Jonasson; 1979; Scott Med J

^ Achkar; 1994; AnnIM and Navarez; 2007; SemArthritis Rheum

Ocular Causes: Acute Narrow Angle Closure Glaucoma



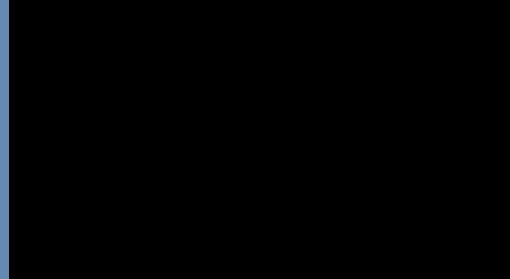
Brief episodes of (usually unilateral) HA, often with halos & photophobia



Documentation

- Avoid computer “macros”
- Document relevant details (positive & negative) in the history & physical exam
- Show that you understand the limitations of tests (especially non-contrast CT)
- Medical decision-making should include sufficient detail to show your thought process

Migraine Headache Is Common Don't Jump to Conclusions!



SELF EVALUATION

Secondary Headaches: Red Flags, Pitfalls, and High-Risk Diagnoses

True/False

1. Pain relief after an analgesic suggests a benign cause of a headache.
2. Anticoagulants are contraindicated in patients with cerebral venous sinus thrombosis who have an intracranial hemorrhage on their CT scans.
3. Patients with cerebral venous sinus thrombosis often have elevated ICP.
4. Tumors or abscesses of the frontal lobe of the brain usually present with early lateralizing motor findings.
5. Cervical artery dissections uncommonly present with a sudden onset severe headache.
6. Steroids should be started in the ED in patients with visual symptoms that are thought to be due to giant cell arteritis.

Answer Key: 1. F, 2. F, 3. T, 4. F, 5. T, 6. T

FACULTY

Emily Rose, MD, FAAP, FAAEM, FACEP

Emily Rose, MD, FAAP, FAAEM, FACEP, of Los Angeles, California, is the Assistant Dean for Career Advising in the Office of Student Affairs at Keck School of Medicine of the University of Southern California and Associate Professor (Educational Scholar) of Clinical Emergency Medicine and Medical Education at Los Angeles General Medical Center. A native South Dakotan, she trained in Emergency Medicine and was chief resident at Los Angeles County/ USC Medical Center and completed a Pediatric Emergency Medicine fellowship at Loma Linda University. She has been core Emergency Medicine faculty at LAC/USC Medical Center since 2010 where she continues to care for both sick/injured children and adults. Dr. Rose is a prolific educator with over 100 publications and over 1000 invited presentations locally, nationally, and internationally. Dr. Rose has been awarded several education awards including multiple LAC/USC faculty of the year awards, outstanding teaching performance, and the Honorable Mention Outstanding Speaker of the Year for the American College of Emergency Physician Scientific Assembly. She has been course director for several national Pediatric Emergency Medicine courses and has published two textbooks--one on life-threatening rashes and a practical clinical textbook for pediatric emergencies for EM-trained providers.

You may contact Dr. Rose with your questions or comments at emilyros@usc.edu.

Navigating Challenging Conversations with Parents in Pediatric Care

Emily Rose, MD, FAAP, FAAEM, FACEP

Navigating Challenging Conversations with Parents in Pediatric Care

Emily Rose, MD FAAP FACEP

Director for Pre-Health Undergraduate Studies
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Associate Professor of Clinical Emergency Medicine (Educational Scholar)
Los Angeles General Medical Center
Los Angeles, CA

Outline

Convince you these concepts will change your life

Talk about us and how we contribute to conflict

Specific tools from teachers and principals

De-escalation pearls

Specific case scenarios

Drivers statistics

According to the doctors...

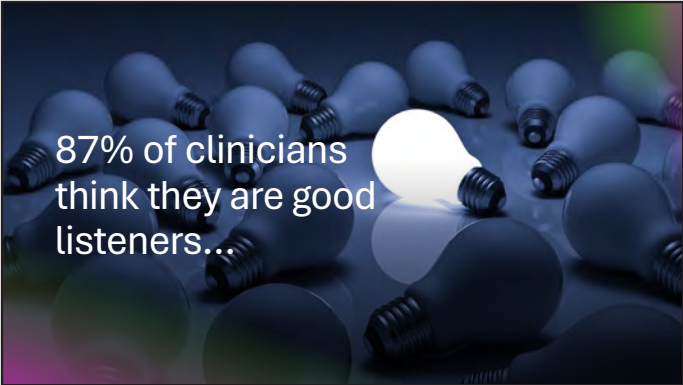
75%

According to the patients...

21%

Everyone has blind spots

FEEDBACK



87% of clinicians
think they are good
listeners...

Time until interrupted a patient....



16 SECONDS



...MAYBE LESS



I would like to go into
Emergency Medicine...
But I don't want to hate my patients
--Med student applicant
and ED scribe

**Assume parents are doing the
best they can**

given their circumstances
(poor conflict resolution, poor role
modeling, stressful circumstances)

VALIDATION

is de-escalation

Communication Concepts

Ladder of inference (the story you are telling yourself)

→*Emotional reaction*

What is the **delta** between the facts and the story?

Change your response

- Changes the other person
- Doesn't give negativity power over you

A
Patient/parent
might hear...

- 🗣️ How you deliver information
- 📄 What information you deliver
- 🔄 Things they don't understand
- 🧠 Is there an explanation for why they don't feel well?
- 💊 Is there a treatment?
- ❓ What else?

And all this is heard through...

Mental Illness
Isolation
Anxiety
Lack of Resources
Frustration
Ownership
Work Difficulty
Pain
Fear
Discomfort
Stress
Overall Impression of Healthcare Systems
Secondary Gain
Appeasing Family
Impression of Specific Physician/Nurse/Provider

Mr. Gillmore

Jihan Akhtar, MD: The Difficult Patient
Medical Economics Physician Writing Contest
Honorable Mention

Wise Principal's Advice

"You don't have to prove who is in charge, everybody know who is in charge."

You will never win an argument with argumentative person (they are good at it)

Zorro's Circle of Influence

Verbal De-escalation

A victory for everyone
Team approach
Requires *training* and *practice*

>90% of **emotion** and >50% of what is **spoken** is communicated **non-verbally**

Verbal De-escalation

Empower patients to **calm themselves**

Verbal de-escalation

Having a **positive regard** for the patient is **more effective** than *any* method/tool/formula...

Verbal de-escalation

Empathy

10 Domains of verbal de-escalation

1. Respect **personal space**
2. Do not be **provocative**
3. Establish verbal contact
4. Be concise and keep it **simple**
5. Identify wants and feelings
6. Listen to the patient and **give acknowledgement**
7. Agree or agree to disagree
8. Lay down the law and set **clear limits**
9. Offer **choices** and optimism
10. **Debrief** the patient and staff

Richmond JS, Berlin JS, Finkkind AB, Holliman GH Jr, Zeller SL, Wilson MP, Bille MA, Ng AT. Verbal de-escalation of the agitated patient: consensus statement of the American Association for Emergency Psychiatry Project BECA de-escalation workgroup. *West J Emerg Med.* 2012;13(1):17-25. Originally published in: Finkkind A. Calming agitation with words, not drugs: 10 commitments for safety. *Current Psych.* 2002;14(6).

2. Do not be **provocative**

Avoid iatrogenic escalation

Calm voice

Align and create **common goals**

Empathy

Sensitivity to humiliation

Treat them as a person worthy of your respect

7. Agree...or agree to disagree

Agree with the **truth**

Agree with the **principle**

Everyone should be treated with respect

Agree with the **odds**

There are probably other patients who would be upset

Empathy

Validation can de-escalate

Patient gains respect

Or, agree to disagree

Tips from teachers

- Lower your voice
- Do not be bullied (do not physically retreat)
- Look parents straight in the eye (a sign of confidence)

Phrases to use

I can tell that you **really care** about your child

Tell me more about your concerns

What is your **greatest fear**?

What do you think **would help** address your concerns?

I am sorry that happened

I am sorry that you feel we haven't addressed your needs



Case 1

Minor head injury—
PECARN negative but
parents really want the
scan



Case 2

Parents are
disrespectful of you,
your knowledge,
your credentials...



Case 3

Mom is **MAD** that dad
allowed you to perform
a urinary catheter and
she is coming in hot in
five minutes...

Case 4

A parent discovers
an error in
management

Case 5

Patient is critically ill and
father is physically in the
resuscitation team's
space

Take Home Points

- We control more of these interactions than we think
- Our response is the only thing that we can control
- Empathy for parents
- It's not about us

Thank you!
emilyros@usc.edu

SELF EVALUATION

Navigating Challenging Conversations with Parents in Pediatric Care

1. Which of the following is the most effective initial response when encountering an angry patient?
 - a. Match the patient's tone to assert authority
 - b. Immediately refer the patient to another provider
 - c. Listen actively and acknowledge the patient's concerns
 - d. Provide them with discharge paperwork
2. What often contributes to a patient or family member being perceived as "difficult"?
 - a. Lack of intelligence
 - b. Intentional desire to be disruptive
 - c. Underlying anxiety, pain, or fear
 - d. Non-compliance with treatment
3. When setting boundaries with a manipulative patient, which strategy is most appropriate?
 - a. Ignore their requests
 - b. Set clear limits and document interactions
 - c. Argue with them to prove your point
 - d. Discharge them immediately from the practice
4. Which communication technique is most helpful in diffusing a confrontational situation with a patient?
 - a. Using medical jargon to establish authority
 - b. Speaking in a calm, non-threatening tone
 - c. Minimizing the patient's complaints
 - d. Standing over the patient while speaking
5. What is the primary ethical consideration when dealing with a non-adherent patient?
 - a. Ensuring they are discharged from care
 - b. Respecting their autonomy while ensuring informed decision-making
 - c. Forcing them to follow your medical advice
 - d. Reporting them to insurance for non-compliance

Answer Key: 1. C, 2. C, 3. B, 4. B, 5. B

FACULTY

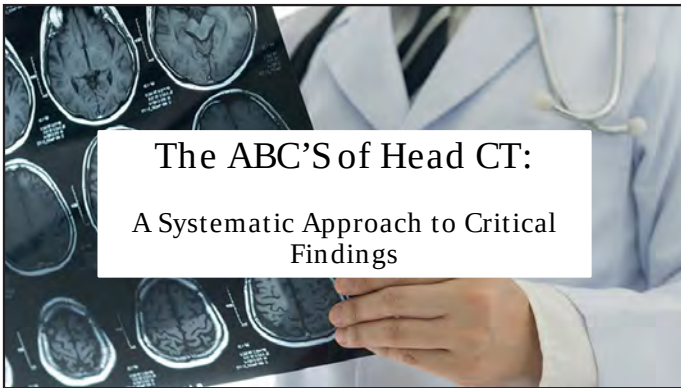
Robert J. Tubbs, MD

Robert J. Tubbs, MD, of Providence, Rhode Island, is an Associate Professor and clinician educator in the Department of Emergency Medicine at Brown University's Warren Alpert Medical School. He serves as Director of the Emergency Radiology elective for the Emergency Medicine Residency Program and has been recognized repeatedly for excellence in clinical teaching, earning awards such as the University Emergency Medicine Foundation "Excellence in Clinical Teaching" (2016) and the national ACEP Faculty Teaching Award. Board certified in Emergency Medicine, he is also an attending physician at Rhode Island Hospital, The Miriam Hospital, and Hasbro Children's Hospital, where he combines frontline patient care with educational leadership and innovative work in emergency radiology and medical simulation.

You may contact Dr. Tubbs with your comments or questions at tubbsrj@gmail.com.

The ABC's of Head CT: A Systematic Approach to Critical Findings

Robert J. Tubbs, MD



So why do we have to know
how to read these?



Sometimes the minutes
count!



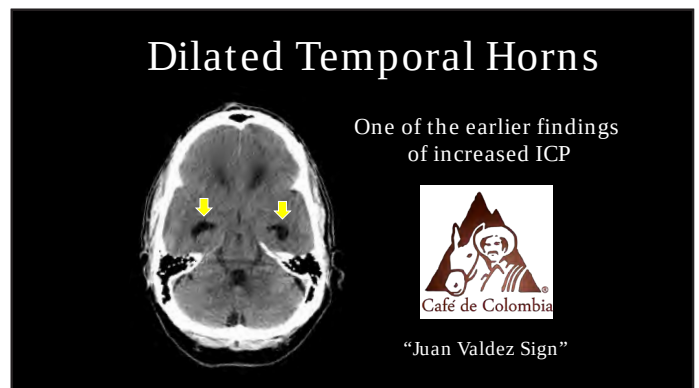
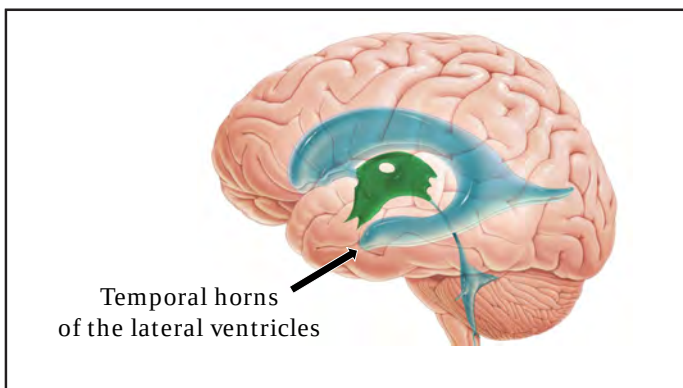
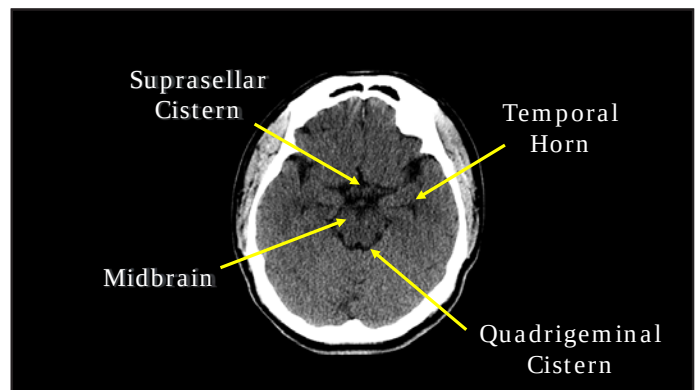
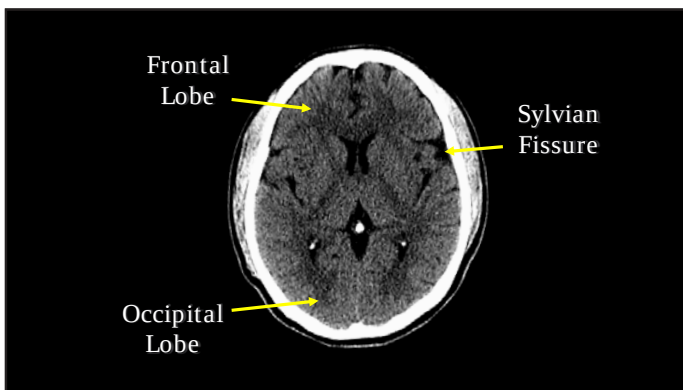
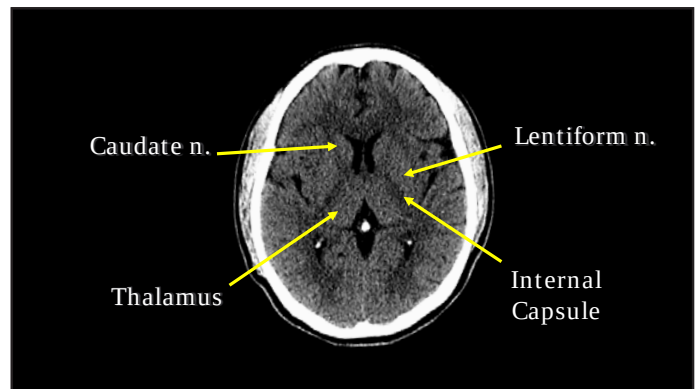
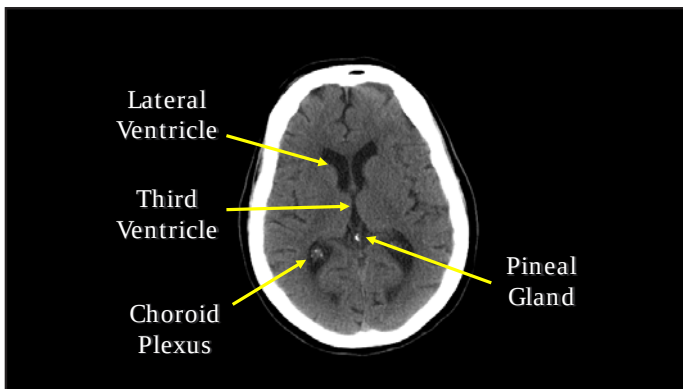
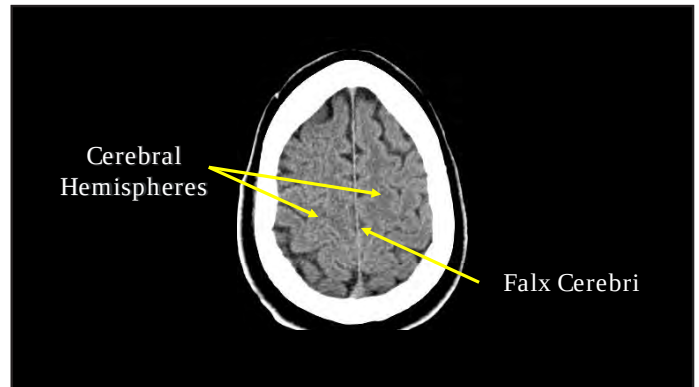
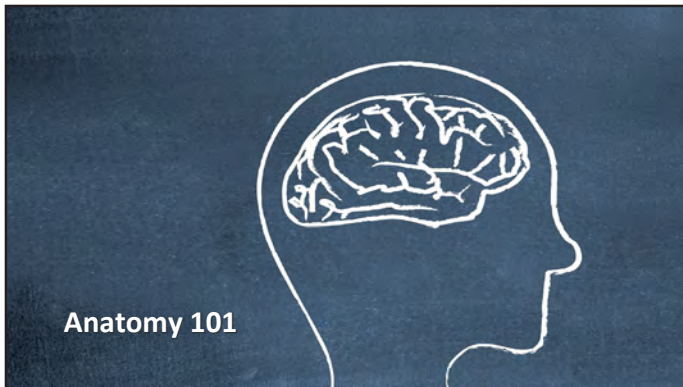
And nobody
is perfect!
(Even radiologists)

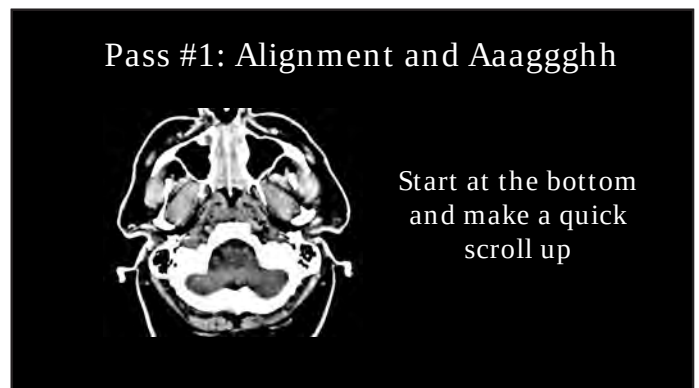
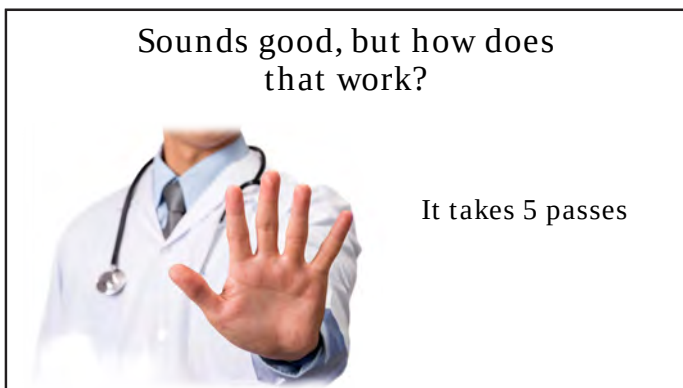
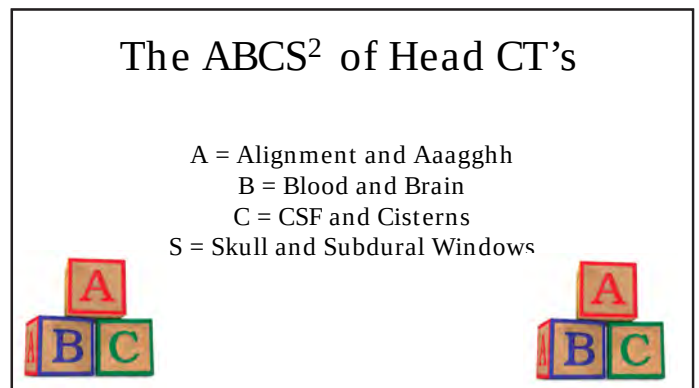
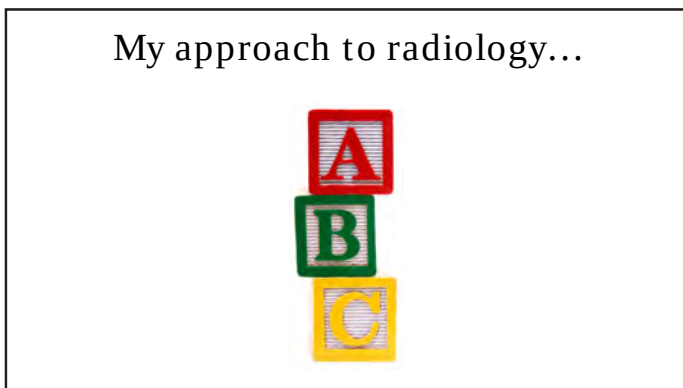
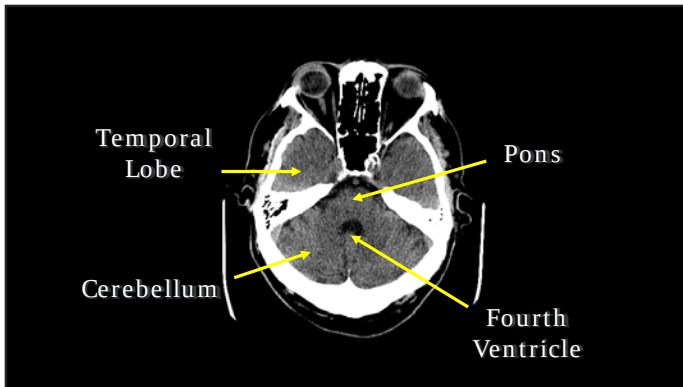


Get comfortable...
You can do this, I promise



- Review (briefly) relevant brain anatomy
- Explore a systematic way of reading head CT's
- Identify emergent, life-threatening pathology that requires immediate action





Use the eye structures to assess alignment



Not Aligned



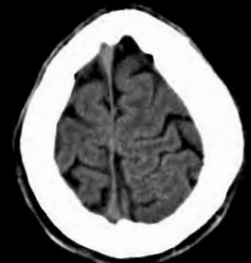
“AAAGGHH” Findings:



Large bleeds
Large masses
Midline shift

Pass #2: Blood & Brain

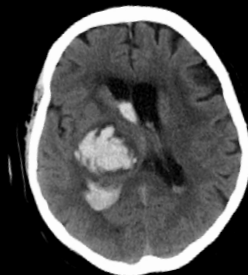
Now go back down
through the brain,
evaluating cross-sectional
anatomy



Pass #2: Blood & Brain

Look for:

1. Presence of blood



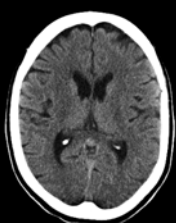
Pass #2: Blood & Brain

Look for:

1. Presence of blood
2. Grey-white differentiation



Grey-white differentiation

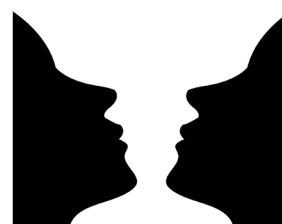


Normal grey-white



Loss of grey-white

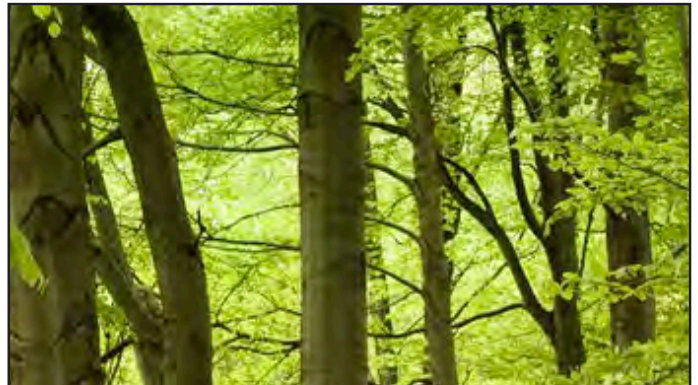
Thank Goodness for Symmetry!!!



Pay careful attention to
symmetry of white and gray
matter!

Loss of gray-white
differentiation is one of the
earliest findings in stroke

Bigger is not always better



“The forest for the trees”

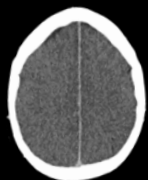
A caution with symmetry...

Symmetry is not always normal

- Global ischemia
- Bilateral subdural hematomas
- Hydrocephalus

CAUTION DANGER

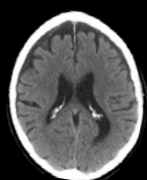
Symmetry Fakeouts



Global ischemia
w/ diffuse loss of
grey-white



Massive
Hydrocephalus



Bilateral frontal
chronic SDH

Pass #2: Blood & Brain

Look for:

1. Presence of blood
2. Grey-white differentiation
3. Edema



Pass #2: Blood & Brain

Look for:

1. Presence of blood
2. Grey-white differentiation
3. Edema
4. Masses

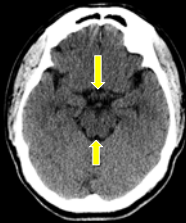


Pass #3: CSF and Cisterns

Now go back up through the brain,
evaluating the CSF spaces:

1. Basilar cisterns
2. Ventricles
3. Sulci
4. Herniation

1. Evaluate the Cisterns



Normal basilar cisterns



Blood filling the suprasellar and lateral cisterns

2. Evaluate the Ventricles

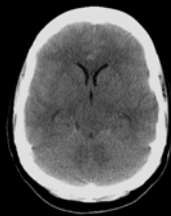
Too big?
Too small?
Or just right?



Ventricles

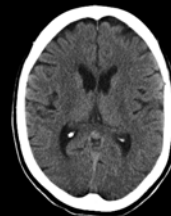


Normal ventricles

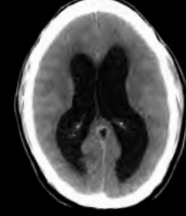


"Slit-like ventricles"

Ventricles



Normal ventricles



Enlarged ventricles

3. Evaluate the Sulci



Normal Sulci



Sulcal Effacement

4. Assess for signs of herniation

Different types of herniation:

1. Subfalcine (midline shift)
2. Transtentorial (uncal)
3. Cerebellar (tonsillar)

Subfalcine Herniation



Large SDH causing shift

Most common type of herniation

Drop a line from where the falx anchors, then measure how far off the septum pellucidum is

The contralateral ventricle is often enlarged due to impaired drainage ("ventricular trapping")

Transtentorial (Uncal) Herniation

Second most common type of herniation

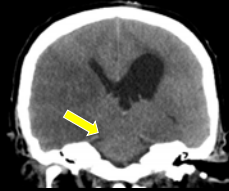
The uncus of the temporal lobe descends medially and under the tentorium



Large area of edema causing leftward shift

Transtentorial (Uncal) Herniation

It leads to obliteration of the basilar cisterns and compression of the brainstem



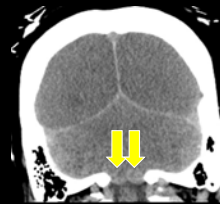
Large area of edema causing leftward shift

Cerebellar (Tonsillar) Herniation

Typically occurs when there is bilateral uncal herniation

Causes the cerebellum to be displaced inferiorly

Cerebellar tonsils herniate through the foramen magnum



Severe anoxic brain injury

Pass #4: Skull Windows

Now go back down through the scan set to bone windows



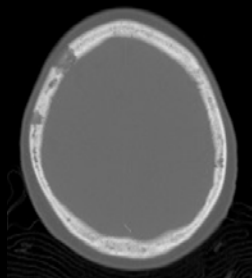
Skull (Bone) Windows

Should check bone windows on every patient, not just in trauma, to look for abnormalities like:

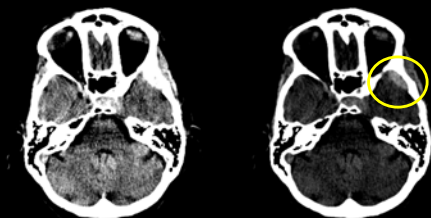
- Metastases
- Multiple myeloma
- Occult fractures (especially in the elderly)
- Air where it doesn't belong (pneumocephalus)



Classic Multiple Myeloma Lytic Lesions



Now what about this case?

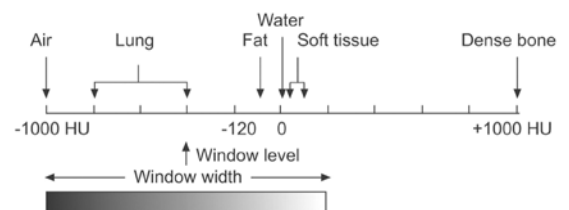


Looks slightly misaligned, right?

A word about windows

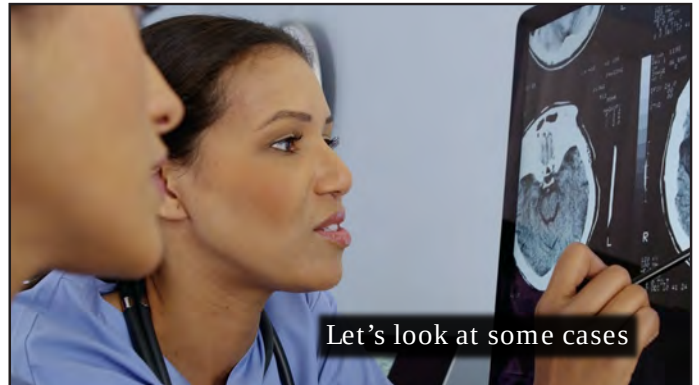
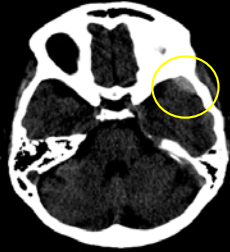


CT windows



Pass #5: Subdural Windows

Make the 5th and final pass back up the scan on subdural windows



32 y.o. fell down the stairs



Holohemispheric Subdural Hematoma



Subdural Hematomas



Most common cause of acute extracerebral injury

Also the most lethal!

Subdural Hematomas

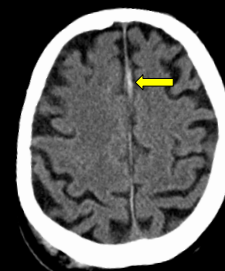
- o Usually venous from the cortical bridging veins
- o Usually crescent-shaped
- o Do not cross suture lines
- o Do not cross falx or tentorium

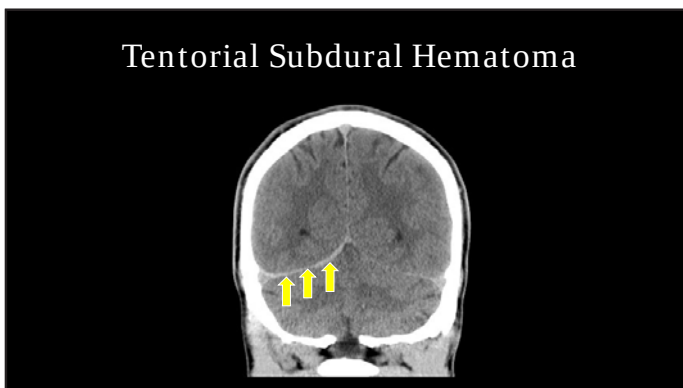
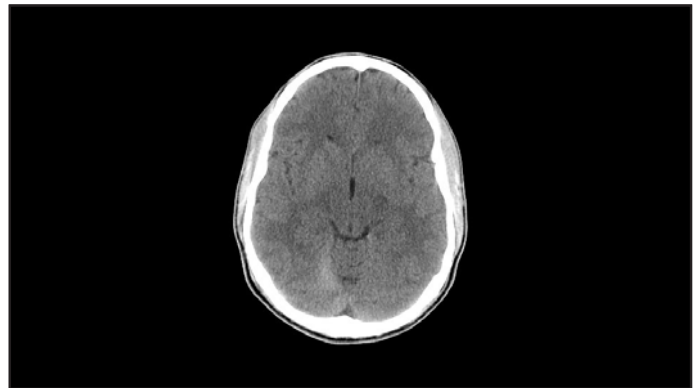
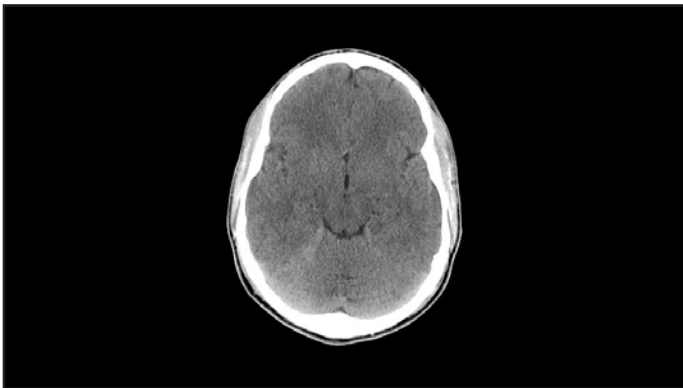
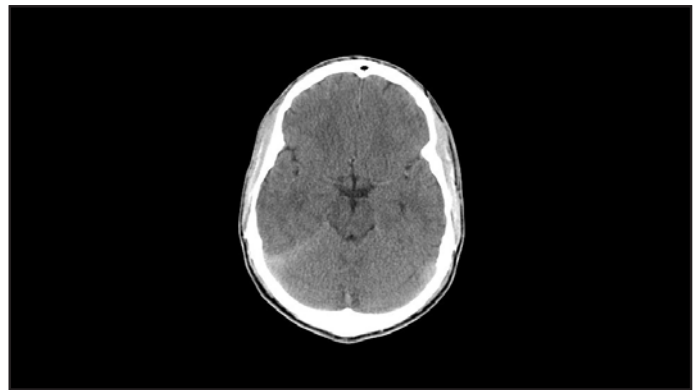
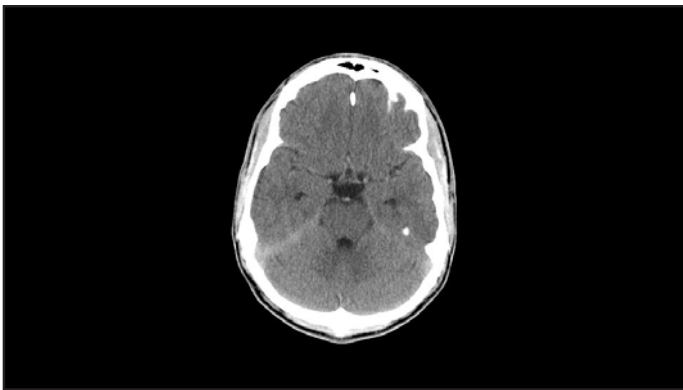
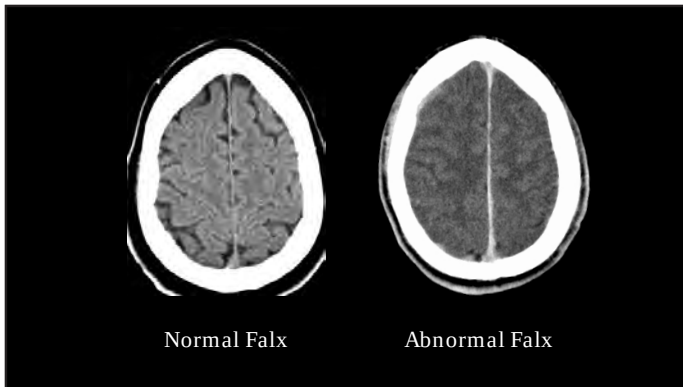


50 y.o. alcoholic fell



Parafalcine Subdural Hematoma





Let's talk about Subdural Hematomas

For the first week (acute period) the blood will appear hyperacute (bright)

From weeks 1 to 3, the clot begins to liquify and the blood will appear heterogenous, and may develop a fluid level

Subdural Hematomas

Keep in mind that as a SDH increases in size, it may put increased traction on the bridging veins, and new bleeding may occur even in the absence of new trauma, causing an acute on chronic appearance

“Grandpa’s more confused”

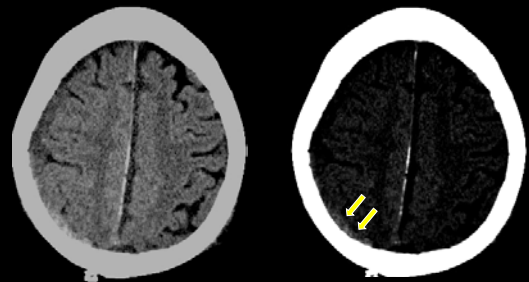


Mixed density of blood products layering out

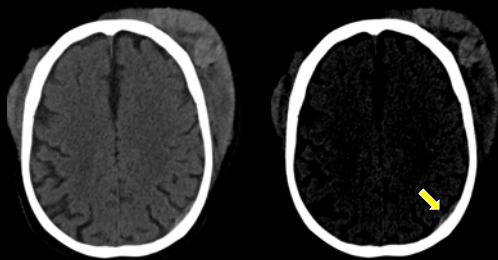
Areas of hyperacute density

Acute on Chronic Subdural Hematoma

Don't forget the subdural windows



They can be subtle!!



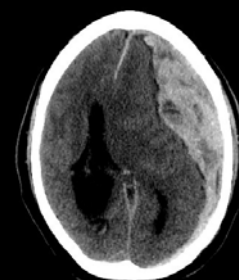
“Swirl Sign”

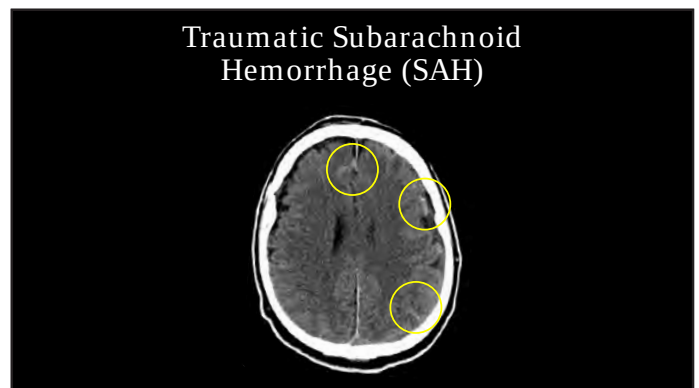
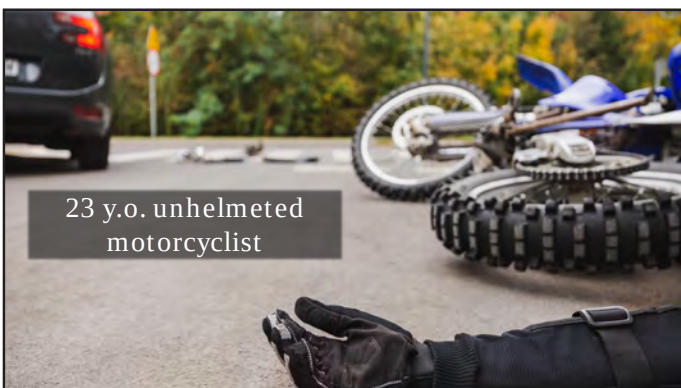
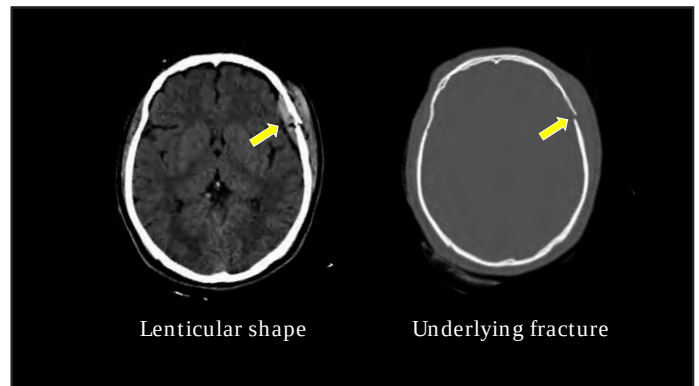
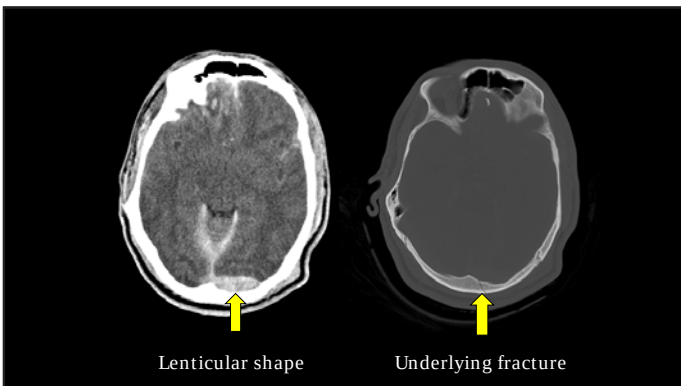
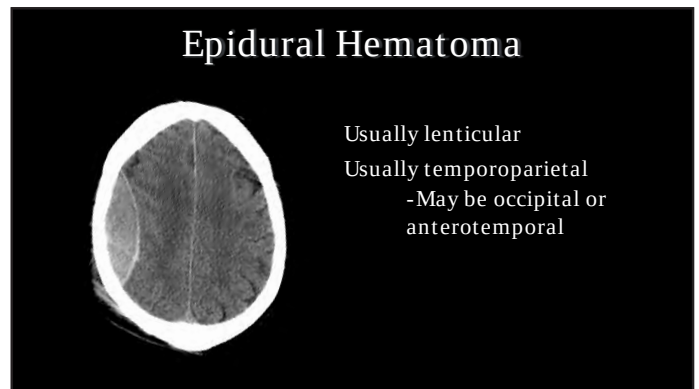
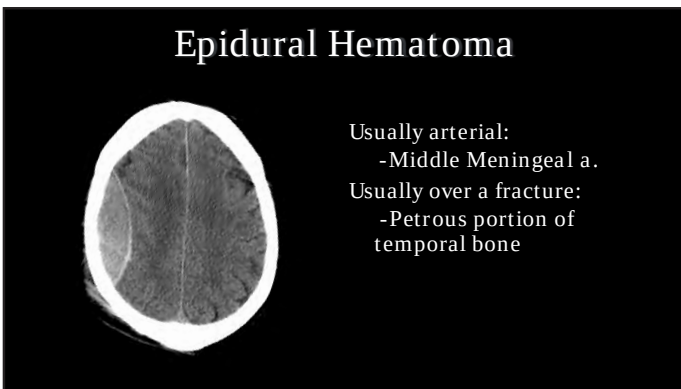
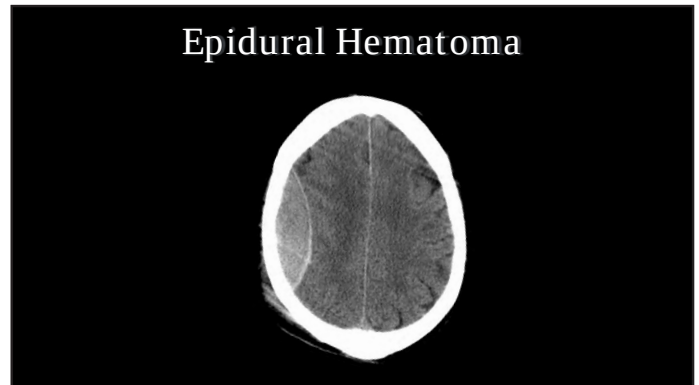


Also mixed density of blood products, but not layering out

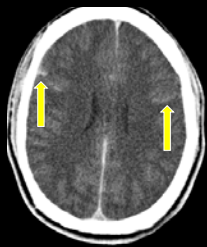
WARNING!!!!

This is a hyperacute bleed, and often needs emergent operative intervention!!





Traumatic Subarachnoid Hemorrhage (SAH)

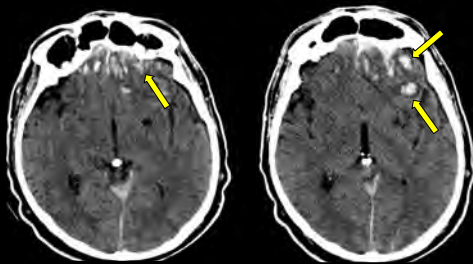


Linear peripheral hyperdensities that layer out in the sulci

Location and appearance differ dramatically from a spontaneous subarachnoid hemorrhage



Intraparenchymal Contusions



Intraparenchymal Contusions

Occur when the brain strikes ridges and crests of bone inside the skull

Occur most commonly in the frontobasal and anterior temporal regions



Skull Fractures

Skull fractures that are linear and do not have associated parenchymal injuries generally have little clinical significance

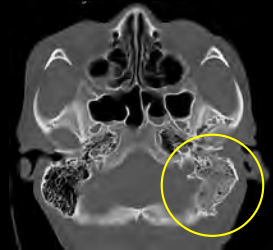


Basilar Skull Fractures

Basilar skull fractures can have multiple associated injuries:

- Hearing loss
- Facial nerve injuries
- Vascular injuries:
 - Carotid or venous sinus injuries

Get vessel imaging!!!



Basilar Skull Fractures

When you suspect it clinically:

Ask the radiologist for a temporal bone protocol

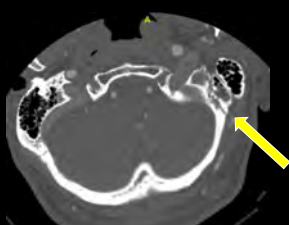
Get a CTA brain/neck to evaluate for possible vascular involvement



Raccoon eyes



Battle's sign

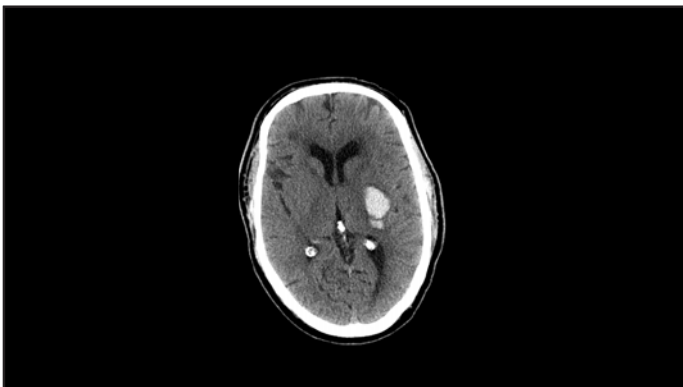
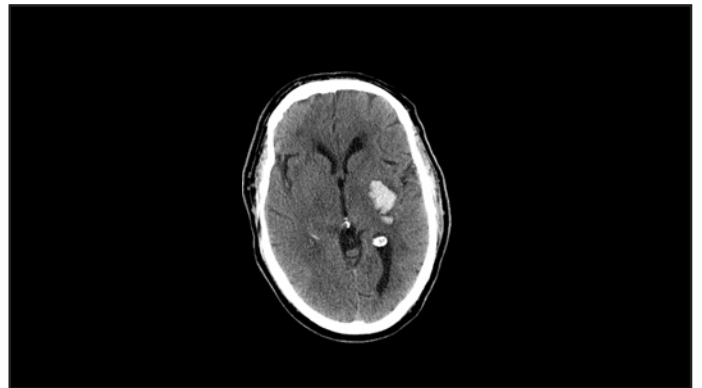
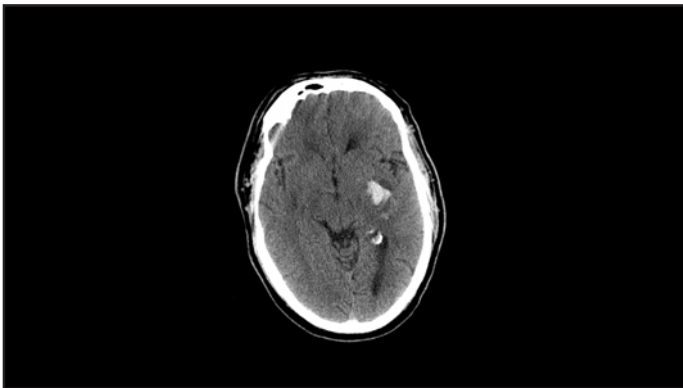
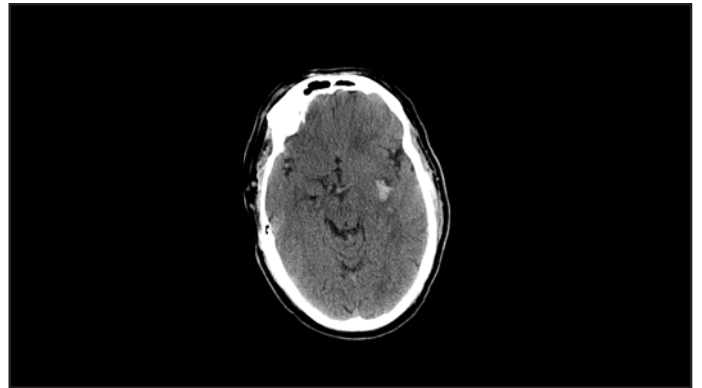
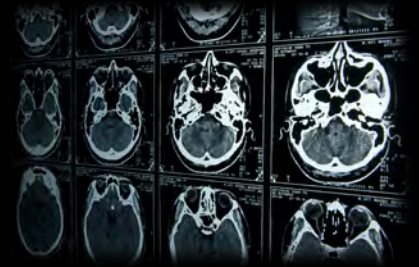


Fracture through the temporal bone with opacification of the mastoid air cell



Part 3:
Non-traumatic
Intracranial Disorders

Let's look at
some cases



Spontaneous Intracerebral Hemorrhage

The majority of these will be hypertensive bleeds

The 4 most common areas:

Basal Ganglia

Thalamus

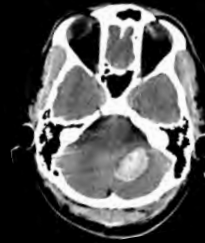
Cerebellum

Pons

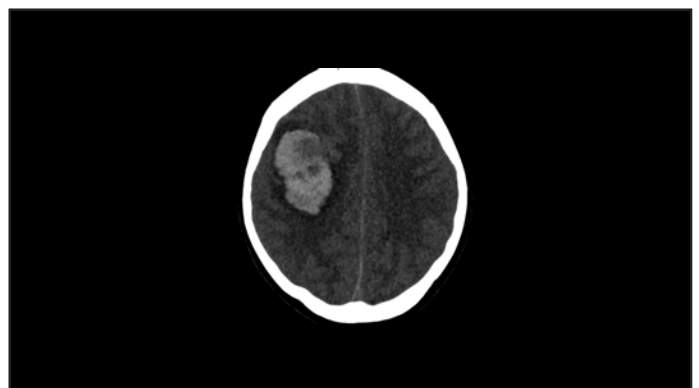
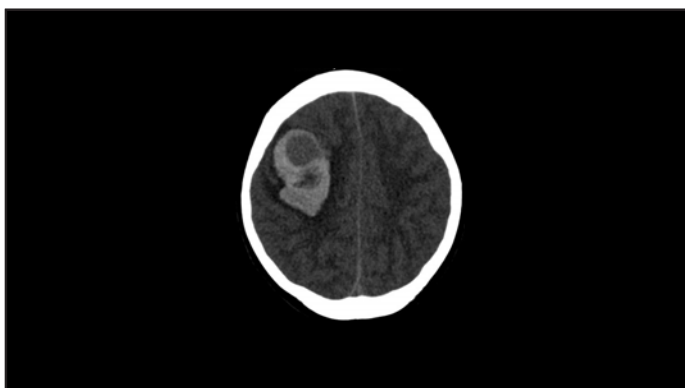
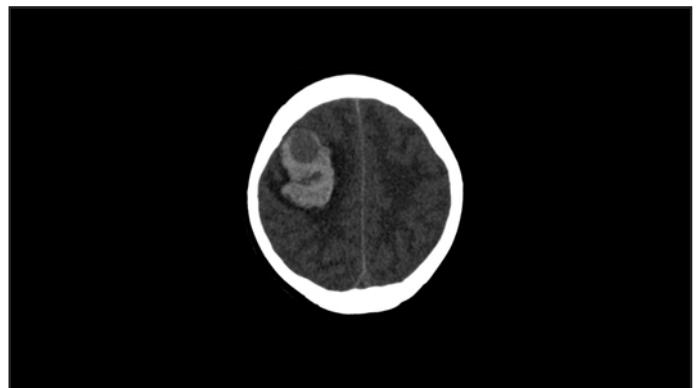
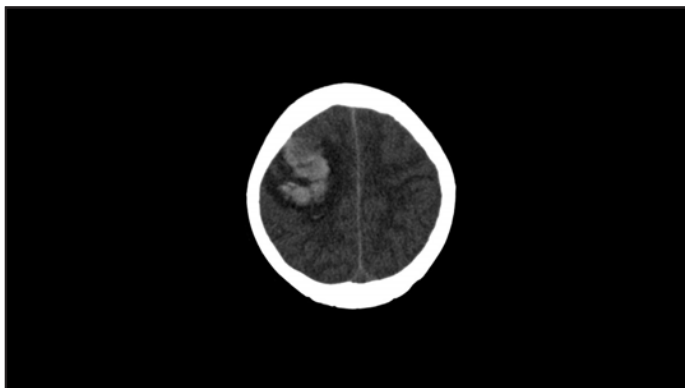
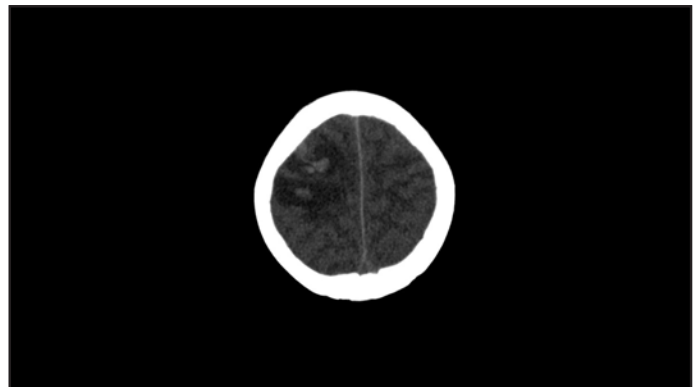


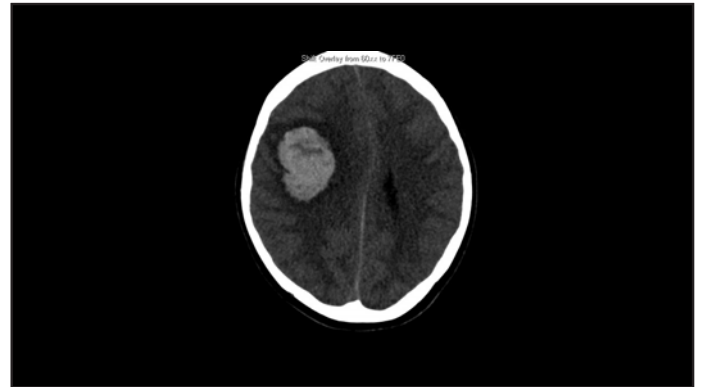
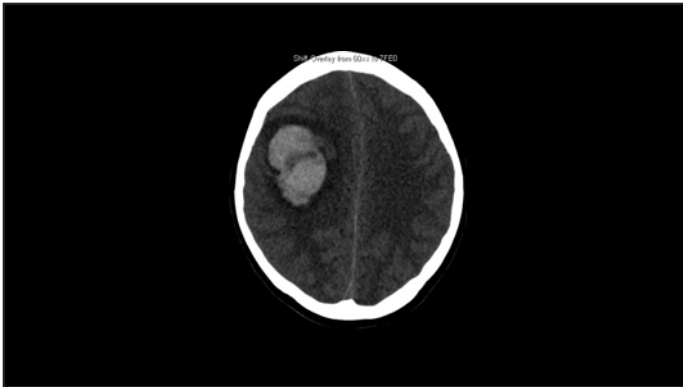
Cerebellar Hemorrhage

Posterior fossa lesions can cause dramatically increased intracranial pressures and can lead quickly to herniation



Not all spontaneous hemorrhages are hypertensive bleeds!





Non-hypertensive spontaneous IPH

Cerebral Amyloid Angiopathy (CAA)

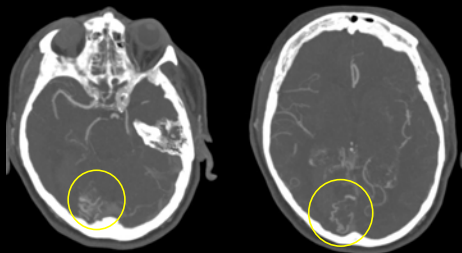
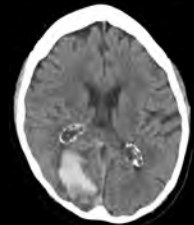
Underlying Masses

Arteriovenous Malformations



For spontaneous hemorrhages outside of the typical areas (basal ganglia, thalamus, cerebellum and pons)

Get a CTA to ensure there is no vascular abnormality that would require emergent vascular intervention



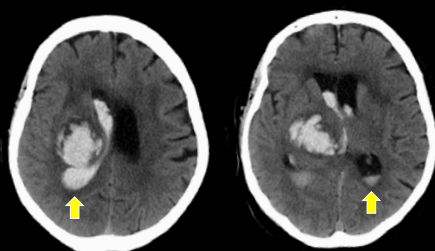
Dural AVM

Remember to assess the CSF and Cisterns

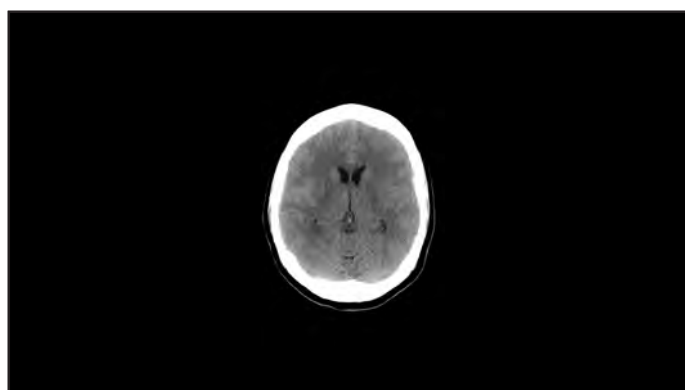
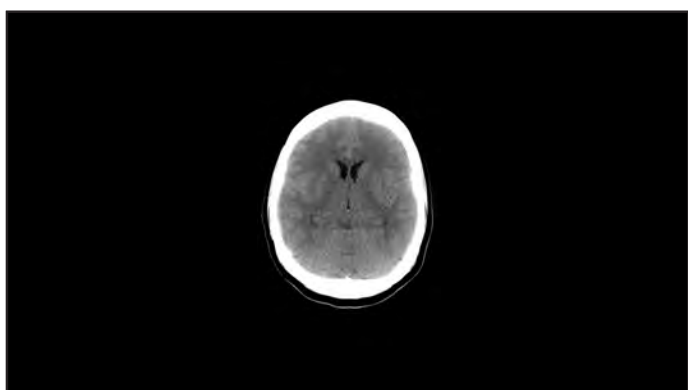
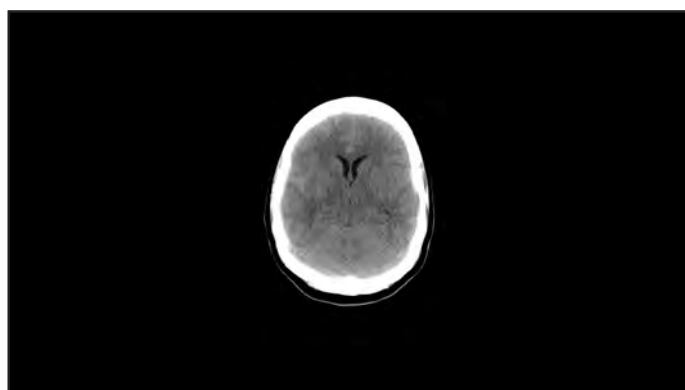
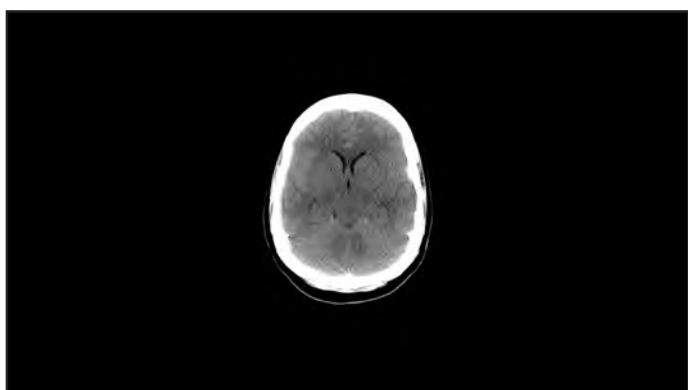
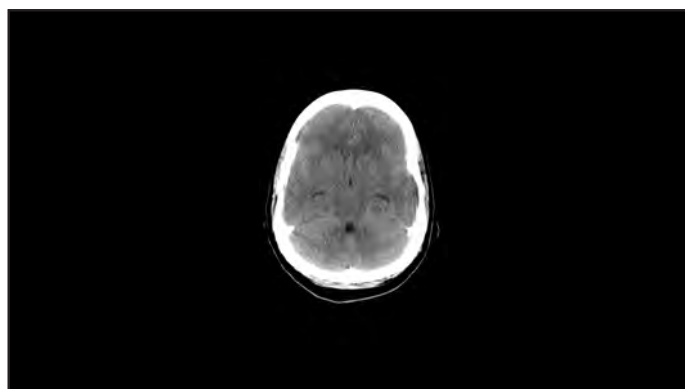
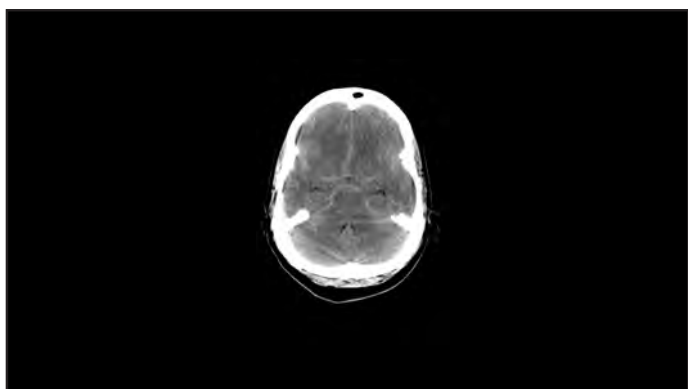
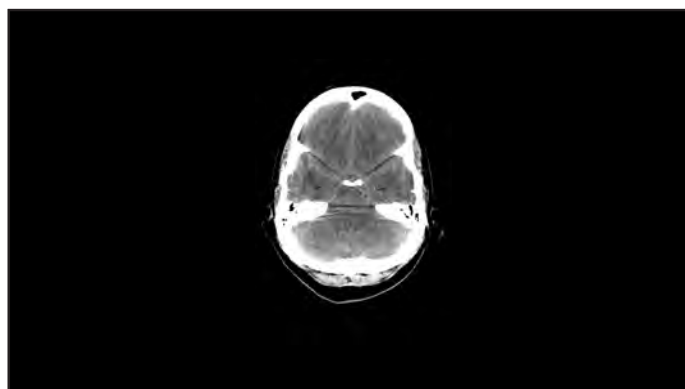
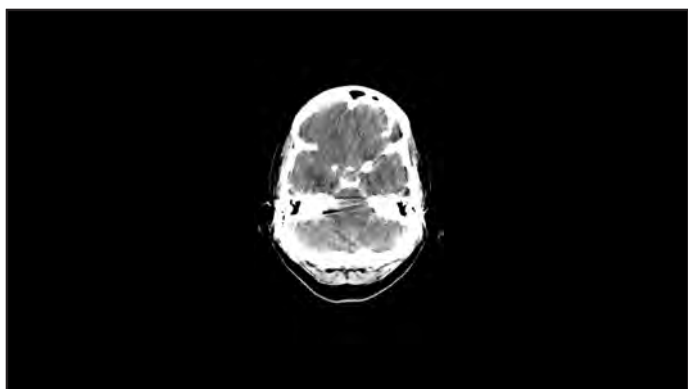
Assess for any intraventricular extension

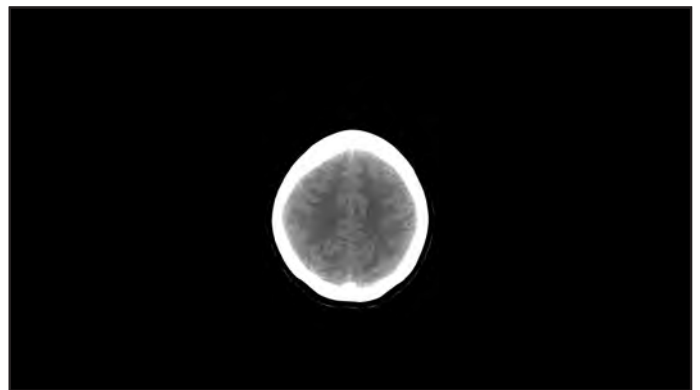
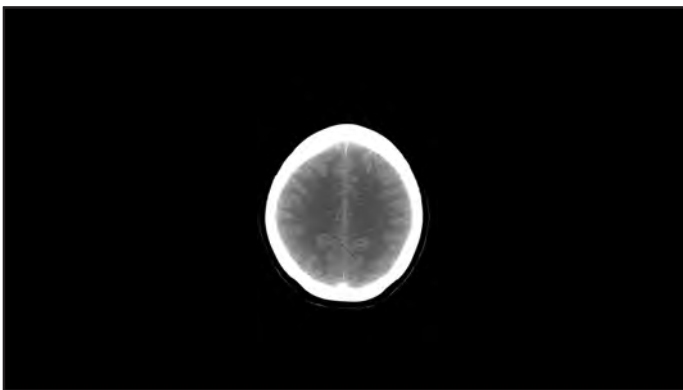
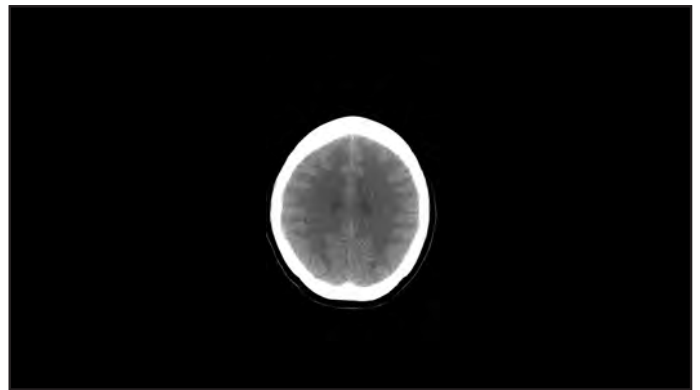
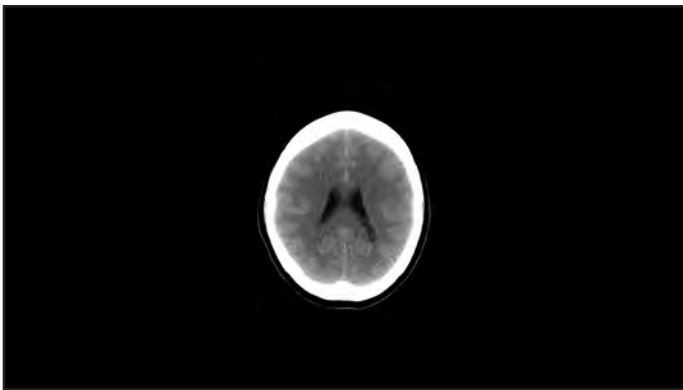
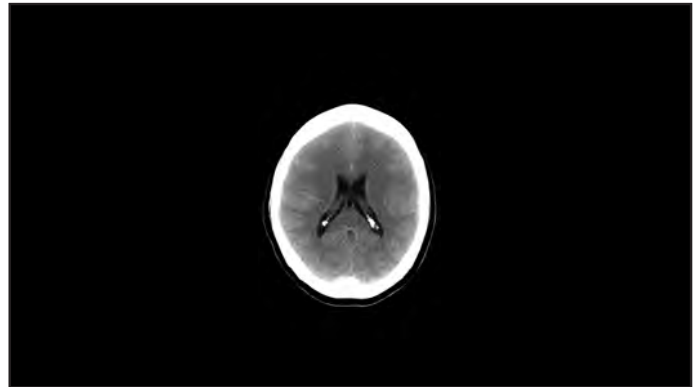
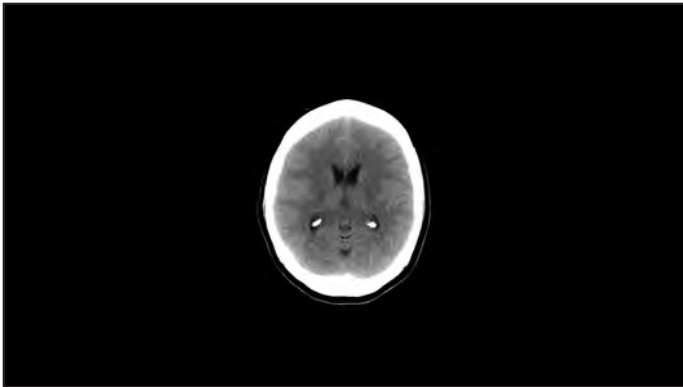
This can lead to obstructive hydrocephalus and may require external ventricular drain (EVD) placement

Intraventricular extension



35 y.o. male with sudden-onset headache





Spontaneous Subarachnoid Hemorrhage

Watch for the
“starfish”

Midbrain becomes
surrounded by
hyperdense
material



Spontaneous Subarachnoid Hemorrhage

Centered in the supracellar cistern because
that's where the Circle of Willis is



Spontaneous Subarachnoid Hemorrhage



Remember, a negative CT does not rule out a SAH

Sensitivity drops to 80% at 48 hours

Spontaneous Subarachnoid Hemorrhage

Watch for sulcal effacement
- Sign of edema and $\uparrow$ ICP



More examples of SAH



More examples of SAH

The "Juan Valdez" sign

- Dilated temporal tips of the lateral ventricles



What is the most common cause of SAH?



TRAUMA!!!



Traumatic SAH



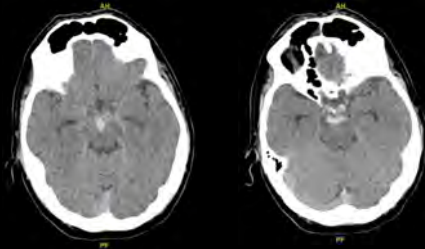
Remember traumatic SAH is in the periphery and layers out in the sulci

Other causes of SAH?

Cerebral vasculitis
Reversible Cerebral Vasospasm Syndrome (RCVS)
AVM
Neoplasm
HSV encephalitis
Secondary extension



And then there is this...

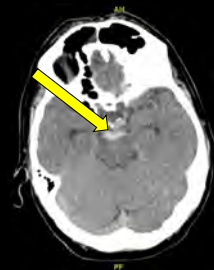


Peri-mesencephalic Bleed

Peri-mesencephalic Non-aneurysmal SAH

Blood extends in the perimesencephalic cistern in front of the midbrain

Presentation can be identical to an aneurysmal SAH with sudden onset severe HA, N/V, brief syncope



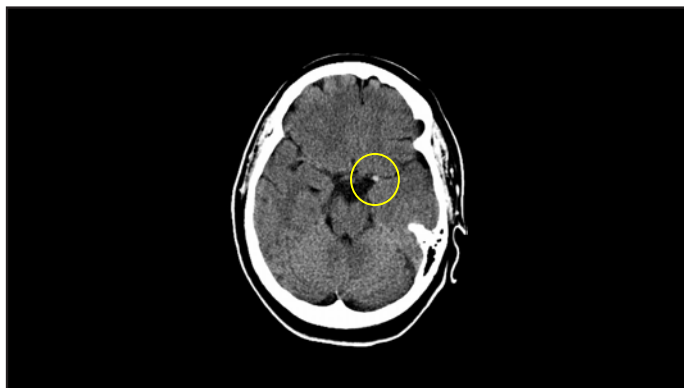
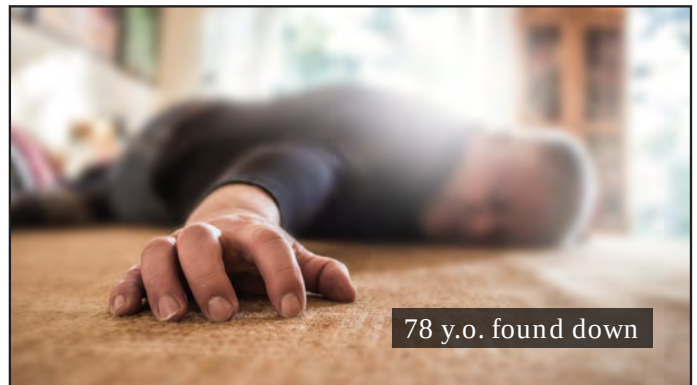
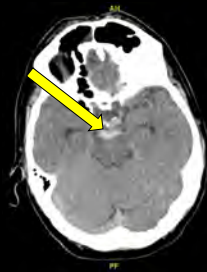
Peri-mesencephalic Non-aneurysmal SAH

10% of spontaneous SAH

Will have no aneurysm on CTA

Treat as aneurysmal until pt has negative angio (often x 2)

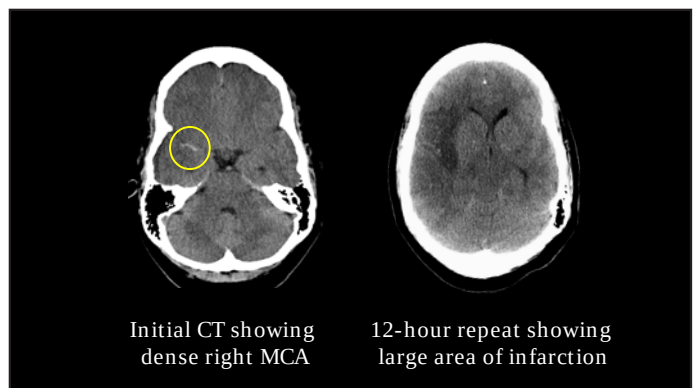
Excellent prognosis



“Dense Vessel” Sign

Dense clot in a vascular distribution

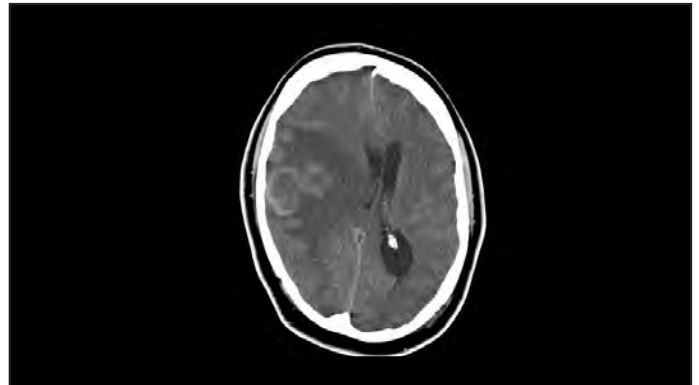
- MCA is more commonly seen
- May also see in basilar artery



Initial CT showing dense right MCA

12-hour repeat showing large area of infarction

54 y.o. female with
new-onset seizure



What do we see here?

Brain mass with
vasogenic edema and
shift



So what is the difference between
vasogenic and cytotoxic edema?

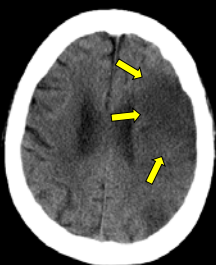


Vasogenic edema:

Typically caused by
disruption of the blood brain
barrier & leakage of proteins
into the brain parenchyma
leading to edema

The most common cause is
tumors

So what is the difference between
vasogenic and cytotoxic edema?

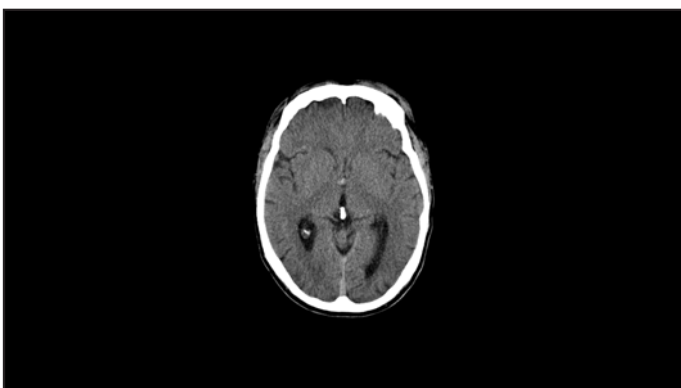


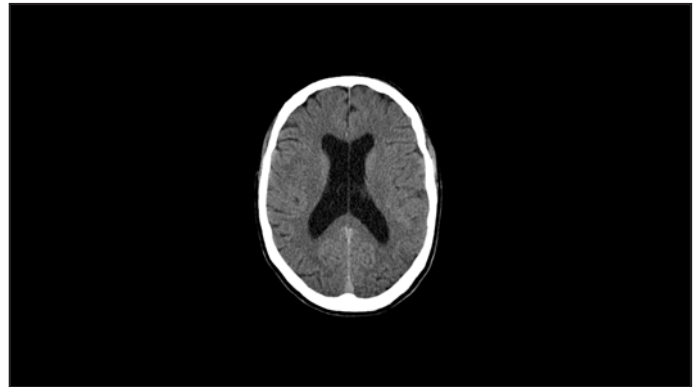
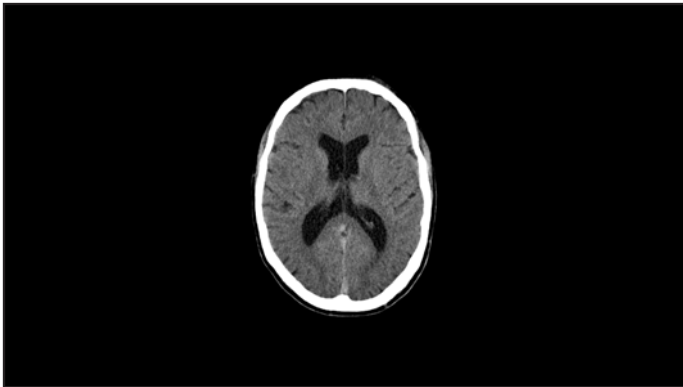
Cytotoxic or cellular
edema:

Due to intracellular
accumulation of fluid due to
either trauma or ischemia



42 y.o. female with gradually
worsening headache, N/V





Colloid Cyst

Epithelial-lined cyst secreting mucinous material

Classic location is opening to the 3rd ventricle

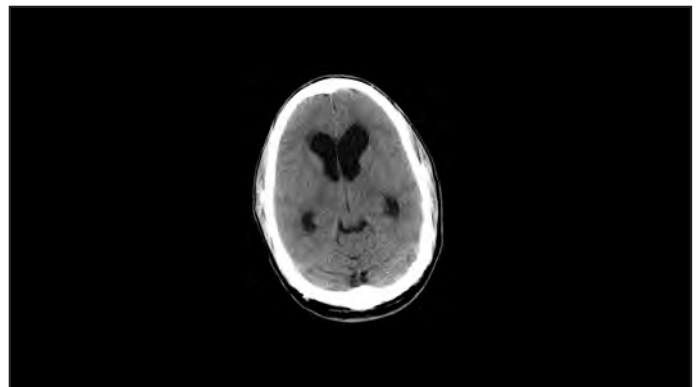
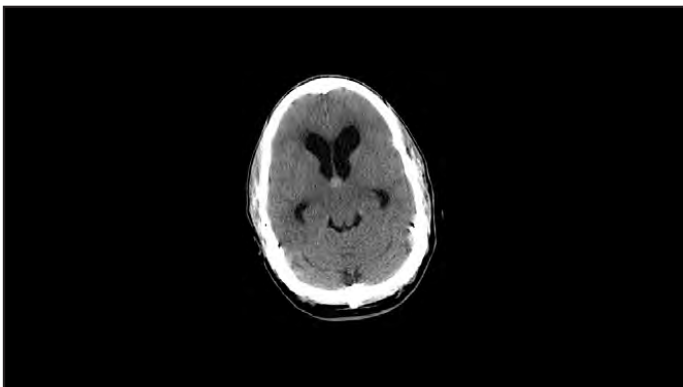
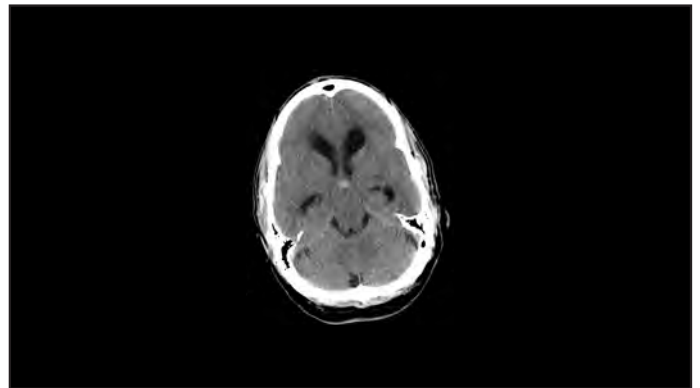
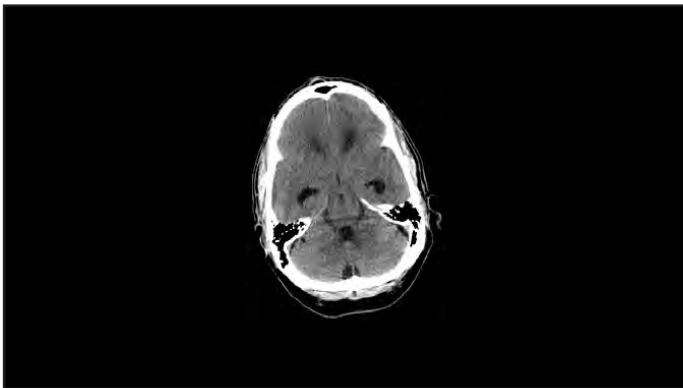
May cause acute obstructive hydrocephalus and sudden death

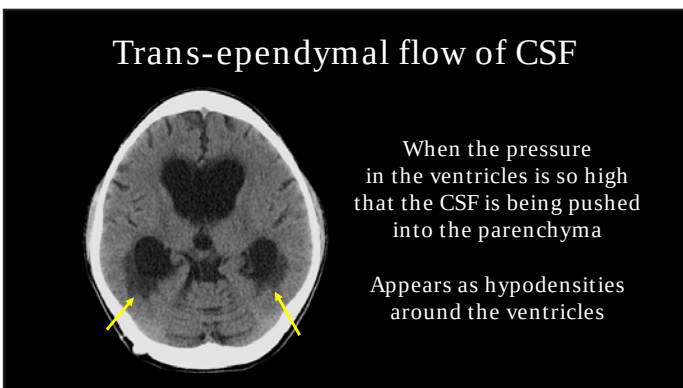
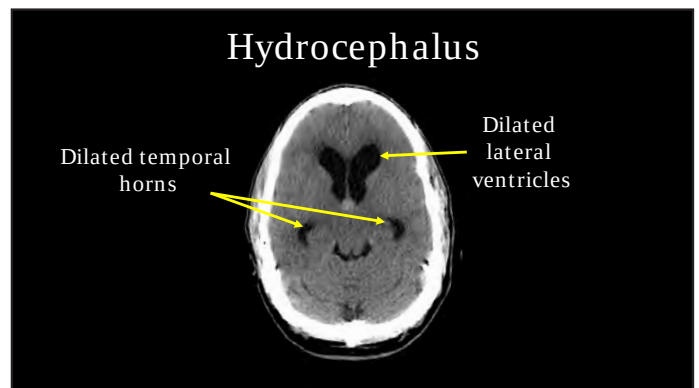
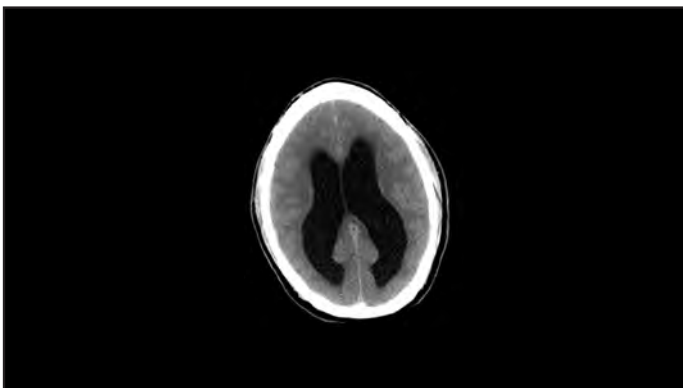
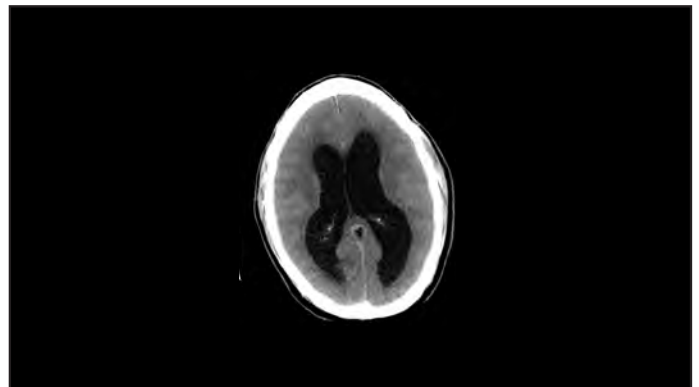
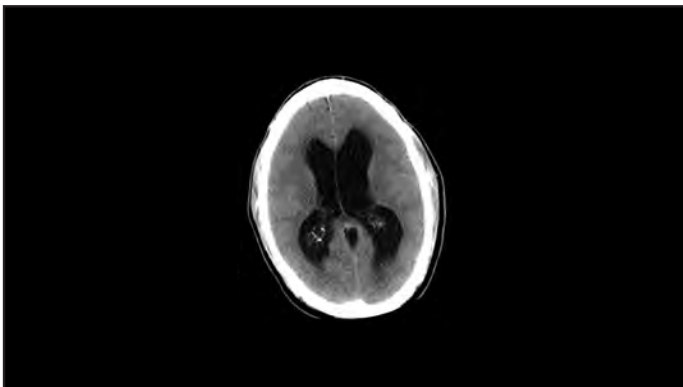
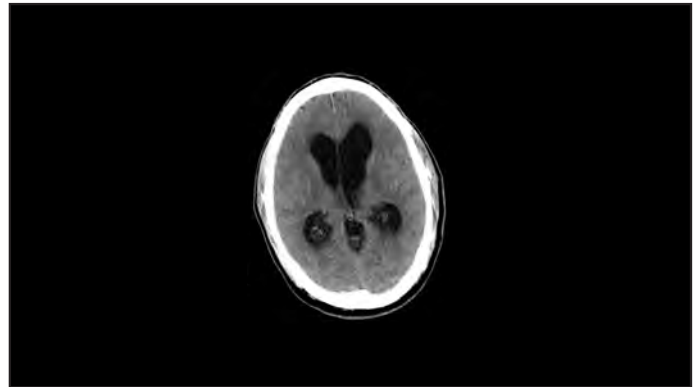
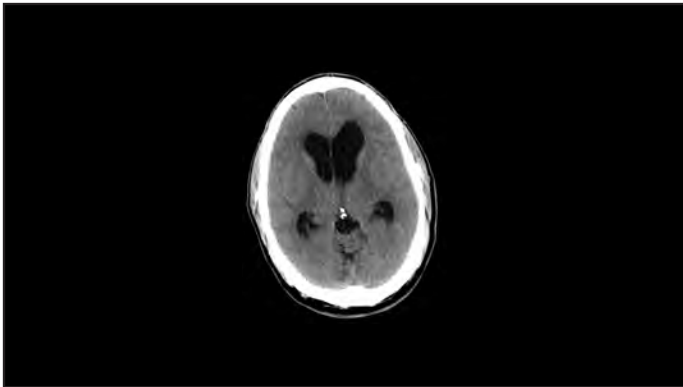


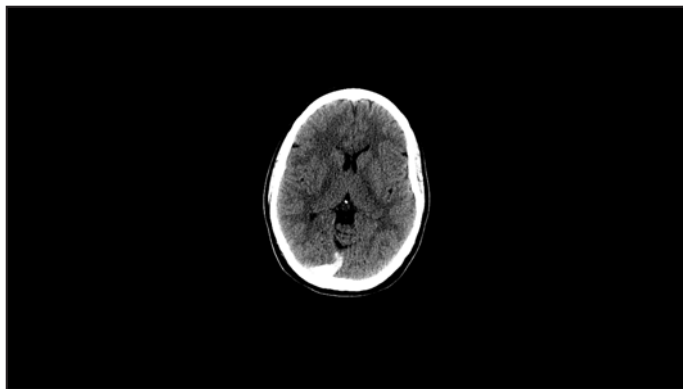
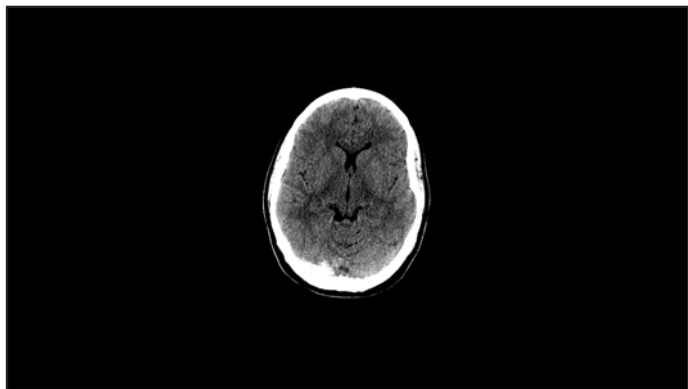
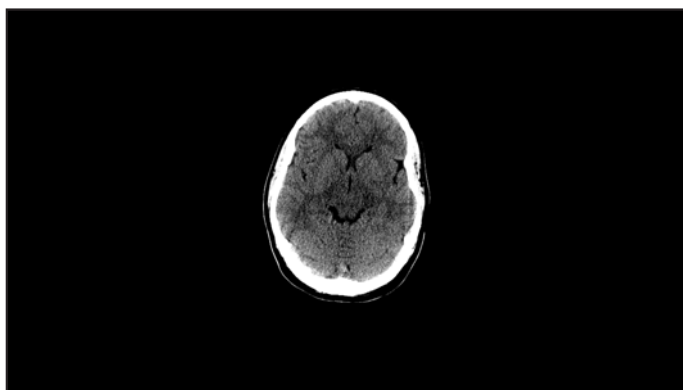
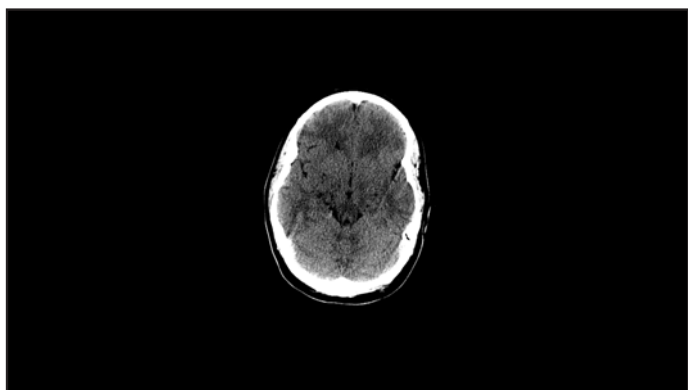
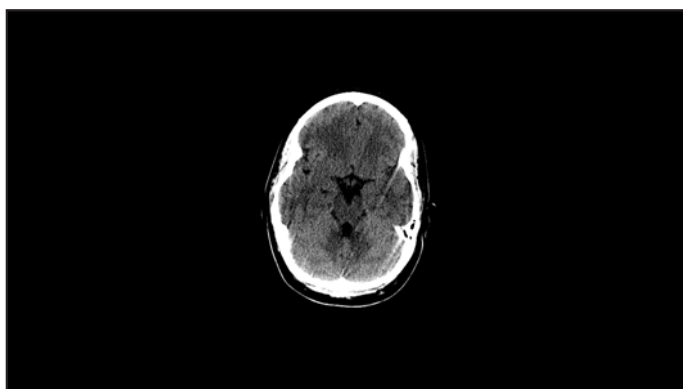
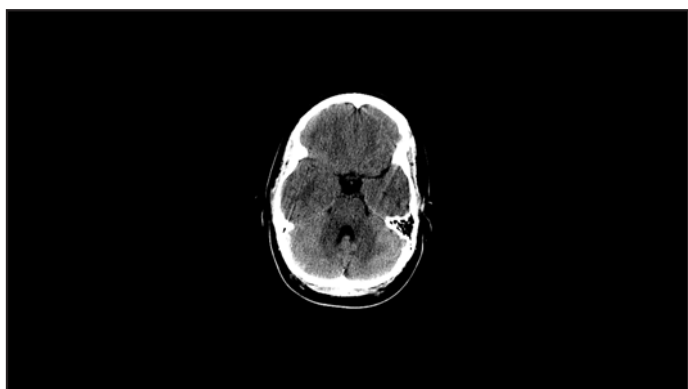
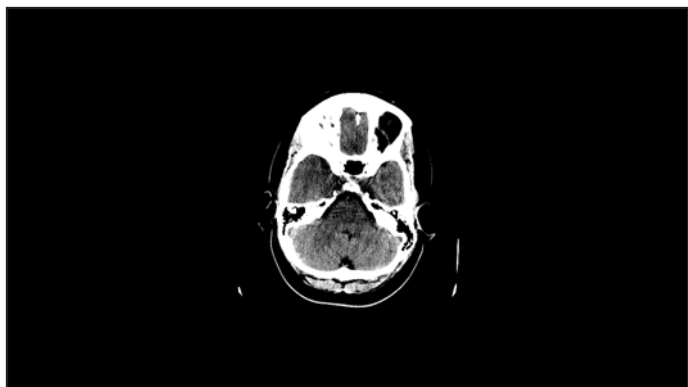
How much CSF is made per hour?

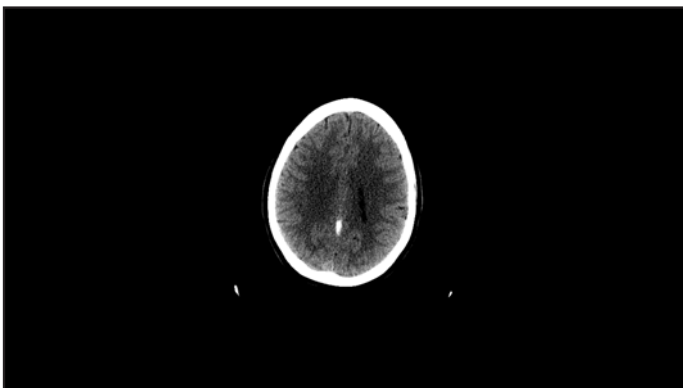
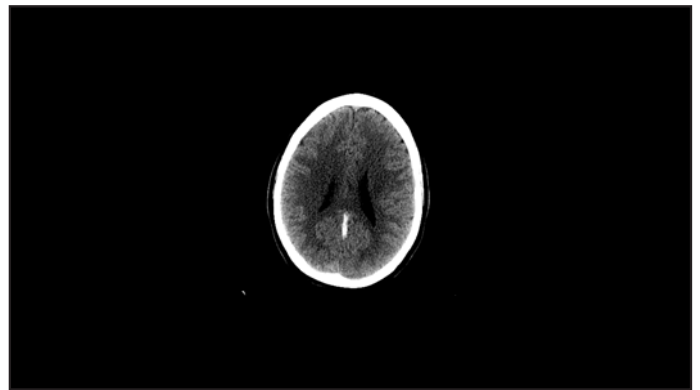
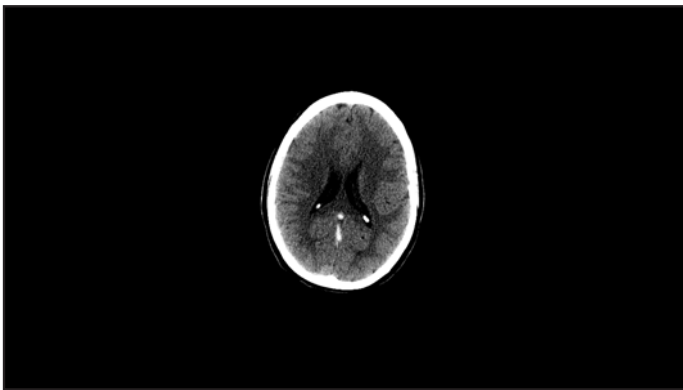
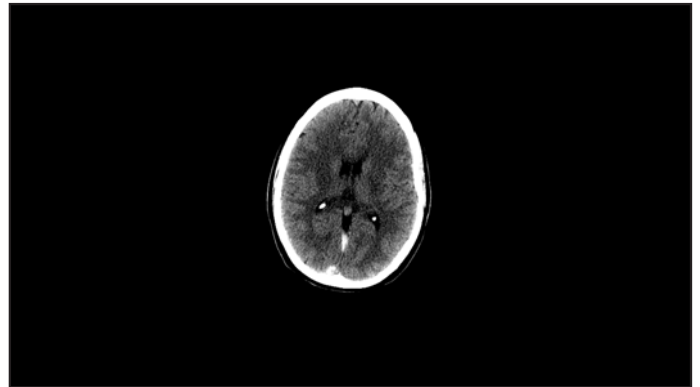
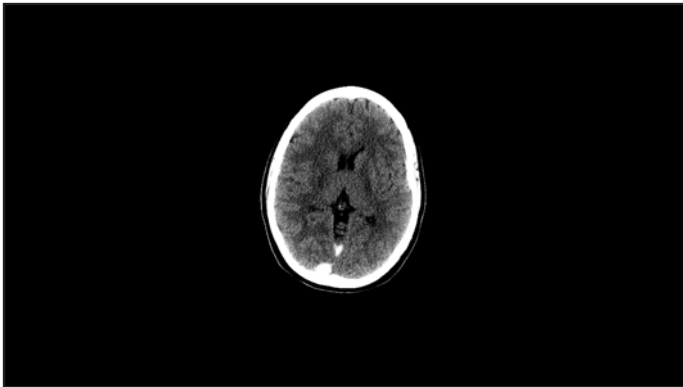


0.2-0.7cc/kg/hour!!









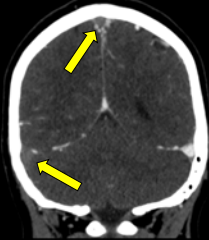
Cerebral Venous Sinus Thrombosis (CVST)

Non-contrast CT may reveal abnormalities, but is only about 33% sensitive

May show hyperdensity in the region of the dural sinus



Cerebral Venous Sinus Thrombosis (CVST)



Contrast-enhanced CT or MRI venogram is the test of choice

CTV is often faster and easier to obtain

“Empty Delta Sign”



Take Home Points

- Remember the ABCS²
- Look carefully for symmetry
- Don't lose the forest for the trees -
Shrink those CTs down



Take Home Points

- Epidural hematomas can
occur in the temporal and occipital area
- Don't forget subdural windows
- Look for brisk SDH with the swirl sign
- Get temporal bone sequences and CTA
with suspected basilar skull fractures



Take Home Points

- IPH outside the typical 4 areas are often
NOT hypertensive in etiology
- Aneurysmal SAH has different location
than other causes
- Colloid cysts can be a cause of sudden
death



SELF EVALUATION

The ABC's of Head CT: A Systematic Approach to Critical Findings

1. The most common locations of spontaneous intra-cerebral hemorrhages include all of the following EXCEPT:
 - a. Pons
 - b. Cerebellum
 - c. Frontal lobe
 - d. Basal Ganglia
 - e. Thalamus
2. The most common cause of subarachnoid hemorrhage is:
 - a. Ruptured berry aneurysm
 - b. Cerebral vasculitis
 - c. Underlying AVM
 - d. Trauma
 - e. Peri-mesencephalic bleed
3. The most common type of cerebral herniation is:
 - a. Subfalcine herniation
 - b. Trans-tentorial herniation
 - c. Uncal herniation
 - d. Cerebellar (tonsillar) herniation
4. Colloid cysts are classically located near which structure in the brain?
 - a. Suprasellar cistern
 - b. Opening to the third ventricle
 - c. Foramen magnum
 - d. Quadrigeminal cistern
 - e. Temporal horns
5. T/F - A normal non-contrast head CT is sufficient to rule out cerebral venous sinus thrombosis (CVST).

Answer Key: 1. C, 2. D, 3. A, 4. B, 5. F

FACULTY

Kevin Klauer, DO, EJD

Kevin Klauer, DO, EJD, of Winter Park, Florida, is currently the Chief Executive Officer of the American Health Information Management Association and was formerly the System Chief Medical Officer HCA Florida and Ocala hospitals. He formerly served as CEO of the American Osteopathic Association and the Chief Medical Officer and Chief Risk Officer for TeamHealth. He holds the following faculty appointments: Clinical Asst. Professor, Michigan State University College of Osteopathic Medicine; Clinical Asst. Professor, Ohio University Heritage College of Osteopathic Medicine. He is the co-author of five risk management books: *Bouncebacks: Critical Care*, *Bouncebacks: Pediatrics*, *Emergency Medicine*; *Bouncebacks: Medical and Legal* (1st and 2nd Editions) and *Risk Management and the Emergency Department: Executive Leadership for Protecting Patients and Hospitals*. Dr. Klauer also served as the American College of Emergency Physicians Council Speaker and subsequently as a member of their Board of Directors. Dr. Klauer earned his Executive JD, with honors, from Concord Law School in 2011.

You may contact Dr. Klauer with your comments or questions at kevinklauer1@gmail.com.

Recognizing Cognitive Bias to Improve Clinical Decision-Making

Kevin Klauer, DO, EJD

Recognizing Cognitive Bias to Improve Clinical Decision-Making

Kevin Klauer, DO, EJD, FACEP, FACCOP
Assistant Clinical Professor
Michigan State University College of Osteopathic Medicine
Ohio University Heritage College of Osteopathic Medicine
Orlando College of Osteopathic Medicine



Croskerry P. From mindless to mindful practice--cognitive bias and clinical decision making. N Engl J Med. 2013 Jun 27;368(26):2445-8.

"The diagnostic failure rate is estimated to be 10 to 15%. The rate is highest among specialties in which patients are diagnostically undifferentiated, such as emergency medicine, family medicine, and internal medicine. Error in the visual specialties, such as radiology and pathology, is considerably lower, probably around 2%."

"More than 100 biases affecting clinical decision making have been described, and many medical disciplines now acknowledge their pervasive influence on our thinking."

Croskerry P. From mindless to mindful practice--cognitive bias and clinical decision making. N Engl J Med. 2013 Jun 27;368(26):2445-8.

"Physicians know the pathophysiology of pulmonary embolus in excruciating detail, yet because its signs and symptoms are notoriously variable and overlap with those of numerous other diseases, this important diagnosis was missed a staggering 55% of the time in a series of fatal cases."

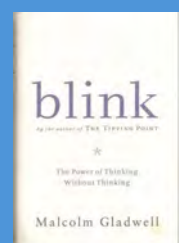
Croskerry P. From mindless to mindful practice--cognitive bias and clinical decision making. N Engl J Med. 2013 Jun 27;368(26):2445-8.

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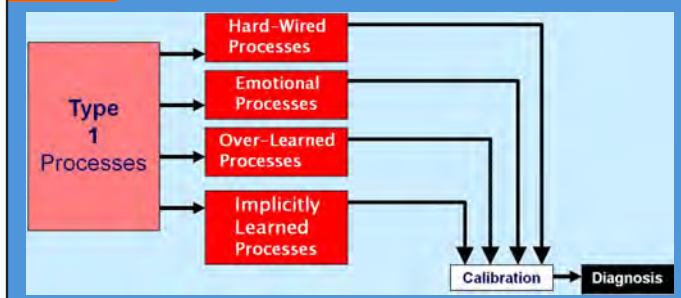
"The Augenblick diagnosis, made in the blink of an eye, is an impressive piece of medical showmanship and the stuff of television entertainment (and corridor consultations), but in real clinical life it is fraught with danger."

"All clinicians should develop the habit of conducting regular and frequent surveillance of their intuitive behavior. To paraphrase Socrates, the unexamined thought is not worth thinking."

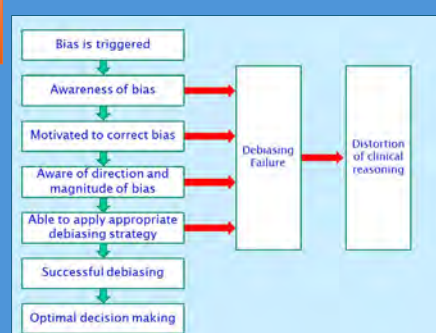
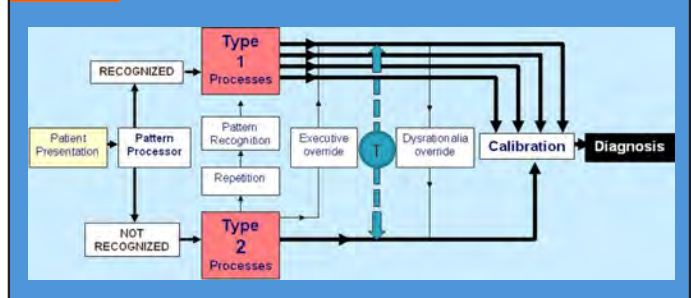
- Gladwell, M. (2005). Blink, The Power of Thinking without Thinking. New York, NY: Little, Brown and Company.



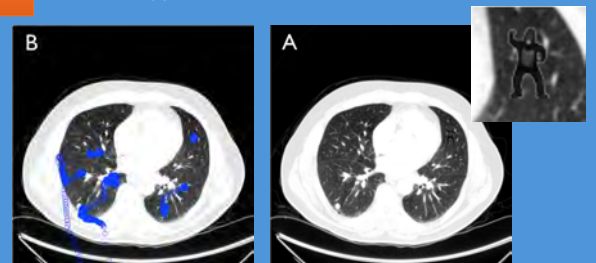
Croskerry P, Singhal G, Mamede S. Cognitive debiasing 1: origins of bias and theory of debiasing. *BMJ Quality & Safety*. 2013;22(Suppl 2):ii58-ii64. doi:10.1136/bmjqs-2012-001712.



Croskerry P, Singhal G, Mamede S. Cognitive debiasing 1: origins of bias and theory of debiasing. *BMJ Quality & Safety*. 2013;22(Suppl 2):ii58-ii64. doi:10.1136/bmjqs-2012-001712.



Drew T, V6 ML, Wolfe JM. The invisible gorilla strikes again: sustained inattention blindness in expert observers. *Psychol Sci*. 2013;24(9):1848-1853. doi:10.1177/0956797613479386



Croskerry, P. (2002). Achieving Quality in Clinical Decision Making: Cognitive Strategies and Detection of Bias. *Academic Emergency Medicine*, 9: 1184-1204.

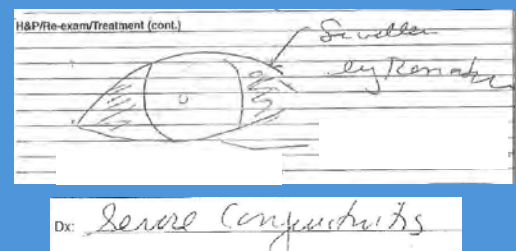
- Anchoring
 - First impression, jumping to conclusions
- Ascertainment bias
 - Response bias, seeing what you expect to find
- Availability and non-availability
 - Recency effect, common things are common
- Commission bias
 - Actions speak louder than words
- Confirmation bias
 - Following hunches with limited data
- Diagnosis momentum
 - Involves intermediaries like the patient
- Gambler's fallacy
 - Coin: 10/10 heads the 11th will be tails
- Omission bias
 - Fear of being held accountable for the outcome
- Playing the odds
- Premature closure
 - Accepted Dx without verification

35 y/o female classic presentation with Lt flank pain. No fever or urinary Sxs. PMHx: None. V.S. Normal.
Diagnostics: POC UA-Mod RBCs and WBCs, CT 7 mm proximal ureteral stone with staghorn calculus. 2/10 pain discharged. No Rx for follow up.



Medical Legal Case

- CC: "Rt eye blurred vision"
- HPI: 63 y/o female presented with a 2-day history of eye redness and blurred vision.
- Pain: 8/10
- PmHx: DM, HTN, Depression
- Meds: Metformin, Cardizem, Celexa
- VA: 20/70 (R); 20/30 (L)
- TX: Rx Blephamide gtts, 48 hour Ophtho F/U
 - (presented to ED on a Saturday)
- APP (physician co-signature)



Availability, Anchoring & Confirmation Bias

Medical Legal Case

- 52 y/o male involved in a MVC
- May 20, 2018: MVC: Rib contusion, ankle sprain and cervical strain
- Nov 1, 2018: Headache and dizziness since MVA in May worse this morning weakness in both arms, BL tinnitus
 - Cervical spine radiographs, CT Brain, Rx's for pain and meclizine

Medical Legal Case

CT of the head
Clinical history: Dizziness, motor vehicle accident, headache
The cerebral ventricles are normal in size. The septum pellucidum is midline. Gray-white differentiation is normal. No intracranial hemorrhage is seen. The orbits and paranasal sinuses are unremarkable.
Impression: No acute intracranial findings. Should symptoms persist, consideration of MRI and/or lumbar puncture is recommended.
CPT code: 70450

Medical Legal Case

- Nov 8, 2018: Persistent Sxs: Rx refills (PA-only)
- Nov 10, 2018: "Headaches, Headaches, Headaches": CTA

Co-Def: PA, 2 RNs, 2 FU physicians
SOC: Weak Defense
Causation: Primary Defense

Demand: \$2.5 million

Settled: PA and Supervising EP \$650,000
All others dismissed

Damages: Lost sensation and increased pain in the left side of his body, inability to swallow, PEG tube feedings

Confirmation & Anchoring Bias, Premature Closure

Medical Legal Case

- January 10, 2013
- 1250: EMS Called for 62 yo male with C.P.
 - BP 210/70, HR 100, RR 20, SpO2 97% RA
 - 6/10 → 0/10 after 2 NTG
- 1320: ED Arrival in no distress
- Hx: 20 min of midsternal, dull CP radiating to the back. Similar symptoms 3 yrs ago
- No other associated signs and symptoms
- Diagnostics: CBC, Troponin I, BMP: NL
- ECG & CXR

HPI
Chief complaint: chest pain / discomfort
Onset / duration: Chest into back
Location: constant "tearing & boring" intermittent episodic lasting
Quality: sudden / gradual onset
Aggravated by: worsens / persists with
Context: 20 min
Location of pain: back / jaw
Associated signs/symptoms: none
Radiation: none
Recent / treated by doctor: 3 yrs ago

Similar symptoms previously: angina "heart pain"

CXR: Interpretation: NAD

HISTORY: Chest pain.

TECHNIQUE: Single portable AP view of the chest is obtained.

COMPARISON: None.

FINDINGS:
The heart size is normal. The thoracic aorta is somewhat ectatic and tortuous. The lungs are clear. There is no pneumonia, edema, or effusion.

IMPRESSION: No acute intrathoracic abnormality.

*** Final ***

CLINICAL IMPRESSION

ARM PAIN - LEFT RIGHT
CHEST PAIN - ACUTE
Aortic Dissection
Cholecystitis - acute
Coronary Syndrome - acute
Esophageal Rupture
Herpes Zoster (Shingles)
Myocardial Infarction - acute
Pneumonia
Pneumothorax
Pulmonary Embolism

Present On Admission: decubitus / UTI w/ Foley

DISCHARGE SUMMARY

DATE OF ADMISSION: 01/08/2013 DATE OF DISCHARGE: 01/10/2013

I have examined the patient, and he is in a stable and satisfactory condition at the time of discharge.

ADMITTING DIAGNOSES:

1. Atypical chest pain. Rule out coronary artery disease.
2. Hypertension.

CERTIFICATE OF DEATH

CAUSE OF DEATH:
A. HEMOPERICARDIUM
INTERVAL: -
B. RUPTURED ASCENDING AORTIC ANEURYSM
INTERVAL: -
C. -

Step 1	Step 2	Step 3	Step 4
ce) Air = 0	Ground = 1	Number of patients	1/10/1
CPA radiates to back, leg numbness resolved			

Premature Closure, Diagnosis Momentum,
Order Effects
Anchoring & Confirmation Bias

Medical Legal Case

- CC: Back pain, numbness and abdominal pain
- 26 y/o Male
- Rt lower back pain for 1wk
- Seen at different ED twice in past 24 hours
 - Dx: "Sciatica"
- Numbness from knees down 4 hours prior to arrival
- PMHx: IDDM, Schizophrenia, ADD

Medical Legal Case

- Physical Examination
- VS: T 101.6, HR 105, RR 20, BP 136/80
- Abdomen: Soft and Non tender
- T8-L1 paraspinal tenderness near ML
- Distal sensation NL
- "Can't move legs secondary to severe pain"
- Patient to be transferred
- Dx: Acute discitis
- "The patient is schizophrenic, not convinced that the patient can't move his legs."

Psych-out Bias

Epilogue

Imagine waking from a deep sleep to find yourself fully conscious but unable to move any voluntary muscles save for the muscles that control your vertical eye movements. You can see, hear, smell, taste, and even feel the bed sheets against your skin. However, you are unable to speak or make any vocalizations at all. You are totally disconnected from your external world in a real sense. You may appear to be in a coma to others although you are quite capable of understanding their speech and actions. You are, in essence, locked in your own body. This scenario is not a fantasy that Rod Sterling would have written for a Twilight Zone episode but a recognized, though rare, neuropsychological syndrome.

1. Failure to Dx Stroke
2. Failure to administer tPA in a timely fashion
3. Loss of Chance

Medical Legal Case

4/22/19: ED Visit

1042: 32-year-old female patient presents to the ED

CC: Headache (Triage RN)

1100: Physician

- CC: AMS
- HPI: Right sided weakness and decreased LOC today
- P.E.: C, A & O x 3, Fundo NL, Coordination ABNL, moving right side less, but moving all 4 extremities

Medical Legal Case

- Dx: Routine labs
- 1134: CT of the brain: Negative
- 1329: No change in status
 - Brief EP assessment
 - Hospitalist contacted for admission
- 1405: HM eval and orders written 25 min later
- 1600: HM physician contacted by ED nurses that patient is less responsive
 - Shift change: No ED doc available (no handoff)
- 1721: Pt. sent to ICU

Medical Legal Case

- 1838: Pt. Intubated
- 2242: Teleneurology consulted
- 2256: CTA of the brain ordered
- 0110: CTA interpreted: "Basilar artery occlusion with pontine infarct"
- Outside the window for tPA (Neuro)
- "We have to do something"
- 0230: Alteplase administered
- No improvement
- 4/30/19: Expired

tPA? Aggregate Bias

Medical Legal Case

- 1/17/18: ED Visit
- 1622: 34-year-old male presented to the ED via EMS.
- CC: Rt knee pain "10"
- HPI: 3 ft. fall from a ladder and twisted his leg
- ROS: Decr ROM, pain and paresthesia of the Rt leg
- PE: 5'7", 300 lb, No deformity, Pulses intact, Cap refill < 3 sec on the Lt and > 3 sec on the Rt.

Medical Legal Case

- Tx: Hydromorphone 1 mg IVP x3
- Diagnostics: CT of Rt Knee
- “Large prepatellar effusion and an area of large, dense irregular fluid posterior to the knee.”
- Dx: “MCL tear”
- Rx: Vicodin and Ibuprofen
- Knee immobilizer and crutches
- FU with orthopedist tomorrow

Medical Legal Case

- 1/18/18: Ortho Appt
- Dx: Compartment syndrome
- 4 compartment fasciotomy performed & a fem pop bypass.
- 1/22/18 ...



Search Satisfying & Premature Closure

Low-Velocity Knee Dislocations

Background: Knee dislocations from minor trauma have been reported sparsely in the literature. The consensus is that these injuries tend not to be associated with neurovascular compromise.

Purpose: To present a series of traumatic knee dislocations in obese and morbidly obese patients and to compare operative versus conservative treatment.

Study Design: Case series; Level of evidence, 4.

Methods: Conclusion: Knee dislocations from minor falls occur in obese patients and are often accompanied by neurovascular complications. While surgical reconstruction is more time consuming and more difficult than that in normal-weight individuals, it may be preferable to non-operative treatment.

Results: Eight patients with knee dislocations from minor trauma were treated. Five patients underwent ligament reconstruction, and three patients underwent total knee arthroplasty. The average operating time for ligament reconstruction was 183 min, of that with injury-matched normal-weight patients. Eight operative patients who complied with therapy had an average range of motion of 91.4° (range, 60°–110°). The nonoperative patients had an average range of motion of 60.45° (range, 0°–120°). Two of these patients later required a total knee arthroplasty (3 total knee arthroplasties overall).

Conclusions: Knee dislocations from minor falls occur in obese patients and are often accompanied by neurovascular complications. While surgical reconstruction is more time consuming and more difficult than that in normal-weight individuals, it may be preferable to nonoperative treatment.

Vaidya R, Roth M, Narasim D, Prince M, Sethi A. Low-Velocity Knee Dislocations in Obese and Morbidly Obese Patients. *Orthopaedic Journal of Sports Medicine*. 2015;3(4):235380715579716.

Popliteal Artery Injury Associated with Blunt Trauma to the Knee without Fracture or Dislocation.

Blunt trauma to the lower extremity has been associated with a 28% to 46% rate of injury to the popliteal artery in the form of transection, occlusion, laceration, perforation, arteriovenous fistula, or intimal injury



Figure 1. Ecchymosis, hemorrhagic bullae, and cyanosis posterior of the left knee and calf.

Immer A, et al. Popliteal Artery Injury Associated with Blunt Trauma to the Knee without Fracture or Dislocation. *West J Emerg Med*. 2014;15(2):145-148.



DDx: Knee Injury & NL X-ray

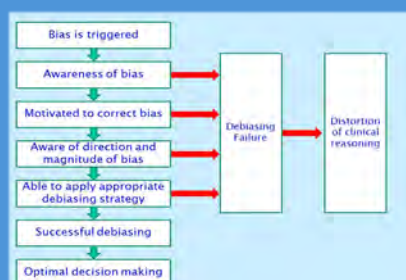
1. Quadriceps tendon rupture
2. Patella tendon rupture
3. Lateral tibial plateau fracture
4. Knee dislocation with spontaneous reduction
5. Locked knee
6. Compartment syndrome

Pulses NL
5-15% of occult Popliteal a. Injuries

“Even if they have palpable peripheral pulses and a normal ABI, speak to your orthopedic surgeon, considering a CT angiogram to rule out a popliteal a. injury, and admit.”

Risk Reduction Recs

1. Consider occult popliteal a. injury in obese pts with knee injuries
“A low-energy mechanism such as stepping off a curb in patients with a body mass index greater than 40 accounts for a significant proportion of missed occult knee dislocations.”
2. NL X-rays and + pulses = Nothing definitively ruled out
3. ABIs are better than nothing, but barely
4. CTA and admit



Thank you!

SELF EVALUATION

Recognizing Cognitive Bias to Improve Clinical Decision-Making

1. What is the estimated diagnostic failure rate in clinical medicine?
 - a. 1–2%
 - b. 5–10%
 - c. 10–15%
 - d. 25–30%
2. T/F - Diagnostic error rates are higher in radiology and pathology compared to emergency medicine and primary care.
3. Which cognitive bias involves accepting a diagnosis without sufficient verification?
 - a. Anchoring bias
 - b. Premature closure
 - c. Availability bias
 - d. Commission bias
4. Which cognitive bias describes sticking with an initial impression despite new conflicting information?
 - a. Confirmation bias
 - b. Anchoring bias
 - c. Omission bias
 - d. Gambler's fallacy
5. T/F - Pulmonary embolism was identified as being missed in approximately 55% of fatal cases in one series.

Answer Key: 1. C, 2. F, 3. B, 4. B, 5. T

Neuro-Ophthalmologic Emergencies

Jonathan A. Edlow, MD

Neuro-Ophthalmologic Emergencies

Jonathan A. Edlow, MD

Professor of Emergency Medicine
Department of Emergency Medicine
Beth Israel Deaconess Medical Center
Harvard Medical School
Boston, MA



Neuro-ophthalmologic Emergencies

Seeing things that are not there

- Visual hallucinations
- Visual flashes & fortifications

Seeing double

- Diplopia

Not seeing things that are there

- Acute visual loss
- Field cuts
- Blurred vision

Eye doesn't look right

- Anisocoria
- Ptosis, proptosis

Always measure visual acuity



“How many fingers am I holding up?”

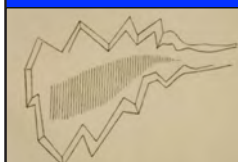
Seeing things that are not there

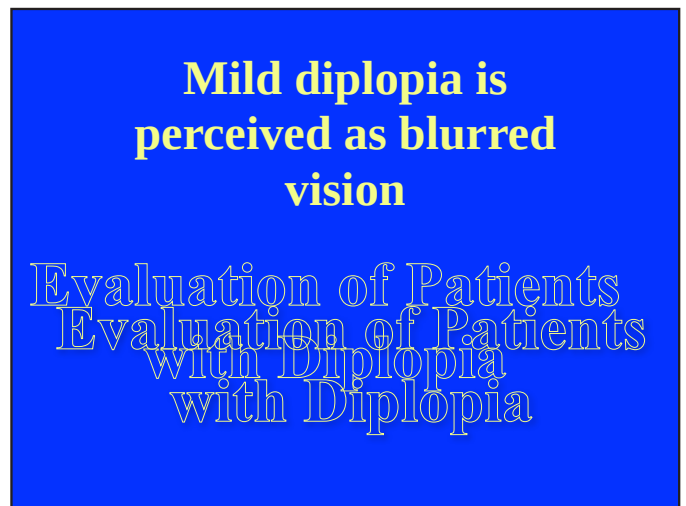
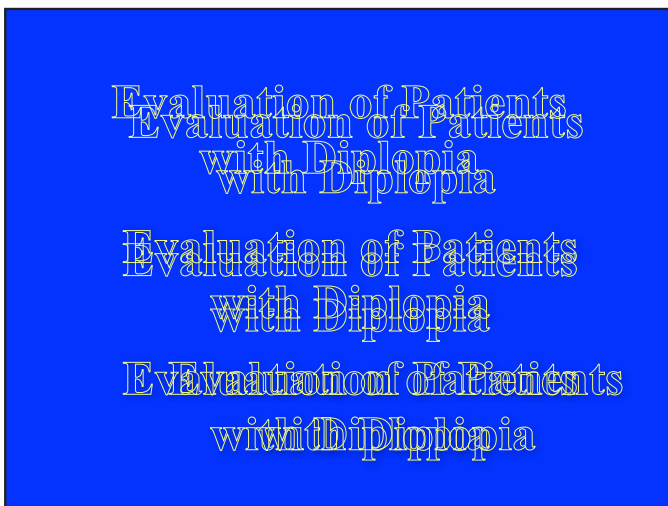
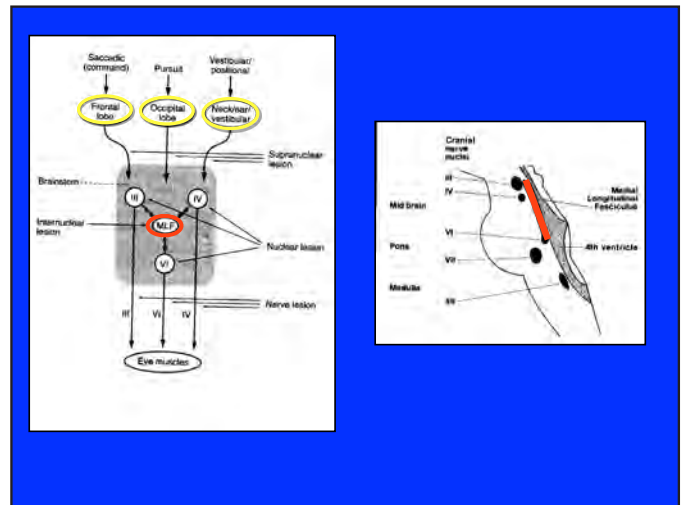
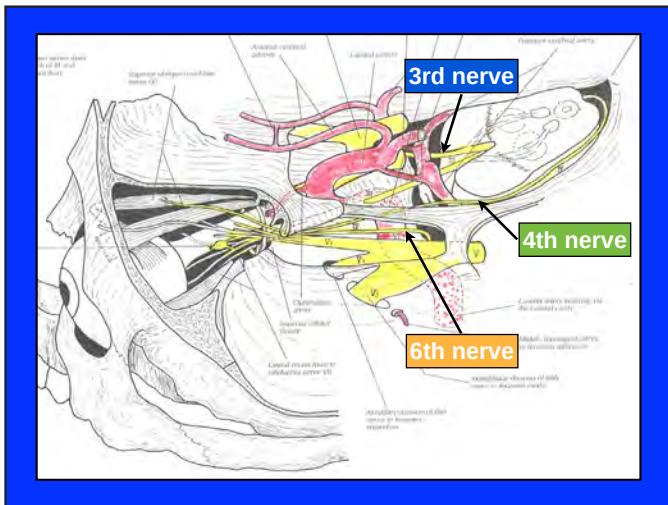
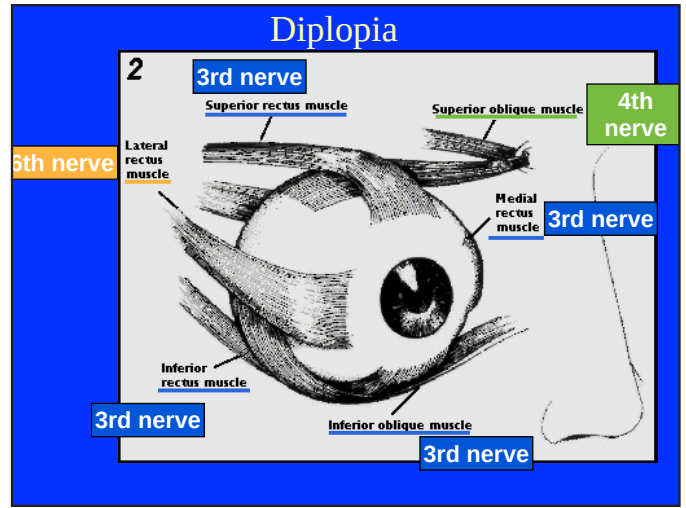
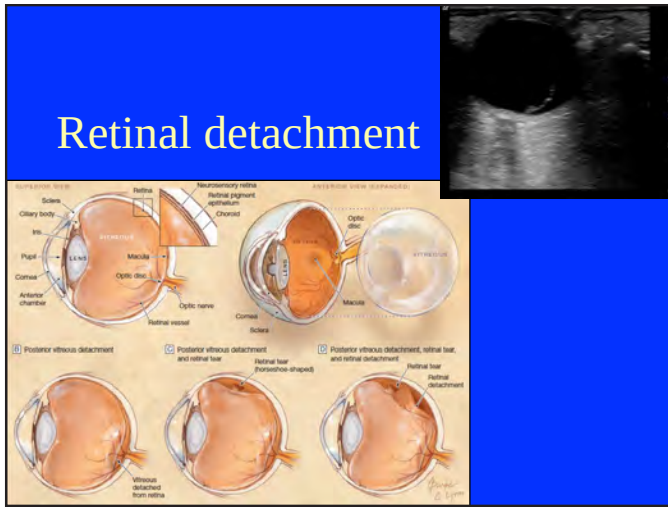
- Concept of a “positive” versus a “negative” symptom
- If positive, is it formed or unformed?
- If negative, where in the visual fields is it?

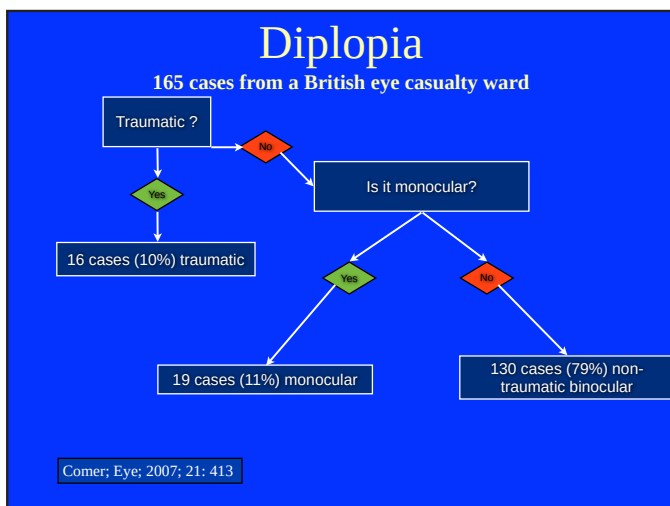
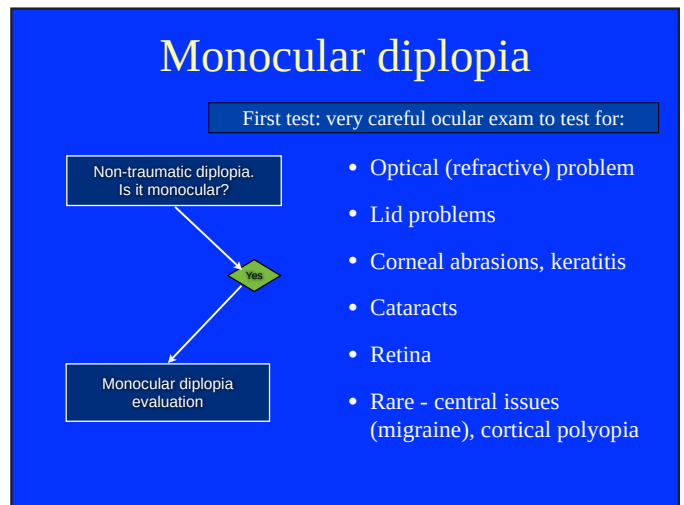
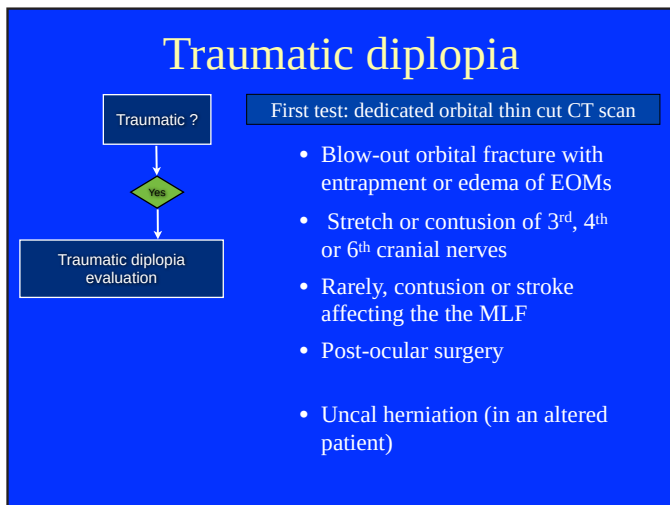
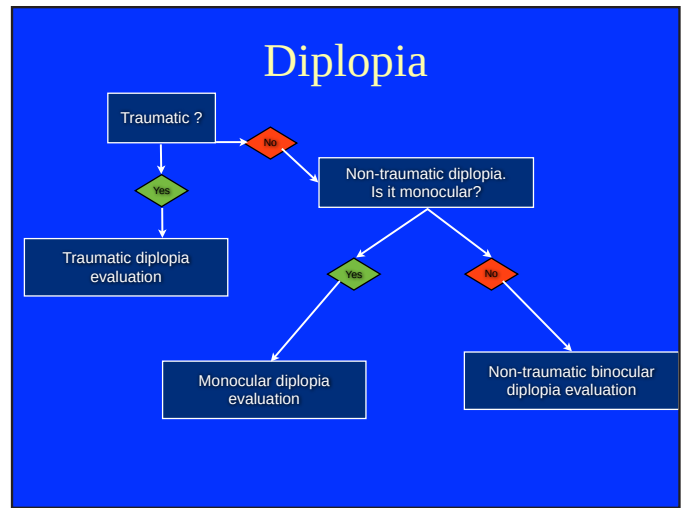
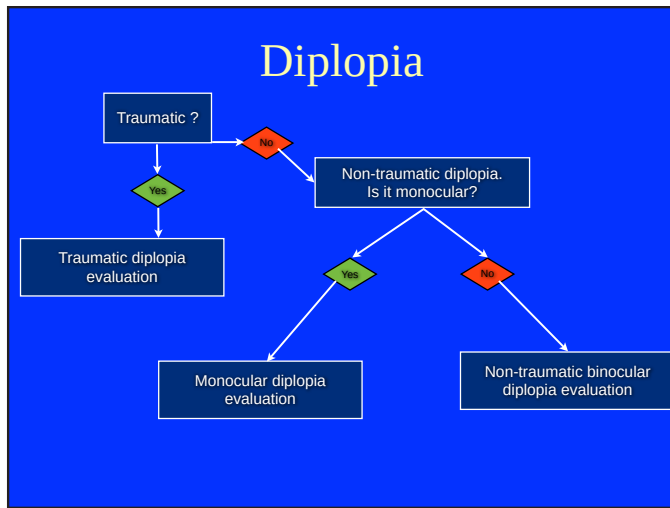
Charles Bonnet syndrome



Migraine auras







Causes: 16 trauma cases

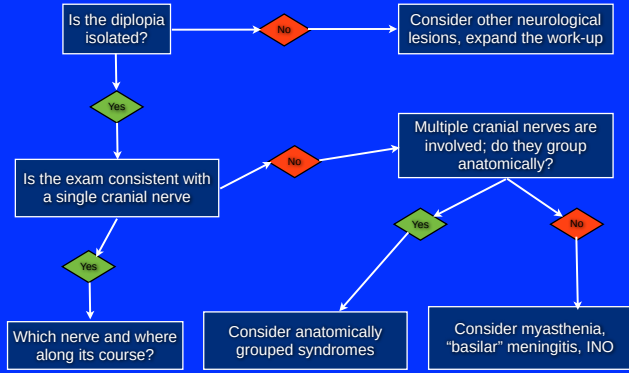
Cause	Number of patients
Trauma	
Soft tissue	9
Orbital floor fracture	7

Causes: 19 monocular cases

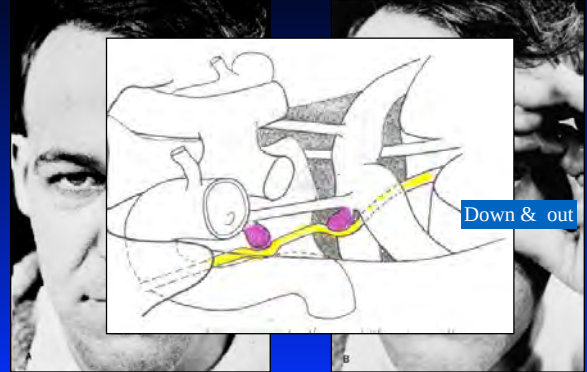
Cause	Number of patients
Optical	
Bifocal segment incorrect	1
Incorrect refraction	1
Lid	
Ectropion	2
Entropion	2
Cornea	
Abrasion	2
Corneal epithelial dystrophy	1
Herpes simplex keratitis	1
Lens	
Cataract	2
Retina	
Epiretinal membrane	2
Chorioidal neovascular membrane	1
Macular oedema	1
Other	
Migraine	1

Comer; Eye; 2007; 21: 413

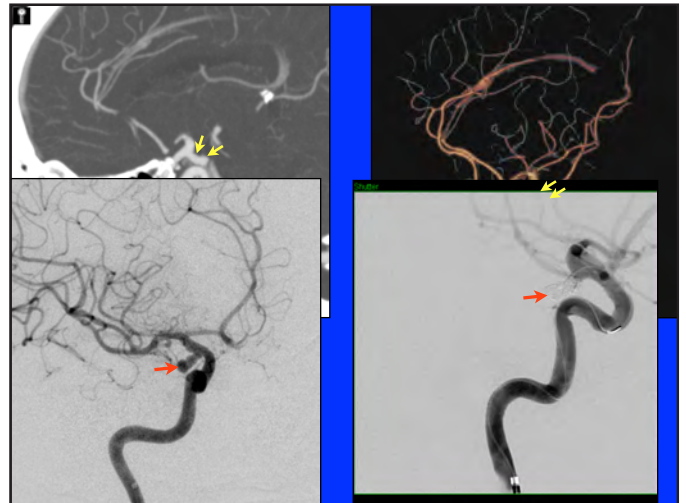
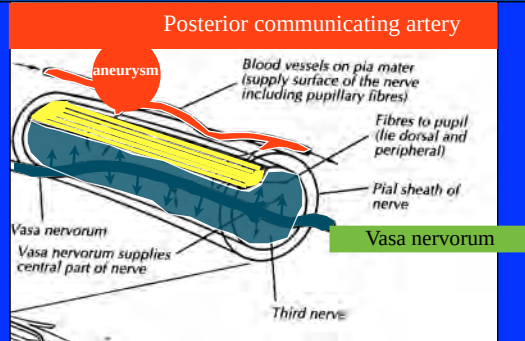
Atraumatic binocular diplopia



Third-nerve Palsy



Section of 3rd nerve showing relation to PCom artery and superficially located pupillary constrictor fibers



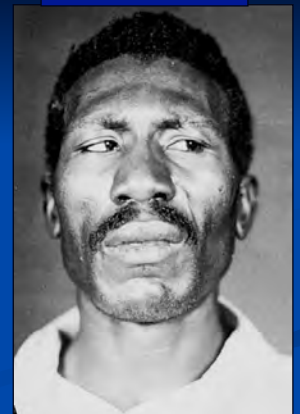
Third Nerve Palsy

	"Diabetic" 3rd nerve	"Surgical" 3rd nerve
Etiology	Microvascular infarction of nerve	External compression, often by PCom aneurysm
Time course	Evolves over days	Evolves over days
Pain present	Ocular pain/pressure	Ocular pain/pressure or SAH HA pain
Pupil involved	Rare	Almost always, but not always initially or completely
Outcome	Benign, resolves over months	Generally worsens, with rupture if aneurysmal

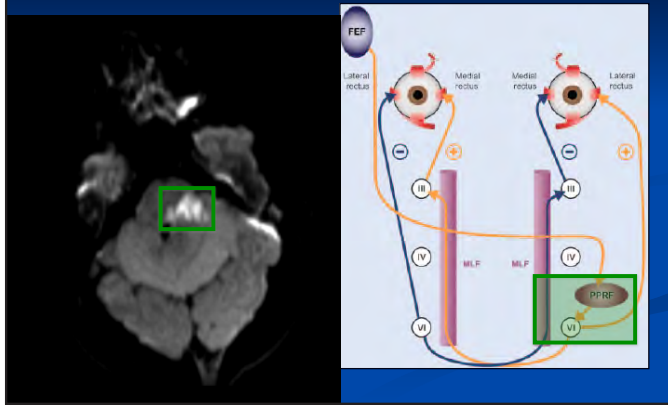
"Look to the right"



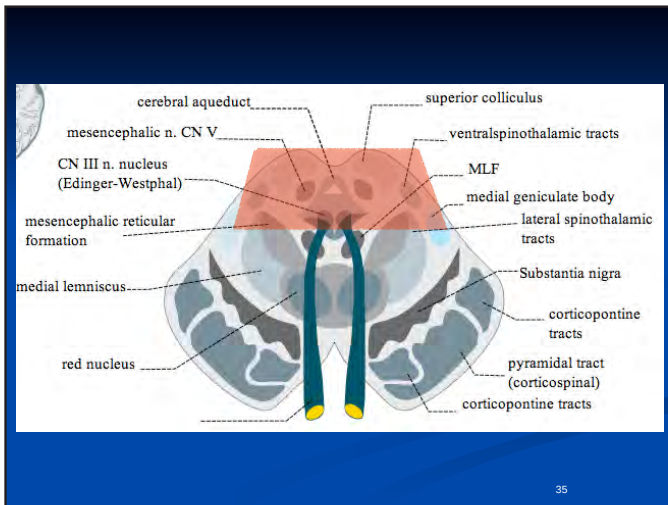
"Look to the left"



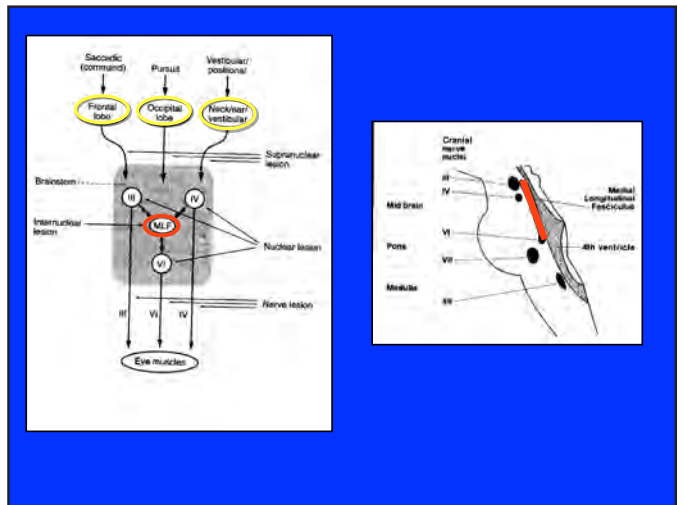
Pontine lesion



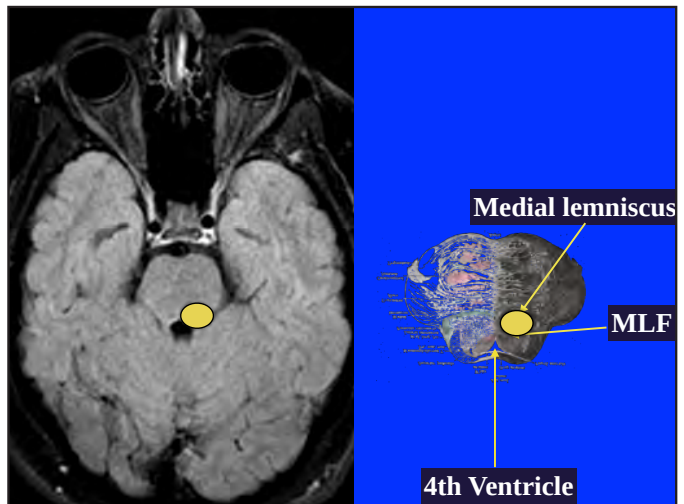
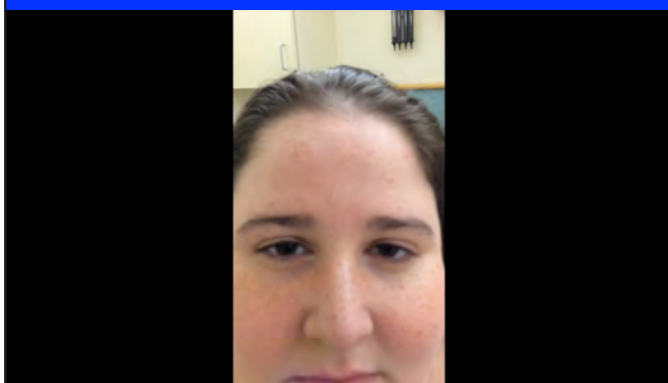
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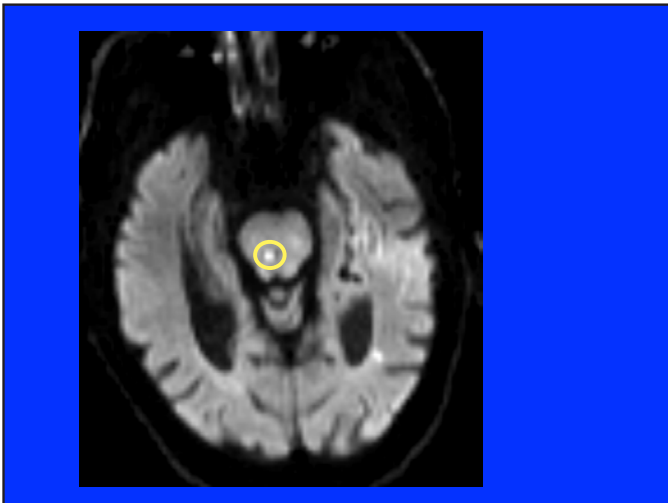
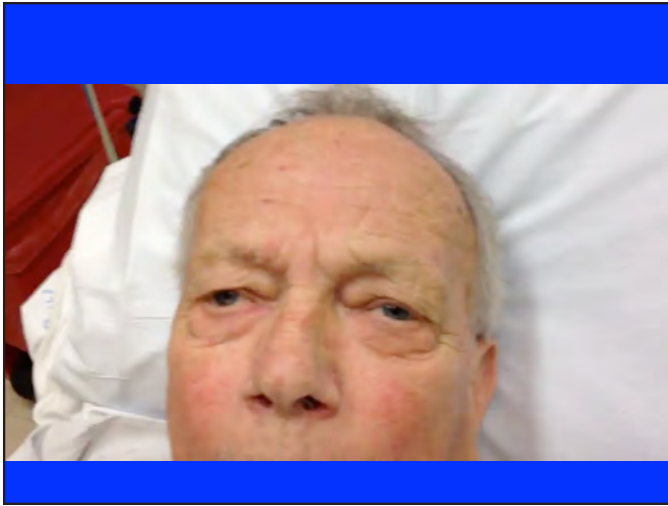


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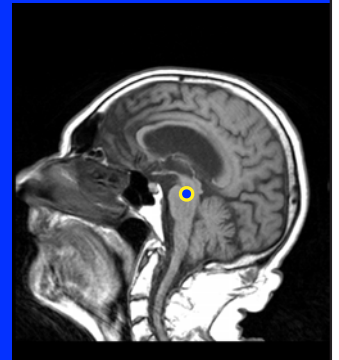
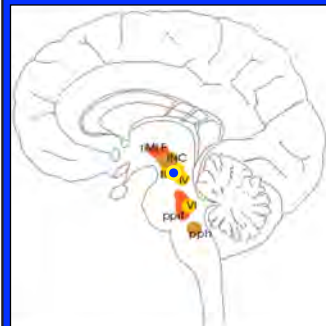


INO more subtle

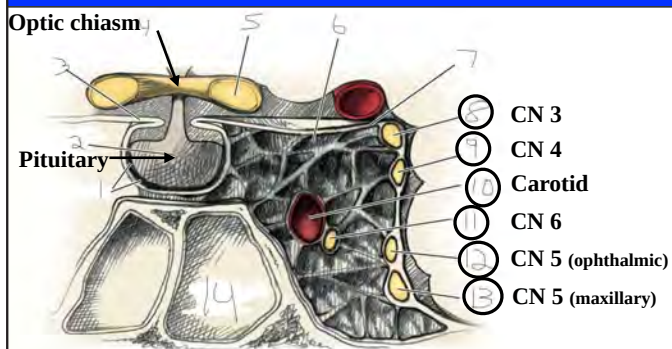




Stroke - isolated to the medial rectus sub-nucleus (of 3rd nerve)



Cavernous Sinus



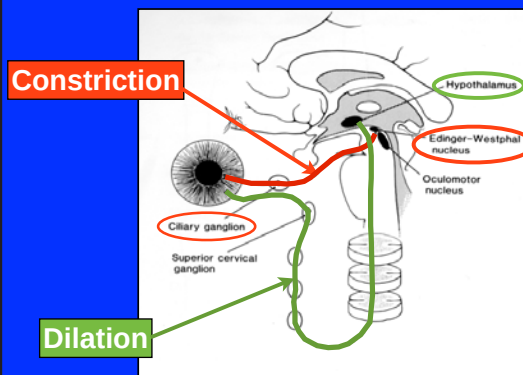
Test facial sensation

- In patients with abnormal eye movements, the presence of facial sensory loss strongly suggests cavernous sinus pathology
- The 6th nerve (because it's more medial) is often the first nerve to be affected.
-

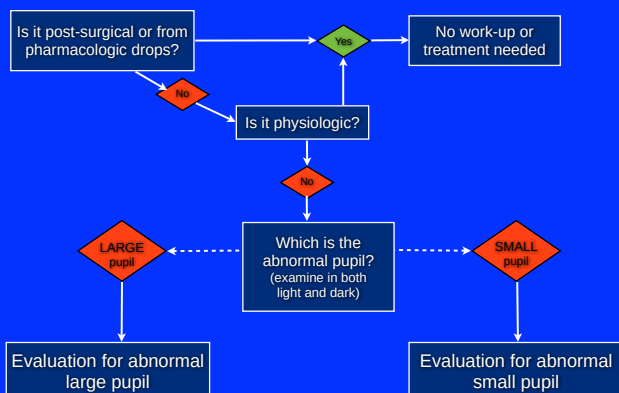
Etiology of CST (N=126)

Category	Specific cause	No (%)
Tumor		80 (63)
	Pituitary	29
	Meningioma	25
	Other (8 types)	26
Vascular		25 (20)
	Carotid artery aneurysm	16
	Carotid-cavernous fistula	9
Inflammatory	Tolosa-Hunt syndrome	16 (13)
Other		5 (4)

Pupillary Innervation



Anisocoria



Physiologic Anisocoria

- A very common cause of anisocoria (along with s/p surgery and eye drops)
- Present in up to 20% of normal individuals
- Difference can be up to 2mm (usually less)
- Both pupils react normally in light and dark

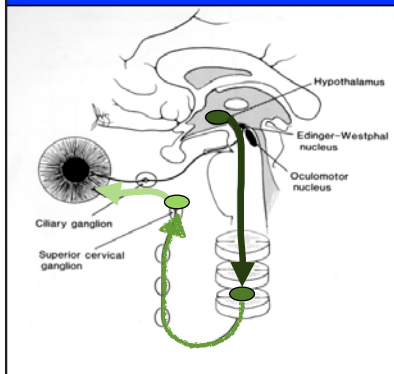
Abnormal Large Pupil

- Exposure to ocular anticholinergics
 - plants
 - drops
- 3rd nerve palsy (abnormal EOMs, ptosis)
- Adie's tonic pupil and Argyll-Robertson pupil
- Acute narrow angle closure glaucoma

Abnormal Small Pupil

- Pupillary constrictor drops
- Horner's syndrome (oculo-sympathetic paralysis)
 - Central
 - Peripheral pre-ganglionic
 - Peripheral post-ganglionic

Pupillary control oculo-sympathetics → dilate



1st order neuron
(stroke, MS, tumor)

2nd order neuron (cord
trauma/surgery, thoracic
outlet, Pancoast tumor)

3rd order neuron
(carotid dissection/
surgery or cavernous
sinus lesion)

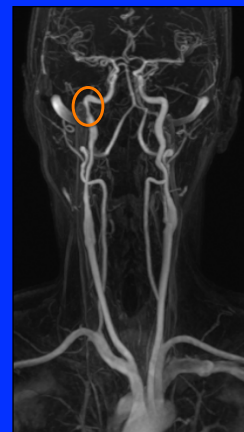
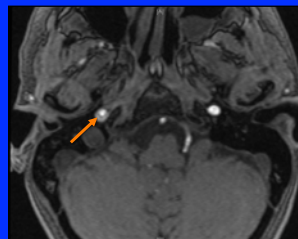
Apparent Enophthalmos



Horner's syndrome

- R eye pain and pressure
- "Sinus infection"
- Notices small right pupil
- Mild ptosis of right eye
- Consultant's diagnosis

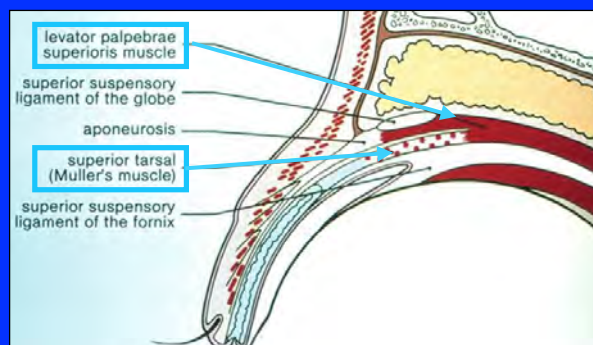
Carotid Dissection



Anisocoria - key points

- History - trauma, surgery, drops, gardening
- Carefully examine the pupils in both light and dark
- Which is the abnormal pupil? Is it an efferent pathway lesion or an intrinsic eye problem?
- Big pupil - is there ptosis, diplopia or abnormal facial sensation?
- Small pupil - is it a Horner's? if so, where does it localize?

Ptosis



Severe ptosis
(3rd nerve palsy)



Mild ptosis (Horner's)



Acknowledgements

- Eyevideos.blogspot.com
- OphthoBook.com
- Todd Thompsen (MAH attending)
- Our patients

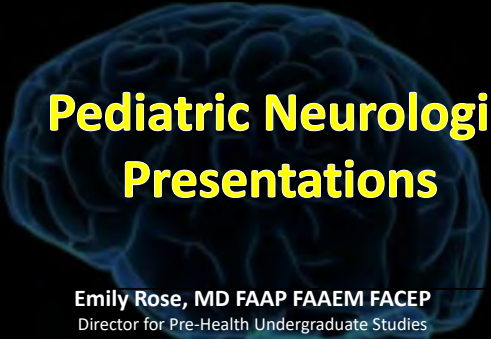
SELF EVALUATION
Neuro-Ophthalmologic Emergencies

True/False

1. Patients with a sixth nerve palsy will have vertical diplopia.
2. Mild diplopia can present as “blurred vision”.
3. In patients with post-traumatic diplopia, CT of the orbits with thin cuts is the diagnostic test of choice.
4. A third nerve palsy that is associated with an ipsilateral dilated pupil is caused by an aneurysm till proven otherwise.
5. An INO (internuclear ophthalmoplegia) is rarely caused by multiple sclerosis.
6. Approximately 50% of patients with carotid artery dissection present with a Horner’s syndrome.

Answer Key: 1. F, 2. T, 3. T, 4. T, 5. F, 6. T

Pediatric Neurologic Presentations
Emily Rose, MD, FAAP, FAAEM, FACEP



Pediatric Neurologic Presentations

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Disclosures

No financial relationships with a commercial interest to disclose

No patient identifiers are present



Status Epilepticus

Benzodiazepines } First Line

Second Line

Phenytoin/Fosphenytoin

Levetiracetam

Valproic Acid

Phenobarbital

Third Line?

Benzodiazepines

- **Lorazepam** (0.1 mg/kg, max 4 mg) IV

duration

4-6 hours

- **Midazolam** (0.1-0.3 mg/kg, max 10 mg) IV

– 0.3-0.5 mg/kg buccal

– 5-10 mg IM

duration

20 minutes

Second Line Agents (20 mg/kg)

- Phenytoin/Fosphenytoin (*can repeat*)
- Levetiracetam (**60 mg/kg, max 4500 mg**)
- Valproic Acid (**40 mg/kg; NOT in <2 yrs**)
- Phenobarbital

**Try One, Then
Choose Second Option**

Refractory Status

SECURE THE AIRWAY

Refractory Status

- **Midazolam drip** (0.05-2 mg/kg/hour)
- **Pentobarbital** (5-15 mg/kg bolus, then 0.5-5 mg/kg/hour)
- **Propofol** (2 mg/kg bolus, then 1-15 mg/kg/hour)
- **Ketamine** (0.5-2 mg/kg/hour)

Why?

Why?

Electrolyte
Toxin
Infection
Trauma
Intracranial pathology....

Glucose—Rule of 50

5 mL/kg D **10** W
2 mL/kg D **25** W = **50**
1 mL/kg D **50** W

Hyponatremia

ACTIVE seizure:

3% NaCl

3-5 mL/kg over 15-20 Min

**NO seizure:
Give over one hour**

Hyponatremia

ACTIVE seizure:

3% NaCl

3-5 mL/kg over 15-20 Min

Do not $\uparrow \geq 8-12$
mEq/L in 24 hr

Hypocalcemia

10% Calcium Gluconate

0.3 mL/kg over 5-10 Min

INH Toxicity?

Pyridoxine (vit B₆)

(70 mg/kg, max 5 grams)

Status Epilepticus

- Initiate treatment **early**
- Don't be afraid to use the IO
- Check the **glucose**
- Consider **underlying etiology**

Status Epilepticus

Benzodiazepines } First Line

Second
Line

Phenytoin/Fosphenytoin

Phenobarbital

Levetiracetam

Valproic Acid

Third Line

SEIZURES

First Time Afebrile Seizures

AAP Choosing Wisely (PEM List)

#3: Do not order laboratory testing or a computed tomography (CT) scan of the head for pediatric patients with an **unprovoked, generalized seizure** or a simple febrile seizure who have returned to baseline mental status

CT rarely changes management

First Time Afebrile Seizures

EMERGENT Imaging:

Persistent AMS
Focal deficit

<1 year of age (labs <6 mo)

Suspicious circumstances/Trauma
VP Shunt, Coagulopathy...

First Time Afebrile Seizures

No Meds
40% Recurrence

Subtle: lip smacking,
eye deviation,
blinking,
bicycling movements

Occur in 20% of preterm infants

Neonatal Seizures



Complex Partial Status Epilepticus

Frequently unrecognized

Altered Mental Status
Minimal Movements

Treat like a seizure

FOCAL NEUROLOGIC DEFICITS

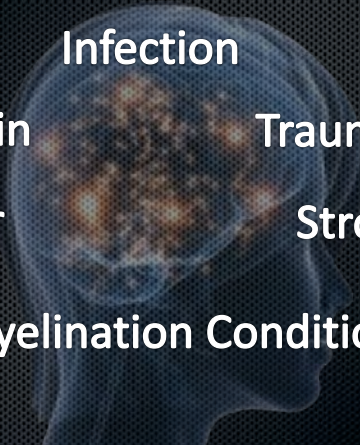


CC: Walking Funny

Ataxia



Ataxia



Infection
Toxin
Tumor
Trauma
Stroke
Demyelination Conditions

Back to the 3 y/o...



Previously Normal
Sudden Onset
Recent Illness

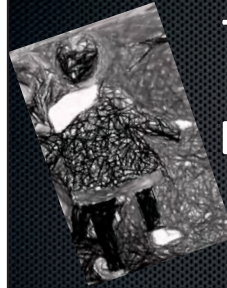
Cerebellar Findings

Acute Cerebellar Ataxia

Focal Encephalitis

50% Pediatric Ataxia

Acute Cerebellar Ataxia



Truncal Unsteadiness
Distal Motor Difficulty

Acute Cerebellar Ataxia

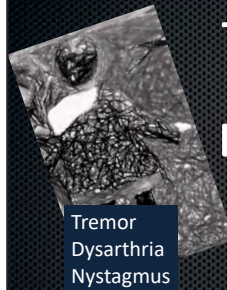
Rapid onset (hours-days)



Truncal Unsteadiness
Distal Motor Difficulty

NO WEAKNESS
No h/o prior symptoms

Acute Cerebellar Ataxia



Truncal Unsteadiness
Distal Motor Difficulty

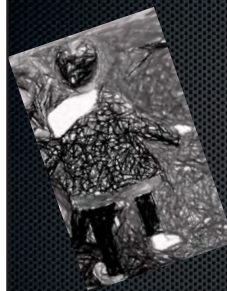
Tremor
Dysarthria
Nystagmus

Acute Cerebellar Ataxia



Neuroimage if:
Altered mental status
Deficit asymmetry
Atypical history
Headache
Trauma

Acute Cerebellar Ataxia



Neuroimage if:
Altered mental status
Deficit asymmetry
Atypical history
Headache
Trauma

MRI

Acute Cerebellar Ataxia



Tremor
Dysarthria
Nystagmus

Truncal Unsteadiness
Distal Motor Difficulty

Tx: Supportive

Resolution 2-3 weeks

9 y/o boy presents with right UE weakness

Exam: **decreased strength**,
diminished reflexes, sensation intact

Recent URI illness

Acute Flaccid Myelitis

Polio-like illness

Attacks CNS grey matter

Acute Flaccid Myelitis (AFM)

URI, GI, fever sx several days prior

Abrupt onset of neurologic symptoms

- Focal limb weakness → quadriparesis
- +/- Cranial nerve involvement
- Respiratory failure

Meningoencephalitis features *uncommon*

Persistent neurologic deficits

AFM Diagnosis

Neuroinvasive **infectious** process (*polio, enterovirus D68*)

Viruses with tropism for **spinal cord and brainstem grey matter**

Autoimmune post-viral syndromes typically attack white matter

Negative CSF cultures and viral PCRs

MRI → grey matter of spinal cord (MULTIPLE levels) +/- brainstem +/- cranial nerves

AFM Treatment

Supportive Care

No medications work

INFECTIOUS not autoimmune

AFM Supportive Care

Support Immune System and prevent complications

Reduce immunosuppression (if possible)
Pain relief
DVT ppx
Avoid decubitus ulcers
Early physical therapy

Infectious not autoimmune

Acute Flaccid Myelitis

Polio-like illness

*Attacks CNS grey matter (spinal cord at
MANY levels, brainstem, CN)*

Enterovirus D68 (A71, +other viruses?)

Children/young adults (<21 years)

Report to public health

**8 y/o boy
acting odd**

Acute onset of psychosis

Hypoglycemia
Cerebral hypoxia
Drug toxicity
(steroids, antibiotics, INH, anticonvulsants)
Medical illness
Psychiatric disease
Zebras...

Back to the boy...

Labs unremarkable

MRI normal

Back to the boy...

Labs unremarkable

MRI normal

EEG abnormal (slowing) but **no epileptic activity**

CSF—lymphocytes pleocytosis (mild)

Back to the boy...

Labs unremarkable

MRI normal

EEG abnormal (slowing) but **no epileptic activity**

CSF—lymphocytes pleocytosis (mild)

CSF and serum anti-NMDA receptor antibodies

Anti-NMDA Receptor Encephalitis

The second most common cause of
autoimmune encephalitis

Anti-NMDA R Encephalitis

Viral prodrome common

Mood, behavior or personality changes

Seizures, dyskinesias

Movement disorders

Anxious, agitated, combative, paranoid

Visual and auditory hallucinations

Autonomic dysfunction (more severe in adults)

Anti-NMDA RE Diagnosis

Antibodies in **serum** or **CSF** but no infectious agents

EEG without seizures (though seizures sometime occur)

MRI typically normal

Search for **teratomas**
(less common in younger children)

Anti-NMDA RE Treatment

Remove tumor (if present)

Immunomodulatory therapy

- Corticosteroids
- IVIG
- Plasma Exchange
- Cyclophosphamide and/or rituximab in refractory cases

Relapses may occur

Anti-NMDA R Encephalitis

Autoimmune encephalitis

Behavior/personality changes

Psychosis

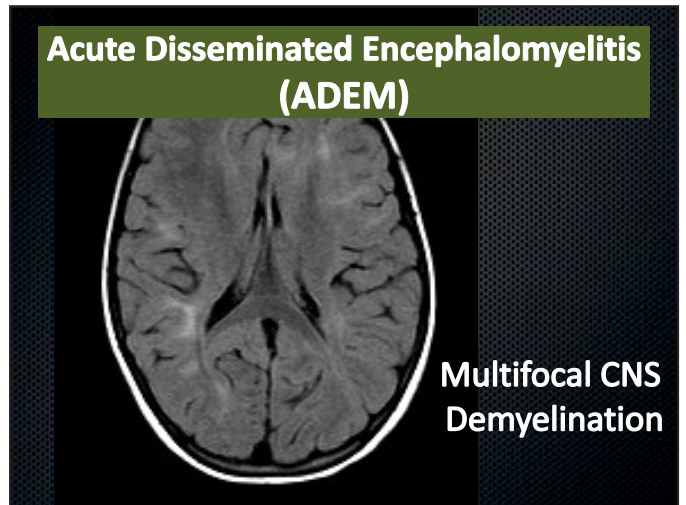
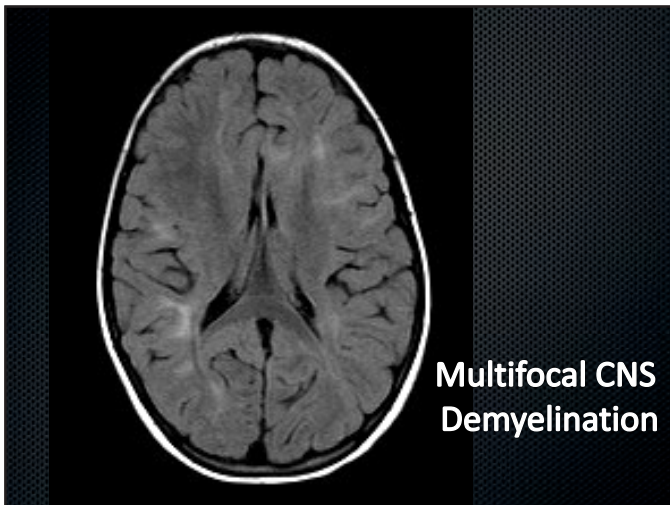
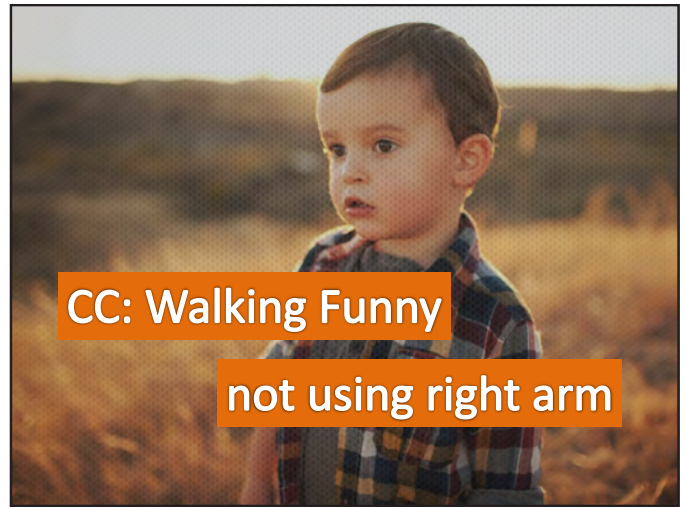
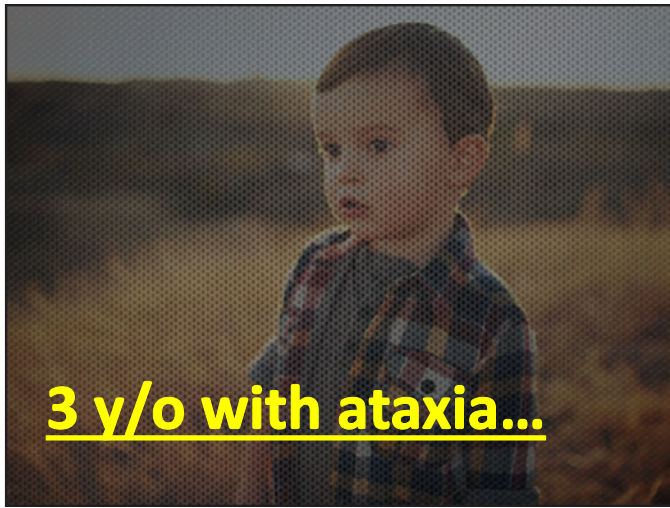
Agitation/Anxiety

Serum +/- CSF Anti-NMDA R Antibodies diagnostic

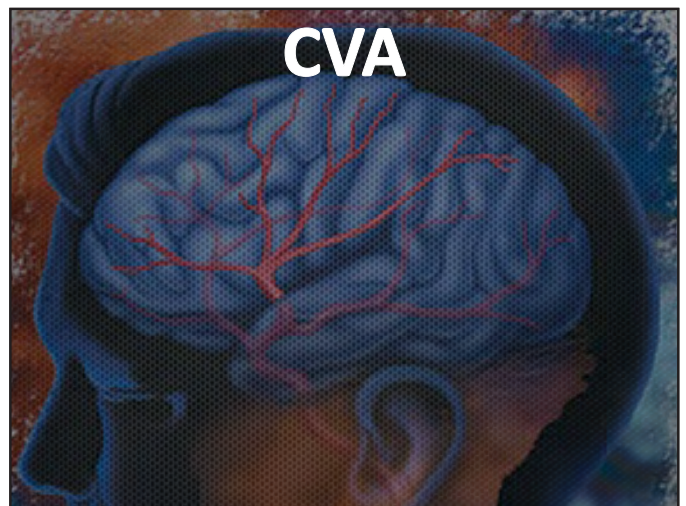
Treatment with **immunomodulators**

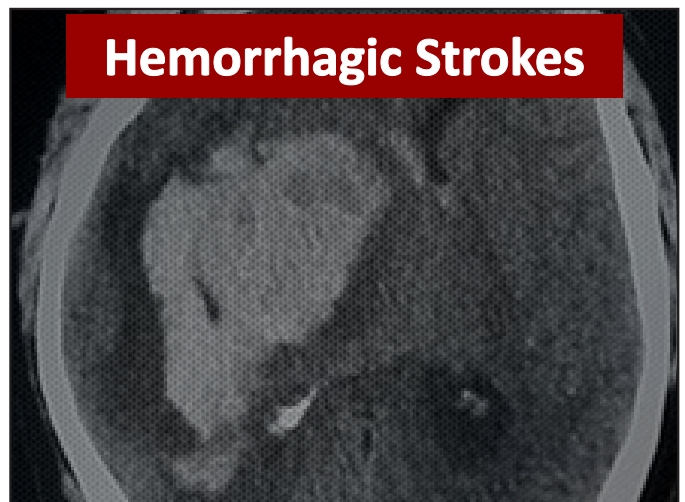
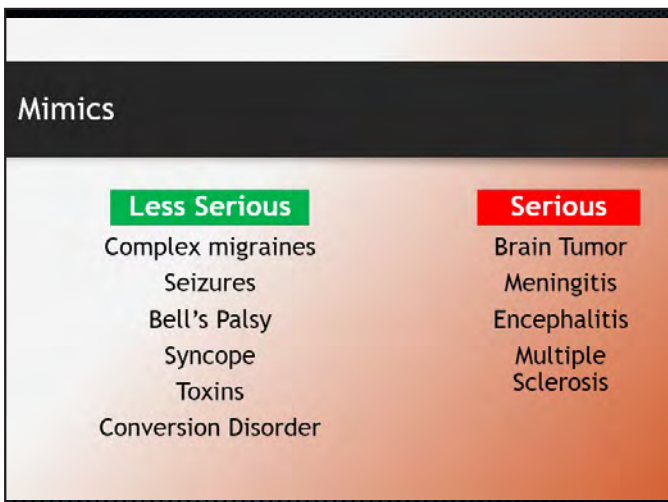
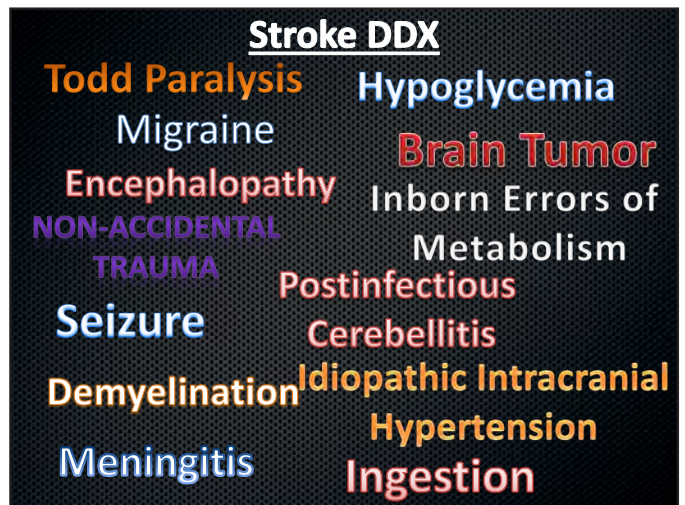
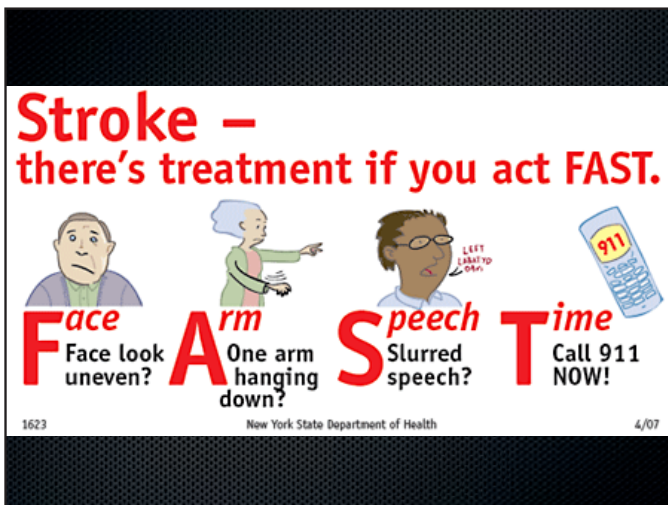
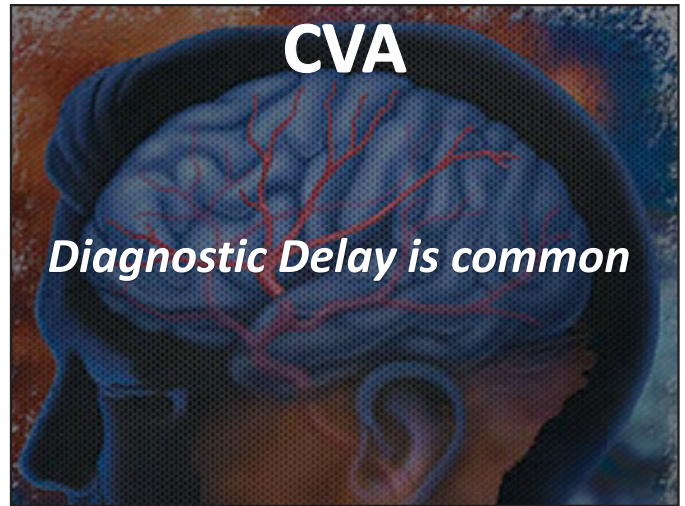
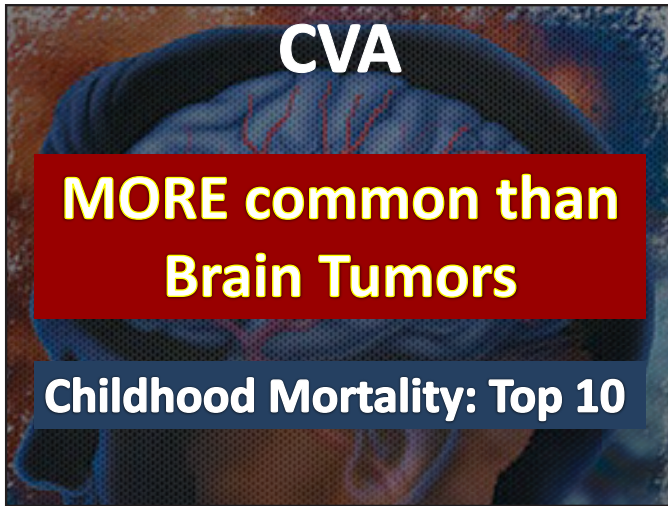
Remove tumor (teratomas) if present

Supportive care



ADEM
The **most common autoimmune encephalitis**
White matter demyelination
“(Post) Infectious MS” (similar clinical presentation)
4-6 weeks
Some degree of encephalopathy
Treatment: IV Glucocorticoids
IVIG, plasma exchange juniperpediatrics

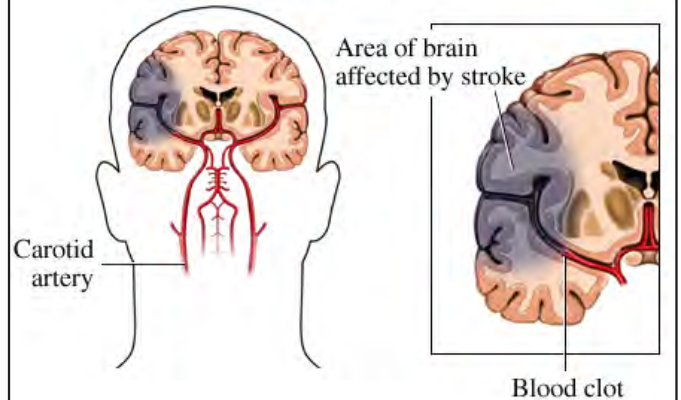




Hemorrhagic Strokes

~50%

Ischemic Stroke



Risk Factors

Infection
Arteriopathies
Cardiac Disease
Hematologic Disease
Other

Presentation

Infants

Non-focal
Altered mental status
Seizures
Full fontanel/ Increasing head circumference
Lethargy
Vomiting
Hemiparesis

Older children: Focal neurological findings

Diagnosis

- Peds NIHSS (on MDCalc)
- Labs for stroke mimics

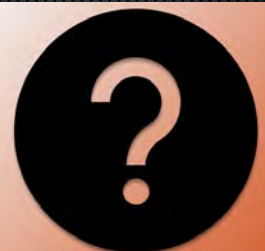
CT—rapid and accessible

MRI—best test for diagnosis, etiology, and mimics

Controversy

No formal recommendation for thrombolytics

Mechanical thrombectomy not formally recommended, but some reports of efficacy



Management



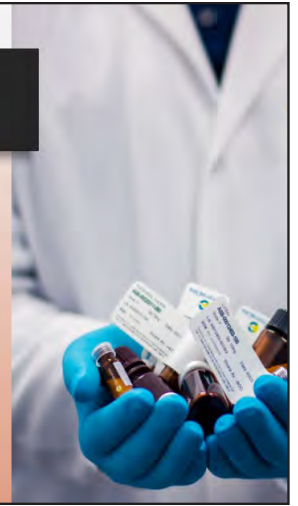
Treatment

LMWH: Children 1 mg/kg SQ every 12h
Neonates 1.5 mg/kg SQ every 12h

UH: 75 U/kg IV over 10m → 28 U/kg/h for infants, 20 U/kg/h for children > 1 year

ASA: 3-5 mg/kg

tPA: 0.9 mg/kg IV, 10% as bolus → 90% over 1 hours



Directed Treatments

Sickle Cell Disease:
Exchange transfusion

Heparin:
Cerebral venous sinus thrombosis
Cervical artery dissection
Cardioembolism

All other ischemic strokes: ASA

Sickle Cell Disease



Exchange Transfusion!

Treatment- Minimize Secondary Damage

Correct	Correct clotting/platelet abnormalities
Prevent	Prevent hypotension
Avoid	Avoid hypoxemia
Avoid/treat	Avoid/treat hyperglycemia

other diagnoses to consider...

Headache Evaluation

Most headaches are primary/benign

Perform a thorough **neurologic exam**

CNS Tumors

Headache

Vomiting

Focal Neurologic Findings

Pseudotumor Diagnosis

- Step 1: **HISTORY**—Identify at risk patient (headache pattern, vision symptoms)
- Step 2: **PHYSICAL EXAM**—Papilledema or CN VI palsy
- Step 3: **Neuroimaging** (MRI/MRV best)
- Step 4: **Lumbar puncture** to confirm increased ICP
- Step 5: Initiate **treatment**

Pseudotumor Symptoms

- Headache** (90%)
- Transient visual obscurations** (70%)
- Pulsatile tinnitus (55%)
- Photopsia** (50%)
- Retrobulbar pain (40%)
- Diplopia (25%)
- Sustained visual loss (30%)
- Cognitive disturbances (20%)
- Back pain (50%)
- Neck pain (40%)

Diagnostic Criteria

- Papilledema** OR **CN VI** (abducens) **palsy**
Otherwise normal neurological exam
- No mass, hydrocephalus on imaging
- Normal CSF
- Increased LP opening pressure**
(>25 cm H₂O in lateral decubitus position)

Pseudotumor Treatment

- 1.Lifestyle** (goal 10% weight loss)
- 2.Medication** (acetazolamide)
- 3.Avoid exacerbating medications
(*hormones, retinoids, tetracycline*)
- 4.Surgical intervention** in refractory or severe cases

Cerebral Venous Thrombosis

Clinical Presentation

1. Increased ICP (**headache**, papilledema, visual disturbance)
2. **Focal neurologic symptoms** (deficits, stroke)
3. Encephalopathy (impaired cognition, stupor, coma +/- neuro deficits)
4. **Stroke** (multiple vascular territories)

May be acute, subacute, or chronic

Cerebral Venous Thrombosis

Clinical Presentation

Headache (90%)

Thunderclap or gradual onset (increased ICP)

****The only symptom in 25%****

Seizures (40%)

Focal neurological deficits (20%)

multiple vascular territories

May be acute, subacute, or chronic

CVT Treatment

Anticoagulation with heparin

EVEN with **hemorrhage**

CVT Prognosis

5% die in acute phase

80% completely recover or mild deficits

~10% with severe disability

Recurrence in 3%

Worse prognosis if deep venous system involved

Up to 6.5% **thrombosis risk** per year (CVT, ischemic stroke, PE, limb ischemia)

Thank you!

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SELF EVALUATION

Pediatric Neurologic Presentations

1. A child presents to the ED with a headache. The mother is concerned it is malignancy. What is the most reassuring finding on physical examination?
 - a. A negative family history for malignancy
 - b. A normal neurological examination and no papilledema
 - c. No evidence of fever or nuchal rigidity
 - d. The absence of deep tendon reflexes
2. A 2 year-old child presents in status epilepticus. She has received benzodiazepines per the paramedics as well as two doses in the ED. Which is the best next option for management?
 - a. Ativan at 1 mg/kg
 - b. Phenobarbital at 20 mg/kg
 - c. Levetiracetam at 20 mg/kg
 - d. Valproic acid at 20 mg/kg
3. Which of the following is the most appropriate first-line treatment for an actively seizing child with intravenous access?
 - a. Phenytoin
 - b. Lorazepam
 - c. Phenobarbital
 - d. Levetiracetam
4. A healthy 7-year-old presents with acute focal paralysis after a febrile illness. What is the most likely diagnosis?
 - a. Acute flaccid myelitis
 - b. Brain tumor
 - c. Pseudoseizure
 - d. Todd's paralysis
5. A 6-month-old infant presents with irritability, a bulging fontanelle, and seizures. What is the most likely diagnosis?
 - a. Febrile seizure
 - b. Hydrocephalus
 - c. Meningitis
 - d. Infantile spasms
6. A 9-year-old presents with sudden-onset right-sided weakness and slurred speech. CT head is normal. What is the next best step?
 - a. Observe and re-scan in 24 hours
 - b. Start tPA immediately
 - c. MRI/MRA of brain and neck
 - d. Begin antiepileptic therapy
7. What medical condition has the highest risk of pediatric stroke?
 - a. Hypertension
 - b. Hyperlipidemia
 - c. Sickle Cell Disease
 - d. Smoking
8. A 2 year-old child presents in status epilepticus. She has received benzodiazepines per the paramedics as well as two doses in the ED. Which is the best next option for management?
 - a. Ativan at 1 mg/kg
 - b. Phenobarbital at 20 mg/kg
 - c. Levetiracetam at 20 mg/kg
 - d. Valproic acid at 20 mg/kg

Answer Key: 1. B, 2. C, 3. B, 4. A, 5. C, 6. C, 7. C, 8. C

Best Practices in Emergency Imaging

Robert J. Tubbs, MD

Best Practices in Emergency Imaging



Objectives

1. Briefly discuss the variability present in emergency imaging utilization
2. Examine some of the existing guidelines and tools to assist Emergency providers in ordering appropriate imaging studies
3. Look at some common ED scenarios where confusion exists regarding appropriate ordering algorithms

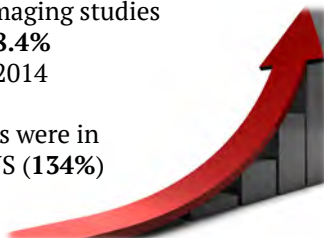


The Increasing Use of Emergency Department Imaging in the United States: Is It Appropriate?

Original Research | Health Care Policy and Quality | June 26, 2013
 Authors: Santosh Kumar Sehgal, David C. Levin, and Laurence P. Miller
 Volume 23, Issue 4 | <https://doi.org/10.22690/23.4.2013>

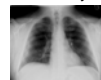
Total number of ED imaging studies increased **38.4%** from 2006-2014

Biggest increases were in CT (**153%**) and US (**134%**)



So many choices!

X-Ray



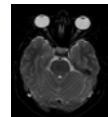
Ultrasound



CT



MRI



V/Q Scan



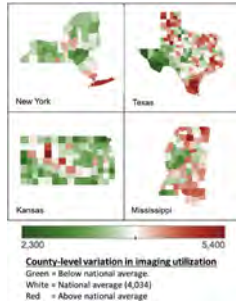
And so much variability!!!



J Am Coll Radiol. 2017 Jun;14(6):725-732. doi: 10.1016/j.jacr.2016.11.020. Epub 2017 Mar 11.
County-Level Population Economic Status and Medicare Imaging Resource Consumption
 Andrew B Rosenkrantz¹, Danny R Hughes², Anand M Prabhakar³, Richard Duszak Jr⁴

- Review of CMS data looking at Medicare imaging utilization
- State-fold variation was up to 1.8-fold and up to 5.3-fold by county
- Costs to Medicare varied 4.2-fold at the state level and 14.1-fold at the county level

Variability in Medicare Imaging Studies



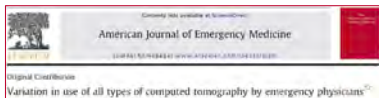
Variability in Ordering Imaging Studies



42,412 children with minor blunt head trauma

- 25 U.S. Peds EDs, all but 5 urban, all but 4 teaching
 - Rates of head CTs – **19.2% vs 69.2%**
- Rates unrelated to positive scans or serious brain injury
- **18.3%** of PECARN low-risk patients received a CT
 - EPs ordered **almost twice** as many scans as pediatricians

Variability in Ordering Imaging Studies



Levine, M.B., *Am J Emerg Med*, October 2013

- 49 EPs, Level I trauma center, 44,724 pts. had CT scans
 - Rate of CT scanning by provider **11.5% vs 32.7%**
- Variation by CC – abd. pain (12%-52%), chest pain (4%-32%) SOB (4%-29%), headache (17%-76%)
 - Most variability was in *discharged* patients

And the variability keeps on going

- Kim, A.S., *Am J Emerg Med*, June 2012
 - Kaiser study, 20 EDs, 20,795 patients with dizziness
 - Rates of CT imaging – **21.8% vs 32.8%**
 - MRI imaging – **0.8% vs 6.2%**
 - Frequency of imaging unrelated to frequency of stroke
- Lodwick, D.L., *Pediatrics*, December 2016
 - Comparison of 30 U.S. pediatric hospitals
 - **Six-fold variation** in CTs scans in patients discharged from the ED
- Chen, Y.A., *Emergency Radiology*, 22:221-9, 2015
 - Canadian tertiary ED, 835 suspected PE patients
 - 22 EPs, rates of CTPA = 2.1/1000 ED visits vs 7.7 (5.7x)
 - Positivity rates = **6.7% vs 38.9%** (5.8x)
 - Rates **unrelated to experience, gender or certification**

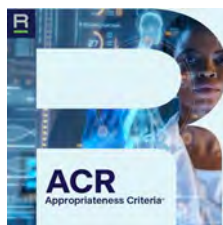
So how do we reign in some of this variability?



We need some tools



ACR Appropriateness Criteria



ACR Appropriateness Criteria

- Evidence-based guidelines developed by the ACR
- Rates the appropriateness of an imaging study on a tertiary scale (1-3, 4-6, 7-9)
- Now a commercial decision-support CPOE program



ACR Appropriateness Criteria

Multi-Disciplinary panel goes through the studies and decision-making for each of the recommendations for imaging choices

CMS payment for expensive imaging will require consulting CPOE decision support



ACR Appropriateness Criteria

Appropriateness Category Name	Appropriateness Rating	Appropriateness Category Definition
Usually Appropriate	7, 8, or 9	The imaging procedure or treatment is indicated in the specified clinical scenarios at a favorable risk-benefit ratio for patients.
May Be Appropriate	4, 5, or 6	The imaging procedure or treatment may be indicated in the specified clinical scenarios as an alternative to imaging procedures or treatments with a more favorable risk-benefit ratio, or the risk-benefit ratio for patients is equivocal.
May Be Appropriate (Disagreement)	3	The individual ratings are too dispersed from the panel median. This different label provides transparency regarding the panel's recommendation. "May be appropriate" is the rating category and a rating of 3 is assigned.
Usually Not Appropriate	1, 2, or 0	The imaging procedure or treatment is unlikely to be indicated in the specified clinical scenarios, or the risk-benefit ratio for patients is likely to be unfavorable.

ACR Appropriateness Criteria

Variant 2: Age greater than or equal to 16 years. Suspected acute cervical spine blunt trauma. Imaging indicated by NEXUS or CCR clinical criteria. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT cervical spine without IV contrast	Usually Appropriate	***
Radiography cervical spine	May Be Appropriate	**
Anteroposterior cervicocervical	Usually Not Appropriate	***
CT cervical spine with IV contrast	Usually Not Appropriate	***
CT cervical spine without and with IV contrast	Usually Not Appropriate	***
CT myelography cervical spine	Usually Not Appropriate	****
CTA head and neck with IV contrast	Usually Not Appropriate	***
MRA head without and with IV contrast	Usually Not Appropriate	0
MRA neck without IV contrast	Usually Not Appropriate	0
MRI cervical spine without and with IV contrast	Usually Not Appropriate	0
MRI cervical spine without IV contrast	Usually Not Appropriate	0



Now that we know *WHICH* study to order, how do we know when *NOT* to order a study?



Over 80 medical societies have created 5 to 10 practices each that clinicians should think twice before ordering (totals 700+ recommendations)

A number of societies, inc ACEP, have developed guidelines pertinent to emergency medicine



1. Don't order CT for uncomplicated headache
2. Don't image for suspected PE without moderate or high pre-test probability (use decision rules to risk stratify)
3. No repeat abdominal CTs for pts with functional abdominal pain unless significant change in status



4. No CTs in suspected pediatric appendicitis without considering ultrasound first
5. No routine spinal imaging for atraumatic low back pain *without* red flag symptoms

And the list goes on....



It is one thing to create guidelines, another to disseminate and, by far the hardest, to implement



More tools in the toolbox: Professional Society Policy Statements



FROM THE AMERICAN ACADEMY OF PEDIATRICS | POLICY STATEMENT | JUNE 27 2024 **Optimizing Advanced Imaging of the Pediatric Patient in the Emergency Department: Policy Statement** **FREE**

Jennifer R. Martin, MD, MSc, FAAP, FACEP; Todd W. Lyons, MD, MPH, FAAP; Jaime Clausius, MD, FACEP; Mary E. Fialat, MD, FAAP, FACS; Michael Aquino, MD; Timothy Rutan, MD, FACEP, FAAP; Reza J. Daugherty, MD, FAAP; AMERICAN ACADEMY OF PEDIATRICS Committee on Pediatric Emergency Medicine, Section on Radiology; AMERICAN COLLEGE OF RADIOLOGY; AMERICAN COLLEGE OF EMERGENCY PHYSICIANS Pediatric Emergency Medicine Committee

Makes a number of recommendations

FROM THE AMERICAN ACADEMY OF PEDIATRICS | POLICY STATEMENT | JUNE 27 2024 **Optimizing Advanced Imaging of the Pediatric Patient in the Emergency Department: Policy Statement** **FREE**

1. EDs that care for children should ensure appropriate imaging resources are available to meet their imaging needs, that they have transfer protocols in place
2. Have mechanism to securely transmit imaging findings to receiving facilities
3. Have processes in place to ensure timely and efficient transfer of pediatric patients who require specialized care

FROM THE AMERICAN ACADEMY OF PEDIATRICS | POLICY STATEMENT | JUNE 27 2024 **Optimizing Advanced Imaging of the Pediatric Patient in the Emergency Department: Policy Statement** **FREE**

4. Have policies in place for imaging consultation with a pediatric radiologist
5. Strive to provide high-quality ultrasonography as first-line imaging for pediatric patients
6. Partner with imaging services to ensure that CT protocols and parameters are pediatric-specific and adhere to the ALARA principle

FROM THE AMERICAN ACADEMY OF PEDIATRICS | POLICY STATEMENT | JUNE 27 2024 **Optimizing Advanced Imaging of the Pediatric Patient in the Emergency Department: Policy Statement** **FREE**

Question to Be Answered	Recommendation
Will imaging assist with determining whether emergent intervention is needed?	Perform imaging.
Will imaging assist with determining whether transfer is needed?	Perform imaging.
Will patient be transferred regardless of imaging findings?	Defer imaging to the receiving institution

ACEP Clinical Policies



Let's look at some
specific scenarios



Sudden-onset severe headache

32 y.o. healthy male presenting with sudden-onset worst HA of his life starting 1 hour ago

+ Neck stiffness

BP 185/110

Neuro intact



ACEP Clinical Policy: Headache

CLINICAL POLICY
Clinical Policy: Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department With Acute Headache
Approved by the ACEP Board of Directors June 26, 2019
Clinical Policy Endorsed by the Emergency Nurses Association (July 31, 2019)

- Negative non-contrast head CT (NCCT) within 6 hours of symptom onset can rule out a subarachnoid hemorrhage in most cases - Level B
- In cases where suspicion still exists despite negative NCCT, can use CTA or LP to rule out SAH - Level C



Guideline really focuses on the diagnosis of spontaneous SAH

Not really applicable for other potentially lethal causes of acute headache

40 y.o. female with sharp, pleuritic CP and SOB

Tachycardic, tachypneic

EKG showing sinus tachycardia with RBBB



ACEP Clinical Policy: Pulmonary Embolism

CLINICAL POLICY
Clinical Policy: Critical Issues in the Evaluation and Management of Adult Patients Presenting to the Emergency Department With Suspected Acute Venous Thromboembolic Disease



Pulmonary Embolism

1. Assess pretest probability first:

- If low risk apply CDR such as PERC (Level B rec)
- If moderate risk or PERC (+) may use D Dimer (Level B rec)

2. CT PE for positive D Dimer OR in high-risk patients

Criterion	Yes	No
Age < 50	Yes	No
Hx of DVT or PE	Yes	No
Hx of recent surgery or trauma	Yes	No
Hx of recent hospitalization	Yes	No
Hx of recent long-distance travel	Yes	No
Hx of recent immobilization	Yes	No
Hx of recent surgery	Yes	No
Hx of recent trauma	Yes	No
Hx of recent surgery	Yes	No
Hx of recent trauma	Yes	No

Pulmonary Embolism in Pregnancy

Differing recommendations regarding CT vs V/Q vs US

- Start with CXR
 - If normal can consider V/Q
 - If abnormal then CT PE
- If LE pain or swelling can start with DVT US and potentially avoid radiation if positive



Pulmonary Embolism in Pregnancy

V/Q may result in more radiation to fetus

CT may result in more radiation to mother

CT can ID alternative pathology in 12% of cases

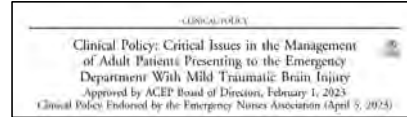
In general radiologists are more comfortable with CT with better inter-rater reliability





21 y.o. helmeted fall with brief(<1 min)
LOC, no external signs of trauma, no
amnesia

ACEP Clinical Policy: Mild TBI



Recommends the use of Clinical Decision Rules to determine who requires a head CT with mild traumatic brain injury

- Canadian Head CT Rule – Level A
- NEXUS or New Orleans Head CT Rule – Level B
- Do NOT use in pts on anticoagulation or anti-platelets (besides ASA)

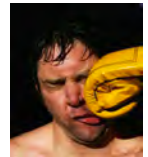
Which brings us to more valuable tools:
Clinical Decision Rules



Adult Minor Head Injuries

The Canadian Head CT Rule has the highest sensitivity and specificity (Stiell, Lancet, 5/5/01)(Stiell, JAMA, 9/28/05)

- 3,121 pts, GCS 13-15 (80%-15)
- 8% had clinically important TBI /1% NSG
- 100% sensitive (CI = 92%-100%) for NSG
- Would require only 32% to get a CT



Canadian CT Head Rule

CT scans to only require for selected adult patients who are at high risk

High Risk (for Neurological Intervention)

1. GCS score < 15 at 2 hrs after injury
2. Suspected open or depressed skull fracture
3. Any sign of basal skull fracture*
4. Vomiting > 2 episodes
5. Age > 65 years

Medium Risk (for Brain Injury on CT)

6. Amnesia before impact > 30 min
7. Dangerous mechanism ** (pedestrian, occupant ejected, fall from elevation)

Signs of Basal Skull Fracture

Periorbital ecchymosis, Battle's sign, Battle's sign

Cranial nerve dysfunction

Cranial nerve III, IV, V, VI, VII, VIII, IX, X, XI, XII

See also Appendix 2, Table 2.1 & 2.2

See also Appendix 2, Table 2.1 & 2.2

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See also Appendix 2, Table 2.1 & 2.2

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Pediatric Minor Head injury



Pediatric Minor Head Injury



NO skull x-rays!!

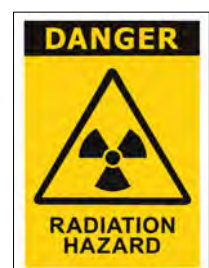
Only 54% of pediatric patients with an abnormality had visible fracture on x-ray

Pediatric Minor Head Injury

Radiation concerns:

Estimated lifetime risk of fatal cancer in a 1 YO:
1/1,000 – 1/5,000 CTs

Estimated risk for a 10 YO: 1/5,000



PECARN Head CT Guidelines



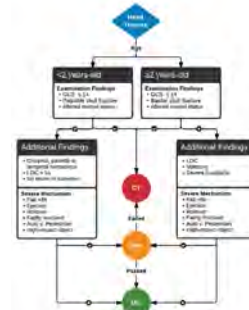
Can be used in children to rule out significant TBI

42,412 pedi head injuries (Easter, J.S., *Ann Emerg Med*, 8/14)

- < 2YO, 100% sensitive
- > 2YO, 96.8% sensitive

- But clinically important injuries were rare (0.9%) and 0.1% had NSG/ no deaths

PECARN Head CT Guidelines



Cervical Spine Imaging

Not every patient requires C-spine imaging

Two major CDR exist for suspected cervical spine trauma:
NEXUS vs Canadian C spine Rule (**CCR**)



NEXUS vs CCR



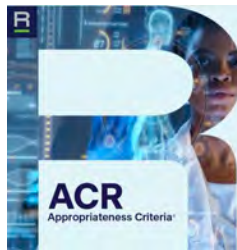
Canadian C-spine Rule more sensitive and specific than NEXUS, especially in the elderly

NEXUS vs CCR

The ACR Appropriateness Criteria:

Either are appropriate to use in low-risk patients

Do not recommend imaging in pts cleared by either



NEXUS vs CCR



Canadian C-spine Rule was not validated for children <16 years

Nexus only included 4 children < 9 and none < 2 with injuries

Are plain C-spine x-rays IN ADULTS dead?



An analysis of 4 studies comparing CT with plain films says
YES

X-rays missed
8-65% of injuries

Hunter B, J Em Med 2/2014

Are plain C-spine x-rays IN ADULTS dead?

Variant 2: Age greater than or equal to 16 years. Suspected acute cervical spine blunt trauma. Imaging indicated by NEXUS or CCR clinical criteria. Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
CT cervical spine without IV contrast	Usually Appropriate	***
Radiography cervical spine	May Be Appropriate	**
Arteriography cervicocentral	Usually Not Appropriate	*
CT cervical spine with IV contrast	Usually Not Appropriate	*
CT cervical spine without and with IV		

Plain C-spine X-rays in Pediatrics

ACR Appropriateness Criteria for children up to 16 years:

Recommends Plain X-rays as first line imaging

Variant 2: Child, 1 to 16 years of age, acute cervical spine trauma, at least one risk factor with reliable clinical examination (based on PECARN or NEXUS). Initial imaging.

Procedure	Appropriateness Category	Relative Radiation Level
Radiography cervical spine	Usually Appropriate	☆☆
CT cervical spine without IV contrast	May Be Appropriate (Disagreement)	☆☆☆☆
MRB cervical spine without IV contrast	May Be Appropriate (Disagreement)	○
CTA neck with IV contrast	Usually Not Appropriate	☆☆☆☆

Ankle injury



22 yo female with ankle pain after fall



Diffuse swelling

Tenderness to palpation over lateral malleolus

Unable to bear weight

Ottawa Foot and Ankle Rules

-
1. Tenderness at posterior edge or tip of lateral or medial malleolus, distal 6 cm
 2. Navicular tenderness
 3. Base of 5th metatarsal tenderness
 4. OR Inability to bear weight immediately AND in the ED!

Ottawa Foot and Ankle Rules

Bachmann et al:
Systematic review
27 studies
15,581 patients
Pooled sensitivity = **97.6%**

Performs equally well in adults and children

Let's finish by looking at some general imaging guidelines



Abdominal CT: IV contrast

IV Contrast Indications:

- Trauma
- Vascular pathology (aorta, mesenteric ischemia, organ infarction)
- Infectious/Inflammatory pathology (diverticulitis, appendicitis)



Abdominal CT: Oral contrast

Majority of CTs DO NOT require oral contrast!!

- Review of studies showing oral contrast is not necessary in routine ED CTs (Aycok Emerg Med News 3/18)

Exceptions include:

- CT Esophageal Perforation Protocol
- Some Penetrating Trauma (flank)
- Gastric Bypass Protocols



Abdominal Imaging

RUG pain:

- US first to evaluate the GB
- After CCY, CT is a better *initial* test to image the remainder of the biliary system



Abdominal Imaging

RLQ pain with suspicion for appendicitis:

- In men /non-pregnant women
 - CT first
- In children and pregnant women:
 - US first, if equivocal then MRI



Abdominal Imaging: Lower GI Bleeding

Colonoscopy is still the best test – but requires a prep

There is an acute GI bleed
CT protocol to localize the source of bleeding, and to guide VIR



CT Acute GI Bleed Protocol

Actually a THREE-phase CT:

1. Non-contrast (baseline)
2. Arterial phase (looking for active extravasation)
3. Delayed phase (looking for redistribution of contrast)



CT Acute GI Bleed Protocol

Requires a very brisk rate of bleeding to be positive:
> 0.35 mL/min



Detection rates:
90% with *active* bleeding

45% with *intermittent* bleeding



"I've fallen and I can't get up!"

Occult Hip Fractures

Hip fractures in the elderly carry high morbidity and mortality

1 year mortality:

22% in women, 33% in men



Occult Hip Fractures

Sensitivity of plain films:

90-98%

Sensitivity drops with:

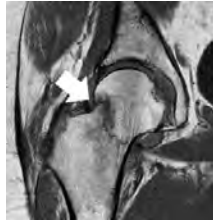
- Osteopenia
- Elderly patients
- Low energy mechanisms (ground level falls)
- Females (4:1)



Advanced Imaging for Occult Hip Fractures

The gold standard for diagnosing occult hip fractures is MRI

Sensitivity and Specificity of **100%** and **99%**



T1-weighted image

CT of the Hip

Sensitivity and Specificity of CT of the hip vary widely, but one meta-analysis suggests they are **79%** and **91%**

Ok to get a CT if there are barriers to getting an MRI, **BUT** if negative and clinical suspicion still exists the patient should still get the MRI



Summary



1. ED imaging rates continue to grow, with almost 50% of ED patients receiving imaging
2. Lots of variability exists regarding utilization, even within institutions
3. Emergency clinicians have an obligation to know the indications for imaging and the safest, most cost-effective modalities
4. Awareness of Clinical Policies and Clinical Decision Rules can help standardize practice

SELF EVALUATION

Best Practices in Emergency Imaging

1. The ACEP Clinical Policy on Acute Mild Traumatic Brain Injury allow for use of all of the following clinical decision rules to determine the need for emergency head CT in adults except:
 - a. Canadian Head CT Rule
 - b. NEXUS Head CT Rule
 - c. PECARN Head CT Rule
 - d. New Orleans Head CT rule
2. T/F - Use of the Pulmonary Embolism Rule-Out Criteria (PERC) rule may be used in all comers, regardless of pretest probability.
3. The PECARN Head CT rule includes each of the following in the list of severe mechanism of injury EXCEPT:
 - a. Fall > 8 feet
 - b. Rollover
 - c. Ejection
 - d. Auto vs pedestrian
4. T/F - The Canadian C Spine rule performs equally well in pediatric and elderly patients in comparison the NEXUS C spine rule.
5. Indications for administering PO contrast for abdominal CT scans include all of the following EXCEPT:
 - a. Esophageal perforation
 - b. Penetrating trauma
 - c. Prior gastric bypass
 - d. Diverticulitis

Answer Key: 1. C, 2. F, 3. A, 4. F, 5. D

FACULTY

Henry Z. Pitzele, MD, FACEP

Henry Z. Pitzele, MD, FACEP, is an Emergency Physician and Chief Health Informatics Officer at Jesse Brown VA Medical Center in Chicago, and part-time attending physician at Advocate Illinois Masonic Medical Center in Chicago, a level one trauma center. He is currently the Vice President of Communications for ACEP and a member of the ACEP Board of Directors. Dr. Pitzele has a medical degree from the University of Illinois at Chicago College of Medicine and completed an emergency medicine residency at University of Illinois at Chicago.

You may contact Dr. Pitzele with your questions or comments at pitztele@gmail.com.

Leadership in Emergency Medicine

Henry Z. Pitzele, MD, FACEP

Leadership in Emergency Medicine

Henry Pitzele, MD FACEP
ACEP Board of Directors

Circuitous Route

- The why
- Educational leadership
- Institutional leadership
- The big tent
- Organized EM
- The why (again)
- The anti-burnout

The Path



My Path

- Finding the reason
- Rinse and repeat
- Organized EM



The Reason

- Finding your 'why'



The Reason

- Finding your 'why' *not*
- Self-definition



The Reason

- Finding your 'why' *not*
- Self-definition
- Impostor



The Reason

- Finding your 'why' *not*
- Self-definition
- Impostor
- Look both ways



The Reason

- Finding your 'why' *not*
- Self-definition
- Impostor
- Look both ways
- Showing up



Deep dive

- Look deep within your self
- Enneagram



Deep dive

- Look deep within your self
- Enneagram



Deep dive

- Look deep within your self
- Enneagram

Strengths of your type	Challenges of your type
• OK asking difficult questions • Aware of trust issues • Plan ahead to avoid problems • OK coping with good and bad news • Aware of responsibilities	• Tendency to expect the worst • Big goals without follow through • People experience me as suspicious and doubting • Overestimate authority of others/underestimate my own • Once trust has been broken...

The Reason

- Thinking I could do it better
- No one else stepping up
- Fear



The Reason

- Thinking I could do it better
- No one else stepping up
- Fear
 - FOMO
 - Fear that this can't last
 - Tough job



Institutional Leadership

- Thinking I could do it better
- No one else stepping up
- Fear
 - FOMO
 - Fear that this can't last
 - Tough job
- Control



Institutional Leadership

- Downside
 - Control?
 - This is a completely different job
- Stress
 - Shift is never over
 - Not just patients
 - Multitasking next level



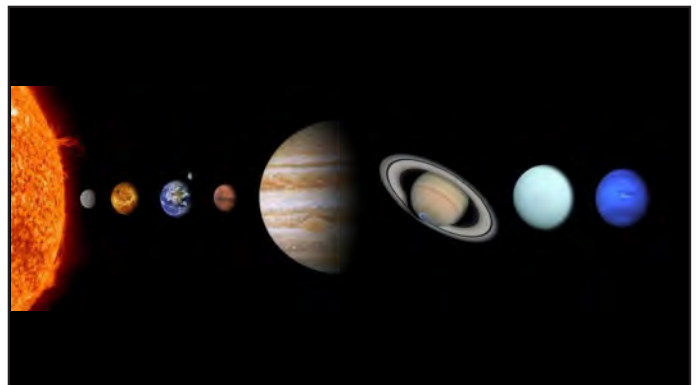
The Reason

- Thinking I could do it better
- No one else stepping up
- Fear
 - FOMO
 - Fear that this can't last
 - Tough job
- (altruism: amplification)



The big tent

- EM covers a lot of ground
 - CCM
 - EMS
 - U/S
 - Research
 - RCM
 - BH
 - OBS
 - Informatics



The big tent

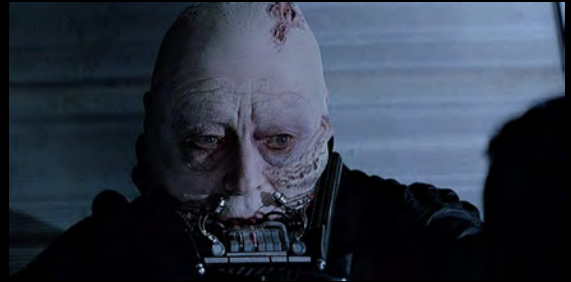
- Pros
 - Geeking out is pretty cool
 - \$
 - Fear/FOMO
 - (altruism/scientific advancement)
- Cons
 - Studying and testing
 - \$
 - Then what?

Institutional Leadership

- Downside
 - Control?
 - This is a completely different job
 - Stress
 - Shift is never over
 - Not just patients



Sunk cost fallacy



Organized EM



Organized EM



IT'S NOT THAT ORGANIZED

Organized EM

- Through-line



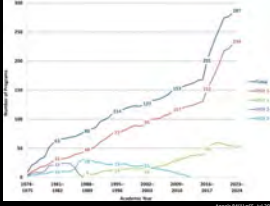
EM PHYSICIAN

Workforce of the Future

Mark Rosenberg, DO, MBA, FACEP

March 9, 2021

Organized EM



Organized EM

- What is “Organized” EM?
- What’s it do?
- Universal anti-burnout



What

- Organized EM = professional societies
 - AAEM
 - ACEP
 - EMRA
- More specialized
 - ACOEP
 - SAEM
 - CORD
 - (ABEM)
 - EDPMA
 - NAEMSP

no

- Hyperspecialized EM orgs
 - ACMT
 - AAEP (ψ)
- Nonphysician orgs
 - SEMPA
 - AAENP
- House of Medicine
 - AMA
 - State medical societies

History of EM = History of EM Orgs



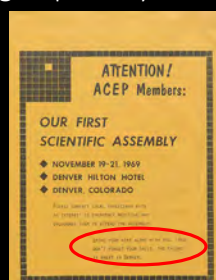
History of EM = History of EM Orgs

- Purpose dictated by epoch
- Easier to see in retrospect

Phase I: Becoming a specialty

- 1968 ACEP forms
 - Advocate for specialty
 - Define scope of practice
 - Create training opportunities

- 1979 specialty recognized, ABEM forms



Phase II: No, really, we’re specialists

- Generate research
- Increase credibility within institutions
- Develop national advocacy efforts
 - Prudent layperson
 - E&M code reimbursement

- ABEM/AOBEM vs ‘grandfathered’

1993 Schism

- AAEM splinters off
 - Residency training
 - Corporate control



Phase III: Did you talk to a doctor?

- NPP vs physician
- Workforce
- Government, payors, corporate entities

I'll talk about ACEP



What ACEP is for

- Advocacy
- Education/Research/Clinical Excellence
- Practice Innovation/Career Fulfillment
- Community

What ACEP is for

- Education/Research/Clinical Excellence
- Practice Innovation/Career Fulfillment
- Community
- Advocacy

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- Education/Research/Clinical Excellence
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What ACEP is for

- Education/Research/Clinical Excellence
- Practice Innovation/Career Fulfillment
- Community
- Advocacy



What ACEP is for

- Education/Research/Clinical Excellence
- Practice Innovation/Career Fulfillment
- Community
- Advocacy



What ACEP is for

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What ACEP is for

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What ACEP is for

- Education/Research/Clinical Excellence
- Practice Innovation/Career Fulfillment
- Community
- Advocacy

Structure of ACEP

- Council
- BOD
- Committees
- Sections
- Staff
 - TX
 - DC
- State Chapters



Council

Meeting	Date	Location
Executive Meeting	April 15-16, 2021	Virtual
Executive Meeting	May 13-14, 2021	Virtual
Executive Meeting	June 10-11, 2021	Virtual
Executive Meeting	July 8-9, 2021	Virtual
Executive Meeting	August 5-6, 2021	Virtual
Executive Meeting	September 3-4, 2021	Virtual
Executive Meeting	October 1-2, 2021	Virtual
Executive Meeting	November 5-6, 2021	Virtual
Executive Meeting	December 3-4, 2021	Virtual

Council



Board



Committee Lists

- Academic Affairs
- Awards
- Bylaws Interpretation
- Clinical Policies
- Coding & Nomenclature Advisory
- Compensation
- Education
- EM Practice
- Federal Government Affairs
- Health Innovation Technology
- Medical-Legal
- National Chapter Relations
- Pediatric EM
- Quality & Patient Safety
- Research
- Web-Blog
- Audit
- Bylaws
- Clinical Emergency Data Registry
- Clinical Resources Review
- Communications
- Disaster Preparedness & Response
- EMS
- Ethics
- Finance
- International Emergency Medicine
- Membership
- Nominating
- Public Health & Injury Prevention
- Reimbursement
- State Legislative/Regulatory

Organized EM

- Through-line

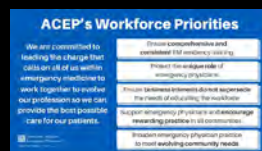


Sections



Workforce

- Pressures
 - Govt
 - Payers
 - NPP
 - Oligopolistic EM industry



Workforce

4-YEAR EM RESIDENCY: Winners & Losers Edition



Structure of ACEP

- Council
- BOD
- Committees
- Sections
- Staff
 - TX
 - DC
- State Chapters



ACEP DC office



Current Advocacy Initiatives

COVID-19 MORE	Surprise Billing MORE	Workforce Issues MORE	EHR Burden MORE
Medicare Reimbursement MORE	Medicare / Medicaid MORE	Drug Shortages MORE	Emergency Medicine APMs MORE
Mental Health MORE	Health Care Reform MORE	Access to EM MORE	Liability Reform MORE
Value of EM MORE	Letters to Congress MORE	ED Violence MORE	Advocacy Image Gallery MORE

LAC



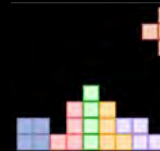
LAC



LAC



LAC



Antidote



Organized EM

- Through-line



How to get involved

- ACEP
 - LAC
 - Chapters
 - Council
 - Committees
 - EMRA
- Non-EM
- Other EM Orgs

Thanks much for your time!

SELF EVALUATION

Leadership in Emergency Medicine

1. Which of these is not identified as a component of ACEP's purpose?
 - a. Education and research
 - b. Clinical excellence
 - c. Practice innovation and career fulfillment
 - d. Pharmaceutical partnership development
2. Which of the following roles is not listed under the "big tent" of EM subspecialty paths?
 - a. Critical Care Medicine
 - b. EMS
 - c. Dermatopathology
 - d. Informatics
3. T/F - The lecture describes "Institutional Leadership" as involving increased control and reduced stress due to delegation.
4. T/F - One of the cons of pursuing subspecialty or academic paths in Emergency Medicine is the ongoing cycle of studying and testing.
5. T/F - "Impostor syndrome" is highlighted in the deck as one of the internal challenges that can influence leadership development.

Answer Key: 1. D, 2. C, 3. F, 4. T, 5. T

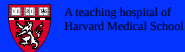
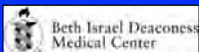
Neurologic Emergencies in Pregnancy and the Postpartum Period

Jonathan A. Edlow, MD

Neurologic Emergencies in Pregnancy and the Postpartum Period

June 2025

Jonathan A. Edlow, MD FACEP
Department of Emergency Medicine, BIDMC
Professor of Emergency Medicine, Harvard Medical School
Boston, MA



Neurological problems in pregnancy & the puerperium

- Unrelated to the pregnancy (e.g., diagnosis of a meningioma during pregnancy)
- Change in a pre-existing neurological condition (e.g., exacerbation of MS or a seizure disorder that occurs during pregnancy)
- **New disorder that occurs uniquely in pregnancy or postpartum state or is strongly associated with pregnancy or the postpartum state**

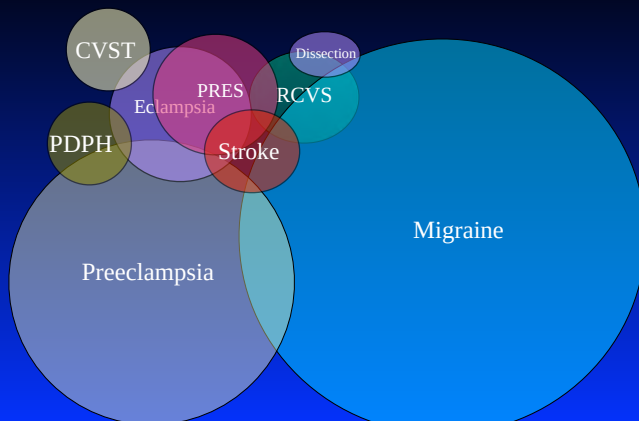
The stakes are big

- Patients are usually young and previously healthy
- Neurologic disease accounts for 20% of postpartum deaths in the US and permanent deficits can occur in survivors
- A fetus (usually later in pregnancy) or a baby (postpartum) is the “second patient”
- Complex family & social issues
- Medico-legal risk is high

The diagnosis can be difficult

- Many of the diagnoses are uncommon, leading to diagnostic anchoring on more common disorders like migraine or preeclampsia
- Our “go to” brain imaging test (brain CT) is often normal or non-diagnostic

Symptom overlap is common



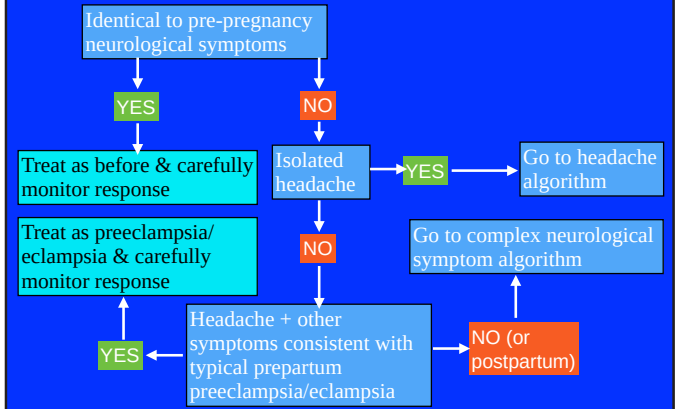
The approach is multi-disciplinary

- Emergency Medicine
- Obstetrics (and/or maternal fetal medicine)
- Radiology
- Neurology
- Critical care

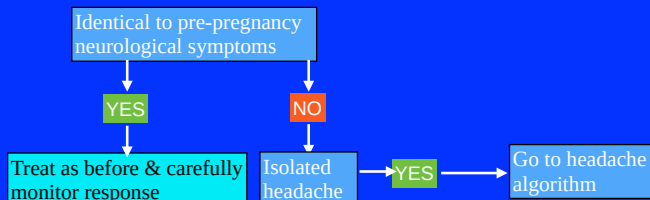
The physiology is altered

- Increased estrogen levels → hypercoagulability
- Elevated lipids → increased vascular risk
- Increased plasma and blood → hypertension
- Elevated progesterone levels → vasodilation & increased capillary permeability
- Combined with postpartum decreases in estrogen levels → increased permeability of the BBB → vasogenic edema

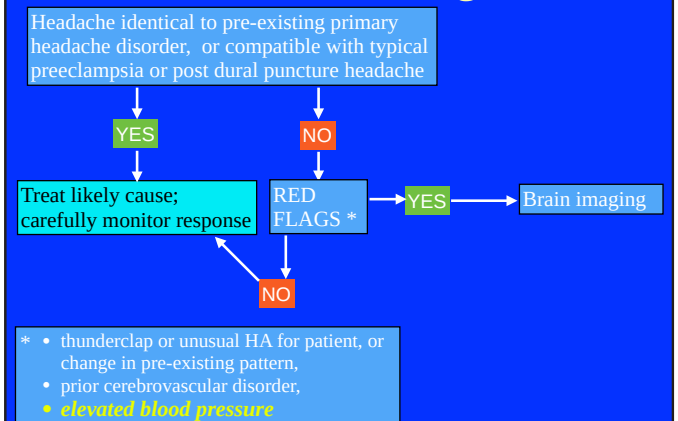
Acute neurological symptoms



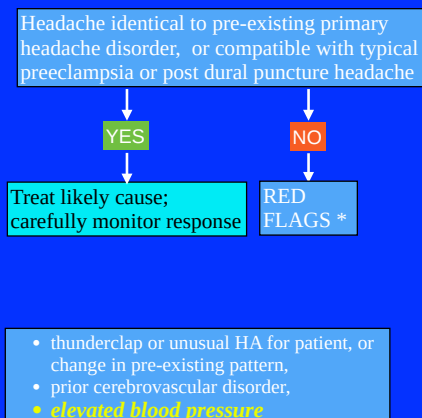
Acute neurological symptoms



Isolated headache algorithm



Isolated headache algorithm



ACOG hypertension criteria for preeclampsia

Systolic ≥ 140 or diastolic ≥ 90 on 2 occasions at least 4 hours apart after 20 weeks of gestation in previously normotensive woman, or

Systolic ≥ 160 or diastolic ≥ 110 on 2 readings within a short interval (minutes)

Isolated headache algorithm

Headache identical to pre-existing primary headache disorder, or compatible with typical preeclampsia or post dural puncture headache

YES

NO

Treat likely cause; carefully monitor response

RED FLAGS *

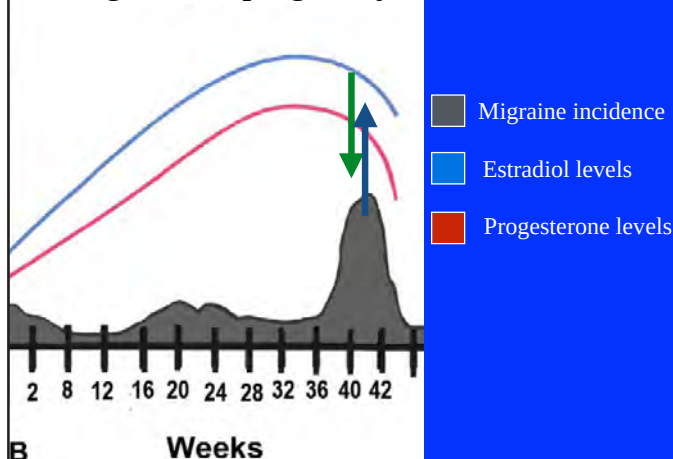
NO

- thunderclap or unusual HA for patient, or change in pre-existing pattern,
- prior cerebrovascular disorder,
- elevated blood pressure**

Primary headache disorders account for 75% of headaches in pregnant and postpartum women

- Migraine ~ 17% of women have migraines!
- Tension-type headache
- Cluster headache

Migraine in pregnancy



Key Point

Despite how common migraine is in this population, and despite the fact that migraines often worsen at or just after delivery, **BE EXTREMELY CAUTIOUS** about diagnosing a **first-ever migraine** in a woman without a very clear history of migraine, extensive testing and neurology consultation

Transient Neurological Deficits

- Very commonly migrainous
- Clues of migraine etiology
 - Symptoms are typically **'positive'**
 - Symptoms often evolve or spread over ~20-30 minutes
 - There may be a change from one modality to another (visual → sensory)
 - Prior migraine history often present, but **first-ever** episodes can occur



Isolated visual symptoms

BRAIN

- In PRES and eclampsia, visual symptoms are binocular & usually in addition to other neurological symptoms
- "Positive symptoms suggest migraine
- Consider pituitary apoplexy; test visual fields

EYE

- Orbital hemorrhage
 - First-trimester with hyperemesis, or postpartum from labor-related pushing
 - Presents with diplopia, eye pain and proptosis
- Retinal detachment (rare), edema or ischemia

Isolated headache algorithm

Headache identical to pre-existing primary headache disorder, or compatible with typical preeclampsia or post dural puncture headache

YES

NO

Treat likely cause; carefully monitor response

RED FLAGS *

NO

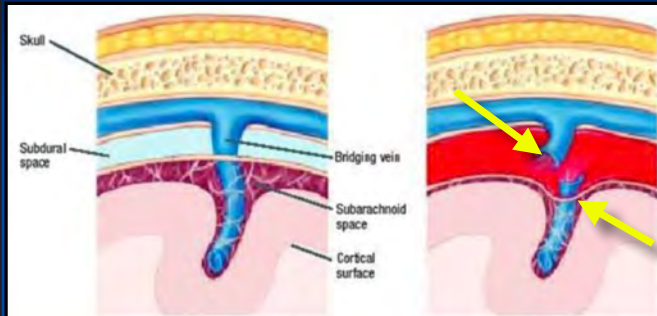
- thunderclap or unusual HA for patient, or change in pre-existing pattern,
- prior cerebrovascular disorder,
- elevated blood pressure**

Post-dural puncture headache

- Same pathophysiology as post-LP headache
- Headache is worse on standing up, better on lying down
- Treated with analgesics, IVFs, caffeine, or blood patch if needed
- Rarely complicated by a SDH



Bridging Veins



21

Preeclampsia

- Affects ~ 5-8% of all pregnancies globally
- 25% increase in the US over past 2 decades
- Most cases occur in healthy nulliparous women without risk factors
- 90% present ≥ 34 weeks of gestation or postpartum

Preeclampsia - diagnosis

- Hypertension (≥ 140 systolic, ≥ 90 diastolic) after 20 weeks of gestation

PLUS

Proteinuria
($\geq 2+$ on dipstick)

OR

Another finding of
end-organ dysfunction

Preeclampsia - end-organ dysfunction

- Platelets $< 100,000$
- Creatinine > 1.1
- Liver transaminases $> 2\times$ upper limit of normal
- Pulmonary edema
- Visual symptoms (blurred, scotomata, flashing lights)
- New-onset, persistent headache**

Key point

This means that pregnant women (> 20 weeks gestation) with hypertension + new onset headache (not accounted for by another diagnosis) can be diagnosed with preeclampsia, even without other findings.

Proteinuria is common **but not required** to making this diagnosis.

Preeclampsia - biomarker

- In May 2023, the FDA approved a biomarker (sFlt:PlGF ratio) for risk assessment of preeclampsia
 - sFlt = soluble fms-like tyrosine kinase
 - PlGF = placenta growth factor
- Not recommended by ACOG
- Currently, there is no recommended biomarker for preeclampsia; the diagnosis remains clinical

Preeclampsia “with severe features”

Higher blood pressure (≥ 160 systolic or ≥ 100 diastolic), on two readings, but without the 4 hour requirement (could be twice within a few minutes, to encourage rapid initiation of treatment).

PLUS some other finding

Preeclampsia “with severe features”

- Severe persistent headache without other explanation, and resistant to analgesics
- Impaired liver function ($\uparrow$ LFTs, severe upper abdominal pain)
- Renal insufficiency ($\text{Cr} > 1.1$ or doubling of prior value)
- Platelet count $< 100\text{K}$
- Pulmonary edema
- Visual disturbances including cortical blindness

HELLP syndrome

Hemolysis (with microangiopathic blood smear)

Elevated **L**iver enzymes (and upper abdominal pain)

Low **P**latelets

Usually presents 28-36 weeks gestation (or early postpartum)

Not all are hypertensive; hepatic bleeding can occur

Should be managed in a tertiary care unit

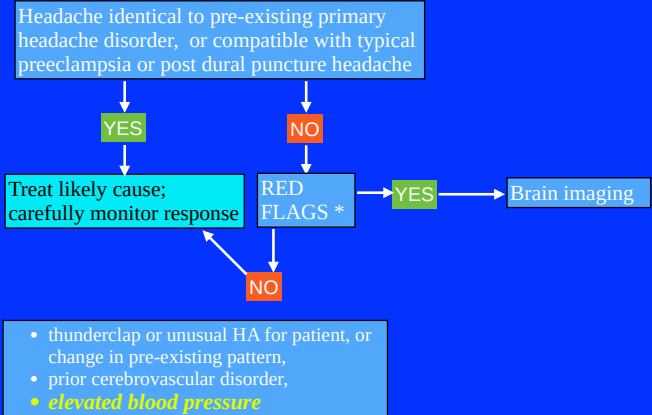
Thrombotic thrombocytopenic purpura (TTP)

- Fever, thrombocytopenia, hemolytic anemia, neurological abnormalities & renal impairment
- Consider TTP in patients with very low platelet counts ($< 50,000$)
- Send ADAMTS13 blood test (low level confirms TTP diagnosis)
- Smear will usually show evidence of hemolysis

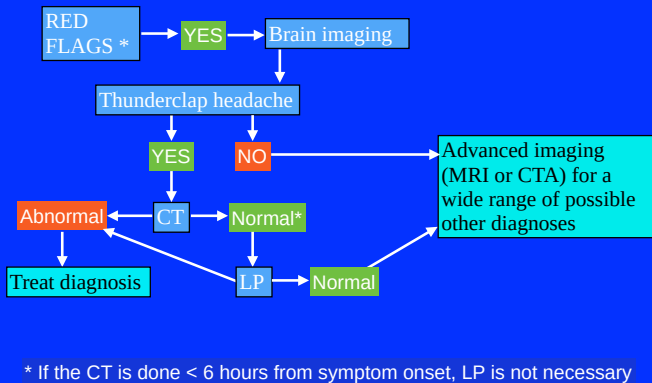
“Preeclampsia labs”

- CBC and coagulation panel
- Blood smear if anemia or concern for HELLP syndrome or TTP
- ADAMTS13 if platelet count < 50,000 or concern for TTP
- Serum chemistries including LFTs, calcium and magnesium levels and uric acid
- Urinalysis

Isolated headache algorithm



Headache with RED FLAGS



Advanced Imaging

- MRI
- PRES
- CVST
- Preeclampsia
- Pituitary apoplexy
- Stroke
- CTA
- CVST
- RCVS
- ICH
- Arterial dissection

Imaging

CT may be helpful but a negative study should not be relied on

MRI is more sensitive to all of the potential diagnoses except for SAH and IH

Iodinated contrast can be used in pregnant women if indicated

Gadolinium should be avoided if at all possible, but if the information to be gained exceeds the potential risk, it can be used in highly selected cases

Complex neurological symptom algorithm

Differential diagnosis

Eclampsia
Ischemic & hemorrhagic stroke
SAH
PRES,
CVST
RCVS
arterial dissection, others

Rare causes

Choriocarcinoma
Amniotic fluid or air embolism
Pituitary apoplexy
TTP
Wernicke's encephalopathy

Appropriate consultations -

Neurology & OB

In specific cases - critical care, hematology & endocrinology

Advanced imaging -

MRI or CTA depending on the case

Labs, empiric thiamine, others depending on the case

Eclampsia

- Preeclampsia **PLUS** a seizure - a clinical diagnosis
 - Brisk reflexes, clonus and visual signs may be present
- 20% of eclampsia occurs postpartum; the highest risk is within 48h of delivery but it can occur up to 6 weeks postpartum
- Half of strokes in pregnant & postpartum women are related to preeclampsia & eclampsia

Eclampsia work-up

- Labs: CBC, BUN/Creatinine, LFTs, uric acid and urinalysis for protein
- Neuroimaging not necessary to make the diagnosis, but should be strongly considered if
 - Focal neurological deficits
 - Persistent visual symptoms
 - Recurrent seizures
 - Refractory headache

Ischemic stroke

- Uncommon but more common than age-matched women, often related to hypertensive diseases of pregnancy
- Thrombolysis can be used (labelling changed in 2015 from “contraindicated” to “caution”)
 - tPA and tenecteplase are large molecules that probably do not cross the placenta
- No contraindication to mechanical thrombectomy

Hemorrhagic stroke

- Rare (4-9/100,000 deliveries)
- 25-50% related to preeclampsia/eclampsia but need to rule out AVM and aneurysms

Subarachnoid hemorrhage

- Rare (~ 8/100,000 deliveries)
- Not clear if aSAH is increased in pregnancy
- Presentation and management same as non-pregnant patients
- Note that location of subarachnoid blood is low around the basal cisterns

PRES

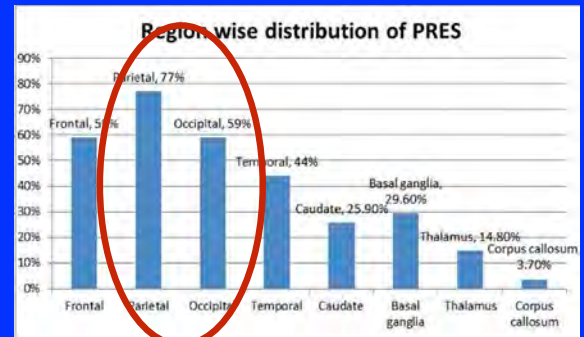
Posterior reversible encephalopathy syndrome

- Associated with preeclampsia, eclampsia & HELLP syndrome; may share the same pathophysiology
- Headache is almost always gradual in onset and only rarely thunderclap
- Altered mentation ranges from mild confusion to coma
- Seizures (75%), visual symptoms (20-40%) are common

PRES - imaging

- CT may show areas of vasogenic edema
- MRI with FLAIR sequences are more sensitive
- Occipital & parietal lobes are usually involved, but other areas of the brain can also be affected
- Usually bilateral (90%) vasogenic edema

PRES - imaging

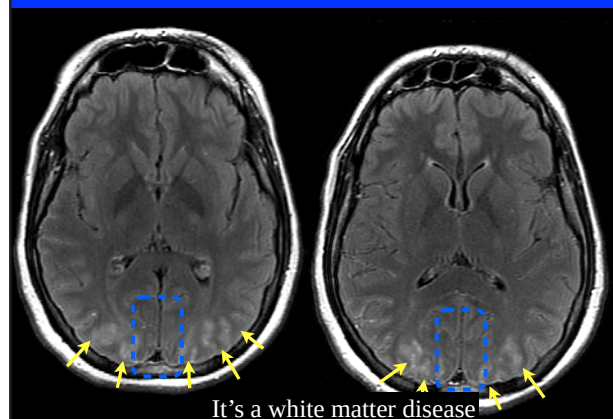


Brain imaging findings from pregnant women with PRES

Non-contrast CT in PRES



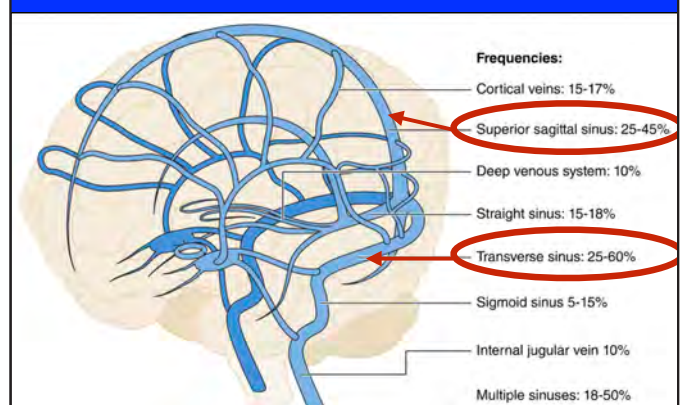
MRI in PRES - imaging (FLAIR)



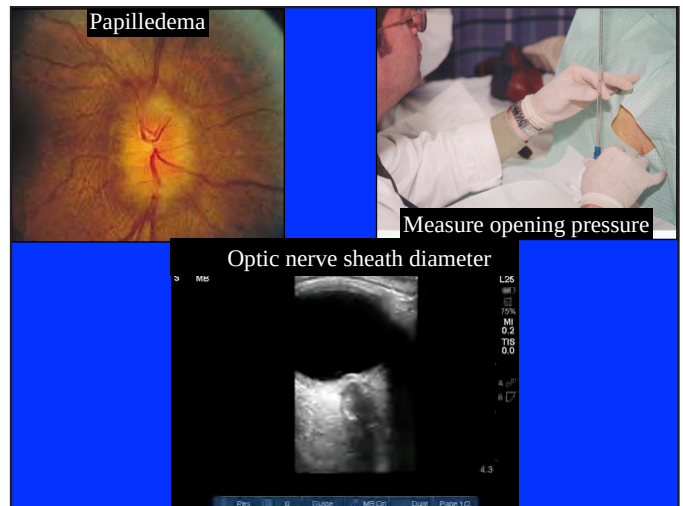
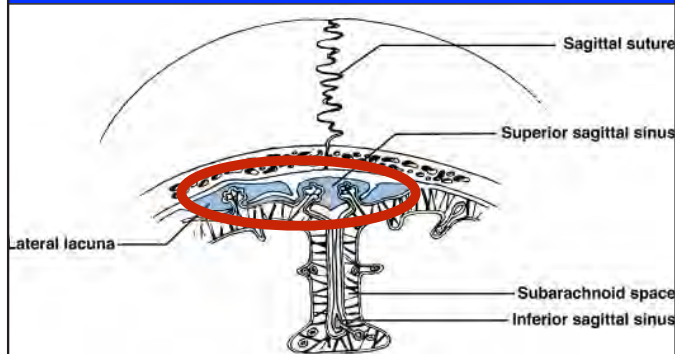
CVST

- Affects ~ 12/100,000 pregnancies
- Has a mortality of ~ 10% mostly due to ICH
- Sub-acute presentation (only 10% have a thunderclap headache)
- Deficits are variable & do not follow any arterial territory
- Elevated ICP is common

CVST



Arachnoid granulations



CVST - imaging

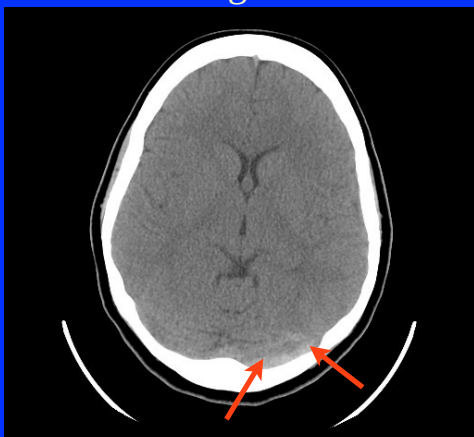
- CT will often show abnormalities
- In a 2018 meta-analysis (11 studies, n = 2417), the sensitivity of non-contrast CT was 81% (95% CI, 78-84)
- A more recent analysis of data from 10 international centers reported a lower CT sensitivity ranging from 41-73%

A negative CT does NOT exclude CVST!

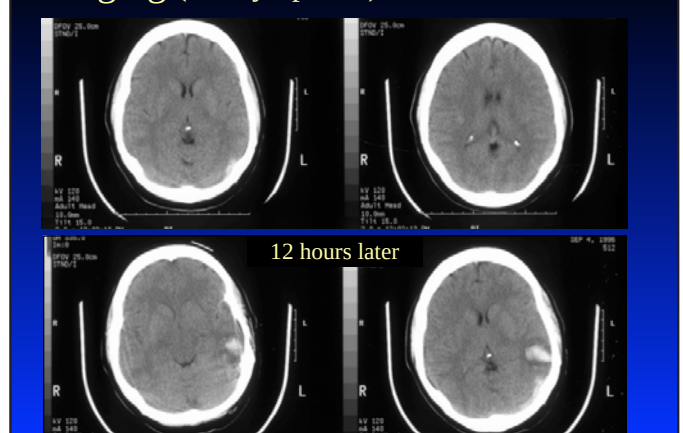
CVST vascular imaging

- **CTV is equally sensitive to MRV!**
- Nearly all CTAs will show the venous sinuses well, so a CTA is a good diagnostic test for CVST
- Best practice is to speak to the radiologist about the concern for CVST so that
 - a) the timing of the bolus may be optimized and
 - b) they will specifically look for CVST

Subtle changes on NCCT



Imaging (and symptoms) evolve over time



CVST - heparin

- Full anticoagulation with a heparin is indicated ***EVEN IN THE PRESENCE of a complicating ICH!***
- Low molecular weight heparins are safe in pregnant and postpartum women
- Rarely, surgical decompression or endovascular interventions

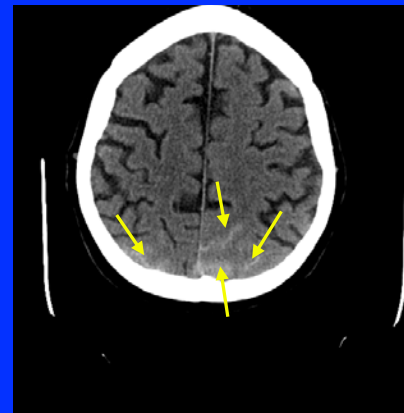
RCVS

- Presents with multiple thunderclap headaches of brief (several hours) duration
- ≥ 3 sequential thunderclap headaches is probably pathognomonic for RCVS
- Seizures are uncommon; blood pressure is often elevated
- During the 2nd week, ICH can occur
- During the 3rd week, ischemic stroke can occur (occasionally, this is the presenting symptom)

RCVS

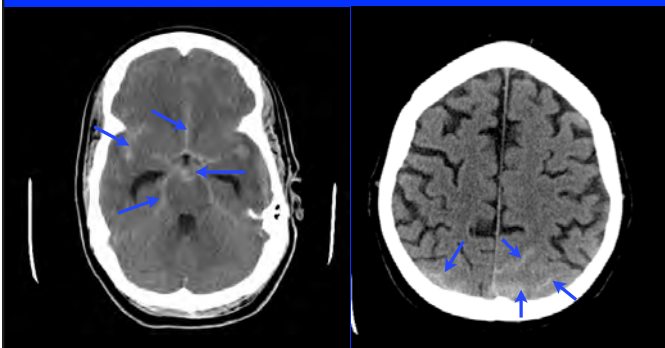
- Non-contrast CT is often normal
- ***Convexal SAH*** occurs in up to 40% of patients, and is often present at presentation
- RCVS is the most common cause of convexal SAH in patients < 60 years of age

Non-con CT convex SAH



Aneurysmal SAH

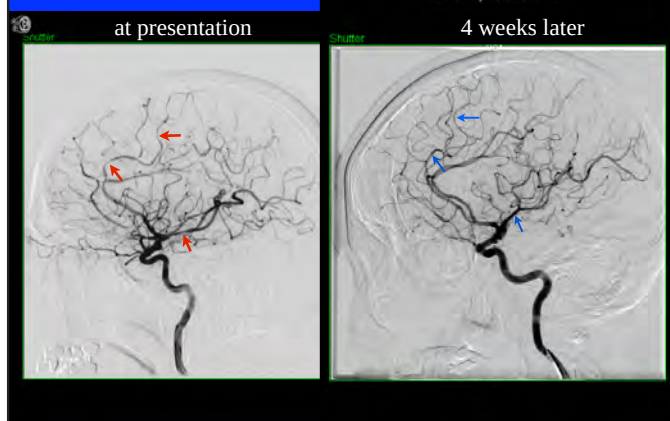
Convexal SAH



RCVS - vascular imaging

- Any form of angiography can be falsely negative during the first week of RCVS, but over time, as larger, more proximal vessels are involved, it will become positive - "sausaging" or "string of beads" appearance
- CTA is fine; DSA is not necessary
- Findings resolve within 3 months of onset and usually sooner

Time 0 and f/u angio of RCVS



RCVS - treatment

- Analgesics
- Avoid steroids and triptans
- Do not over treat hypertension if it occurs to avoid causing a stroke in distal cerebral circulation
- Calcium channel blockers have been used but do not affect the vasoconstriction and may lead to BP over-treatment

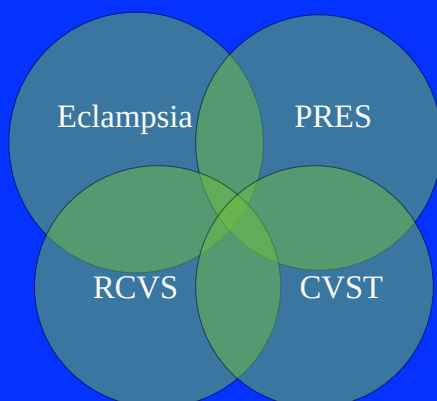
Arterial dissection

- Rare (1.5/100,000 pregnancies)
- Probably increased in pregnancy
- Presentation similar to non-pregnant women (Horner's syndrome common with carotid dissection)
- Can be associated with coincident PRES and RCVS

Rare Syndromes

- Amniotic fluid embolism
- Air embolism
- Metastatic choriocarcinoma
- Wernicke's encephalopathy *
- TTP
- Pituitary apoplexy

* In one study of 623 non-alcoholic patients with Wernicke's, 115 (18%) were women with hyperemesis, and 69 (11%) were s/p bariatric surgery (Scalzo, 2014; JNNP)



	Eclampsia	PRES	CVST	RCVS
Onset	Any time after 20 weeks.	Late 3rd trimester or postpartum	3rd trimester or postpartum	3rd trimester or postpartum
Key findings	Seizures in all, visual Sx, abd pain, hyperreflexia, high BP, proteinuria	Seizures early, visual Sx common, some altered mentation, HA onset gradual	HA in > 90%, thunderclap in only ~10%, seizures and neuro deficits less common, occur later	Multiple thunderclap HAs, seizures much less common; neuro deficits vary from ICH & ischemic strokes
Evolution over time	Evolves (from preeclampsia) gradually or abruptly	If BP controlled, Sx resolve over days-weeks	Evolves over several days, non-arterial territory strokes	Dynamic process, HA during 1st week, ICH during 2nd week, ischemic stroke in 3rd week

Treatment - key point

It is important to treat **BOTH** the hypertension **AND** the seizures in cases where both occur

Hypertension treatment



Hypertension treatment

Drug	Dose	Comments	Onset of Action
Labetalol	10–20 mg IV, then 20–80 mg every 10–30 minutes to a maximum cumulative dosage of 300 mg; or constant infusion 1–2 mg/min IV	Tachycardia is less common and fewer adverse effects. Avoid in women with asthma, preexisting myocardial disease, decompensated cardiac function, and heart block and bradycardia.	1–2 minutes
Hydralazine	5 mg IV or IM, then 5–10 mg IV every 20–40 minutes to a maximum cumulative dosage of 20 mg; or constant infusion of 0.5–10 mg/hr	Higher or frequent dosage associated with maternal hypotension, headaches, and abnormal fetal heart rate tracings; may be more common than other agents.	10–20 minutes
Nifedipine (immediate release)	10–20 mg orally, repeat in 20 minutes if needed; then 10–20 mg every 2–6 hours; maximum daily dose is 180 mg	May observe reflex tachycardia and headaches	5–10 minutes

Abbreviations: IM, intramuscularly; IV, intravenously.

What about nicardipine?

- Not traditionally used in this setting & not mentioned in ACOG recommendations
- However, in a large study (n = 830) of hypertensive pregnant women, IV nicardipine was found to be both safe and effective; the authors concluded it should be considered as first-line therapy
- Faster than hydralazine and does not have all the cautions that labetalol has

Bijvank; Acta OBG Scan; 2022

Blood pressure targets

- Remember the general principles of cerebral perfusion
- Targets may differ in patients who have chronic hypertension
- Ideally use an IV agent that is easily titratable (labetalol or nicardipine)
- Lower to below diagnostic threshold numbers but be careful to not overshoot by too much too fast

Seizure treatment

- Magnesium
 - 6gm IV over 15 minutes followed by 2gm/hour drip
 - Or 10gm IM if no IV access (5gm in each buttock mixed with 1cc of 2% lidocaine)
 - Continue the drip to prevent recurrent seizures
- In magnesium-resistant seizures or magnesium-toxic patients, use benzodiazepines, then fosphenytoin, then levetiracetam then intubation & propofol
- Avoid valproate

Magnesium toxicity

Table 2. Serum Magnesium Concentration and Toxicities

Serum Magnesium Concentration			Effect
mmol/L	mEq/L	mg/dL	
2–3.5	4–7	5–9	Therapeutic range
>3.5	>7	>9	Loss of patellar reflexes
>5	>10	>12	Respiratory paralysis
>12.5	>25	>30	Cardiac arrest

Be especially careful with magnesium toxicity in patients with renal dysfunction



Additional considerations for postpartum patients

- Primary headache disorders are still most common
- If an epidural anesthetic was used, consider post-dural puncture headache (or SDH complicating a post-dural puncture headache)
- Eclampsia can occur up to 6 weeks postpartum
- CVST & RCVS are most common postpartum

Final thoughts

- Don't anchor only on preeclampsia/eclampsia
- Don't be reassured by a negative CT scan
- Have a very low threshold for OB, maternal-fetal medicine and/or neurology consultation
- Treat the hypertension
- Consider early transfer to a tertiary center after stabilization

SELF EVALUATION

Neurologic Emergencies in Pregnancy and the Postpartum Period

True/False

1. The American College of Obstetrics and Gynecology (ACOG) defines the blood pressure thresholds as > 150 systolic and > 100 diastolic for preeclampsia measured twice at least 4 hours apart.
2. Migraines frequently get worse near delivery or post-partum due to decreasing estrogen and progesterone levels.
3. Preeclampsia is becoming less common given modern obstetric care.
4. Proteinuria is necessary to diagnose preeclampsia.
5. Posterior reversible encephalopathy syndrome (PRES) presents with hypertension, visual symptoms seizures and various degrees of altered mentation.
6. Cerebral venous sinus thrombosis (CVST) and reversible cerebral vasoconstriction syndrome (RCVS) both typically present post-partum and both always presents with a thunderclap headache.

Answer Key: 1. F, 2. T, 3. F, 4. F, 5. T, 6. F

Pediatric Respiratory Emergencies: Evidence-Based Assessment and Intervention
Emily Rose, MD, FAAP, FAAEM, FACEP

Pediatric Respiratory Emergencies: Evidence-Based Assessment and Intervention

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Director for Pre-Health Undergraduate Studies

Director of the Minor in Health Care Studies

Keck School of Medicine of the University of Southern California

Associate Professor of Clinical Emergency Medicine (Educational Scholar)

Los Angeles County + USC Medical Center

Los Angeles, CA

Comparison with adult physiology

Predisposition for **respiratory failure**

Anatomic

Physiologic (1-2 min safe apnea time)

Susceptible to URIs

obligate nose breathers

small airway caliber

95% of all **cardiac arrest**
in children is of a
respiratory etiology

Upper respiratory tract infections

- **Viral**
- NO indication for antibiotics
 - Includes bronchitis and sinusitis (treat only if
sx >3 weeks + purulent discharge + pain)
- The **average** cough last two weeks
- No antitussive medications in young children (<4 years)
- **Honey** (>1 year)

Recent URI
Resting Stridor

Croup

Mild—cough, stridor with agitation
(85%)

Moderate—mild stridor at rest,
increased wob

Severe—severe stridor, significant
resp distress (<1%)

Croup

Mild—cough, stridor with agitation
(85%)

Clinical diagnosis

Severe—severe stridor, significant
resp distress (<1%)

Croup Rx

Mild

Moderate

Severe

STERIODS

EPI NEB

STERIODS

Dexamethasone*

0.15-0.6 mg/kg Max 10-16 mg
PO/IM (IV form PO)

Budesonide

2 mg/2 mL Nebulized
(more expensive)

Epinephrine Neb

Indications:

Stridor At Rest

Respiratory Distress

Observe for 2 hours

Epinephrine Neb

Racemic Epinephrine

(2.25%) 0.5 mL

Epi 1:1000

0.5 mL/kg (max 5 mL)

Croup Differential Diagnosis

Epiglottitis (rare)

Bacterial tracheitis

Peritonsillar abscess

Uvulitis

Retropharyngeal abscess

Allergic reaction

Foreign body aspiration

Neoplasm

Croup Rx

Mild

Moderate

Severe

STERIODS

EPI NEB

Epiglottitis Overview

- Rare since Hib vaccine, check re immunizations
- Abrupt onset, minimal or no prodrome, often drooling, sitting tripod, sniffing, stridor, no cough
- Get help, IV ceftriaxone, get soft tissue images only if safe / direct visualization likely safer
- Be ready for airway management



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Epiglottitis D's:

Dysphagia

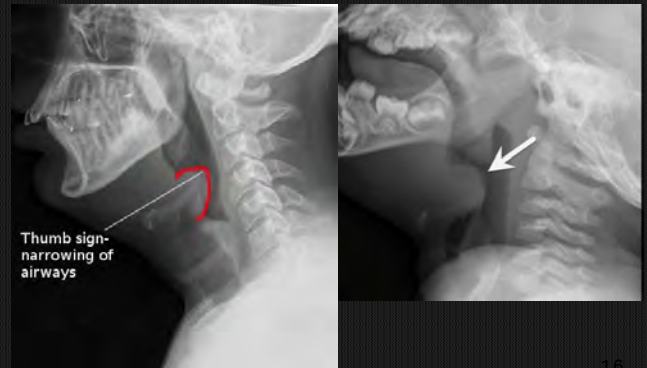
Drooling

Distress

15

Epiglottitis on X-ray

- Thumb sign on lateral neck x-ray



16

Oxygen Sat 89%
Tachypnea
Nasal Flaring
Intercostal Retractions





Bronchiolitis

Diagnosis of **Hx** and **PE**

—Fine rales, diffuse, fine wheezing

<2 Years

Nov-April (PEAK **Jan/Feb**)

Apnea in neonates, ex-premies

Bronchiolitis→

Clinical Diagnosis

NO imaging or laboratory testing

PATHOPHYSIOLOGY

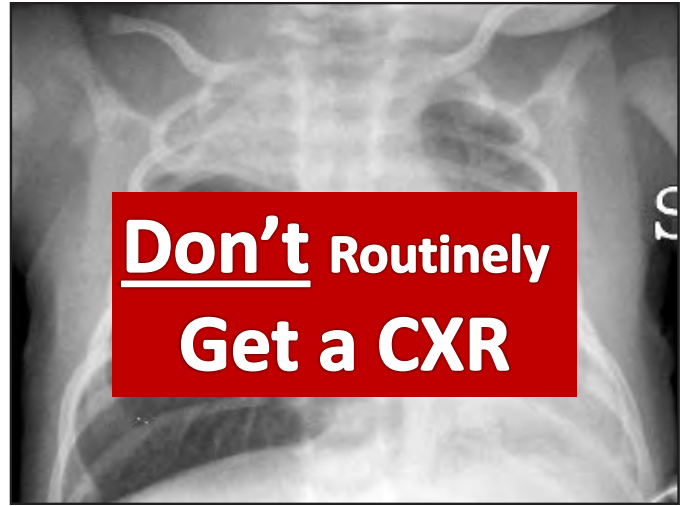
- RSV can cause severe pneumonia with necrosis of lung parenchyma and formation of hyaline membranes
- Complications
 - Prolonged hospitalization
 - Respiratory failure → mechanical ventilation
 - Wheezing in the future
 - Bronchiolitis obliterans

EVALUATION

- Several days of upper respiratory tract signs (usually associated with low-grade to moderate fever)
- Worsening cough
- Tachypnea
- Irritability, malaise, anorexia

EVALUATION

- CXR
 - AAP: No evidence to support routine chest x-ray in child with bronchiolitis
 - Hyperaeration with areas of interstitial infiltration
 - Consolidation, which may represent atelectasis, occurs in 25%
- Pulse oximetry
 - Hypoxemia, often in face of benign radiograph



Bronchiolitis Treatment

I have some bad news...

Don't Give...

- Albuterol
- Epinephrine
- Hypertonic Saline
- Corticosteroids
- Oxygen (if >90%)
- Chest Physiotherapy
- Antibiotics

AAP

Bronchiolitis Treatment

Suctioning

If needed,

Oxygen
NPPV

Bronchiolitis Treatment

YES

-Suction
-Oxygen
-NPPV
(if needed)

Maybe

-Albuterol
-Neb Hypertonic
Saline
-Neb Epi

TREATMENT

Beta-agonists

AAP: "Should not administer albuterol (or salbutamol) to infants and children with a diagnosis of bronchiolitis"

(Level B, Strong recommendation)

TREATMENT

Epinephrine

AAP: "Should not administer epinephrine to infants and children with a diagnosis of bronchiolitis"

(Level B, Strong recommendation)

Bronchiolitis Treatment

NO

Steroids
Routine Antibiotics

Steroids

AAP: "Should not administer systemic corticosteroids to infants with a diagnosis of bronchiolitis in any setting"

(Level A, Strong recommendation)

Antibiotics

Additional bacterial infection extremely rare.
There is no role for routine antibiotic use

TREATMENT

Nebulized hypertonic saline

AAP: "Hypertonic saline should not be administered to infants with a diagnosis of bronchitis in the emergency department, but may be administered to hospitalized patients"

(Level B, Moderate/weak recommendation)

Bronchiolitis Admission?

- Hypoxia (definition?)
- Tachypnea (>70-80 bpm)
- Respiratory Distress (retractions)
- Comorbid Conditions
- Ex-Premie
- Apnea
- Po Intolerance

Low threshold in neonate/young infant

Classically,
Bronchiolitis
symptoms
peak
on **day 3-5**

Bronchiolitis Admission?

- Hypoxia (definition?)
- Tachypnea (>70-80 bpm)
- Respiratory Distress (retractions)
- Comorbid Conditions
- Ex-Premie
- Apnea
- Po Intolerance

Low threshold in neonate/young infant

Pneumonia

Pathogens?

Neonates: Grp B Strep, Gram negative enteric bacteria, Listeria, Chlamydia

Infants/Toddlers: Viral (RSV, influenza, parainfluenza, metapneumovirus, adenovirus);

Bacterial (Strep pneumo, Haemophilus, S. aureus, Pertussis, atypicals?)

>4-5 Years: Mycoplasma

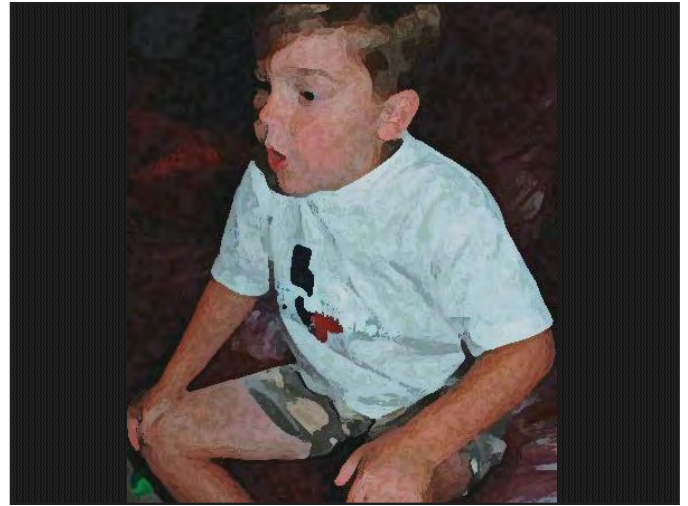
Antibiotics?

Neonate → Sepsis

Afebrile staccato cough →
Azithromycin

> **3 Months** → Amoxicillin

> **4-5 Years** → Macrolides



Asthma Facts

- Asthma is the **most common chronic disease** in industrialized nations
- Asthma still **kills** kids (way more than it should)
- Significant **racial** and **socioeconomic** disparities exist

Asthma Facts

African American children are
500 times more likely
to die of an
asthma exacerbation
compared to white children

Asthma Updates

- **MDIs** are better tolerated than nebulizers
- Any kid (or infant) can use an MDI with a spacer
- 1-2 doses of **dexamethasone** (over pred)
- Most kids coming to the ED should be on controller meds

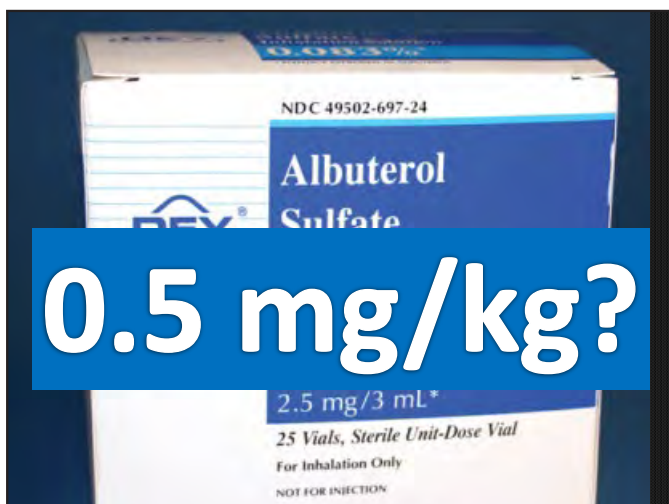
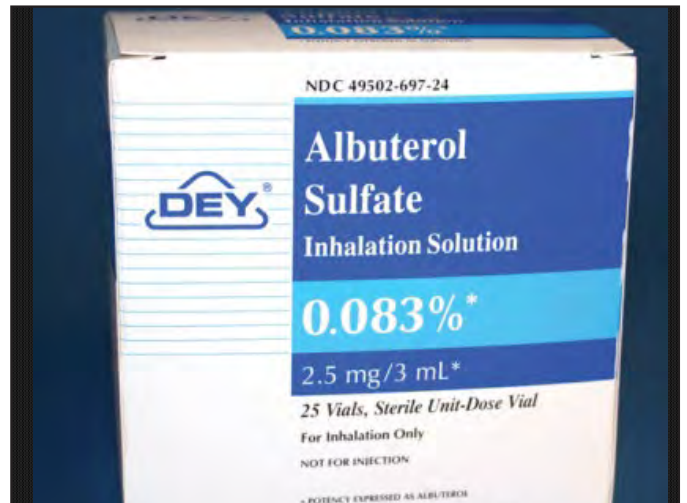
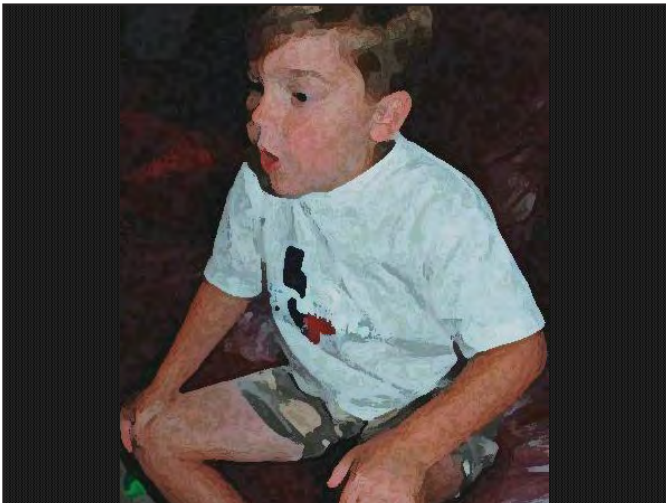
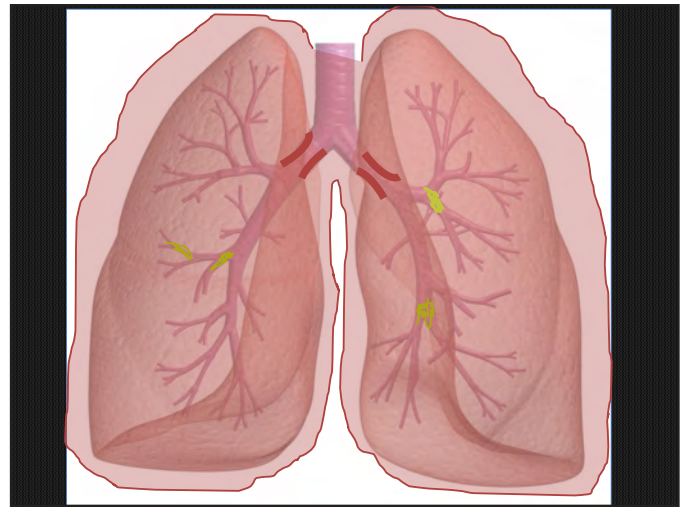
All patients need inhaled beta agonists

Asthma

- 80% present <5 years
- Cough (night)
- Chest pain
- Wheeze
- **URIs** most common trigger

Many fatal or near fatal exacerbations occur in kids without h/o prior hospitalization for asthma

(PMID: 22494876)



Albuterol

Max dose??

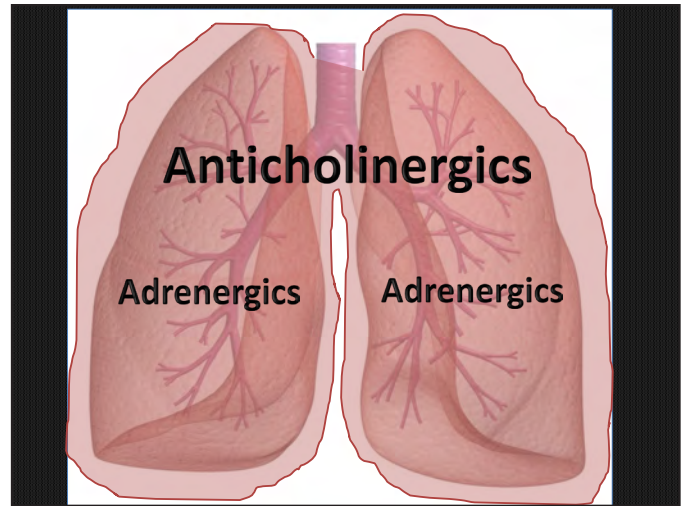
Minimum dose = 2.5 mg

5 mg albuterol **neb** =

8 puffs albuterol **MDI**

Only 10% of meds get to small airways

Ipratropium Bromide



Ipratropium Bromide

250 mcg <20 kg

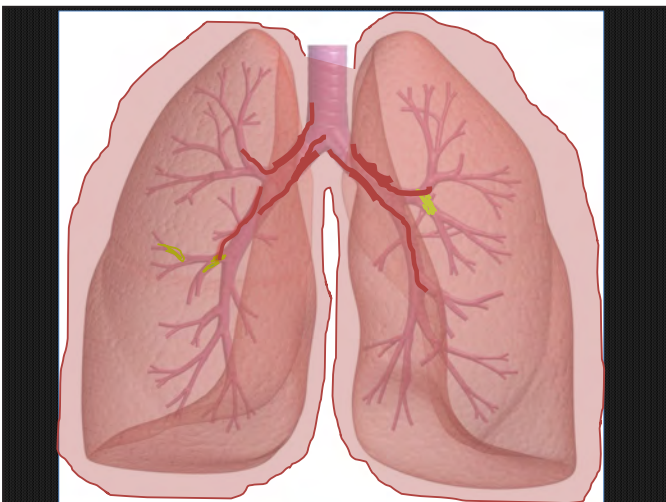
500 mcg

x3 doses in 24 hours
NNT 12

Steroids

Give within 1st hour

NNT 6 to prevent 1 admit



Steroids

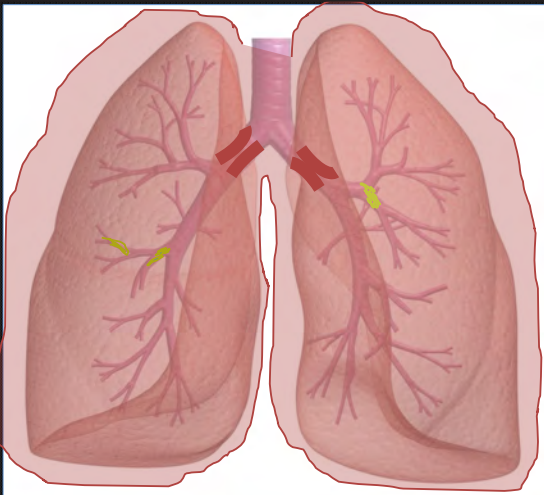
Methyprednisolone
1 mg/kg

Magnesium Sulfate



**50-75
mg/kg**

IVF



Epinephrine



**0.01 mg/kg
1:1000 IM**

**0.3 mg
0.15 mg**

Epinephrine

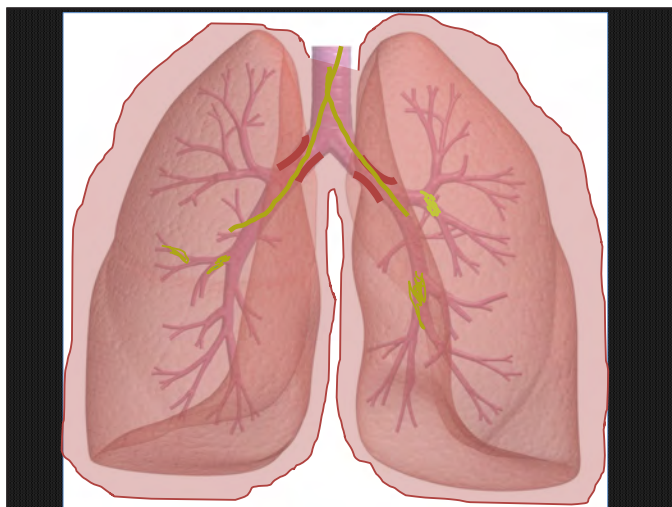
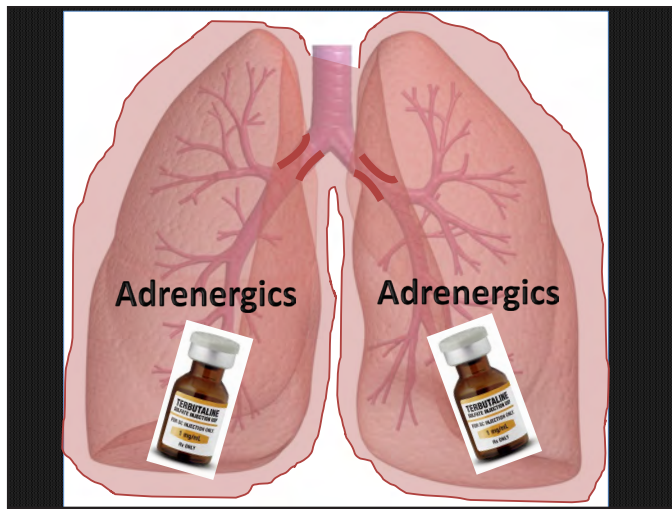


**10 mcg/kg Bolus
0.1 mcg/kg/min prn
1:10,000 IV**

Terbutaline



**10 mcg/kg IV bolus
0.1 mcg/kg/min**



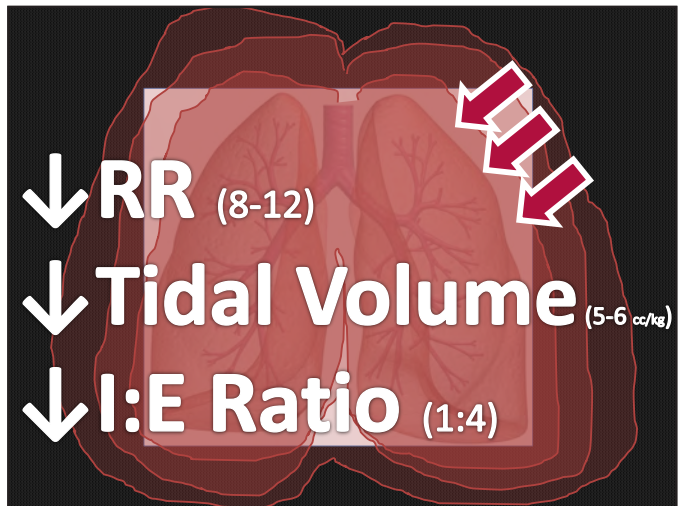
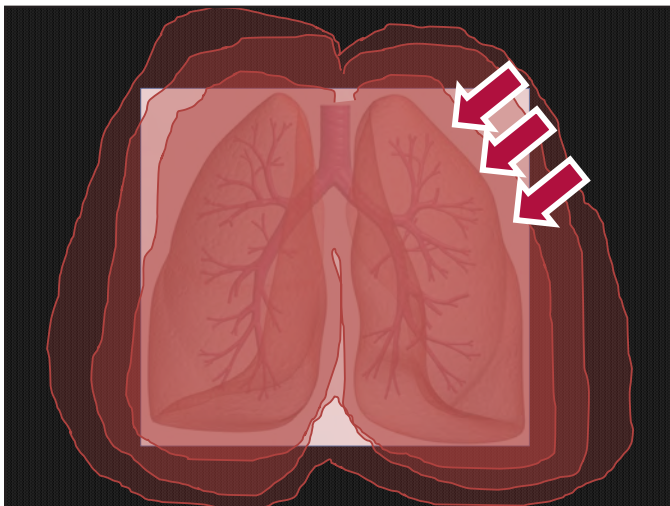
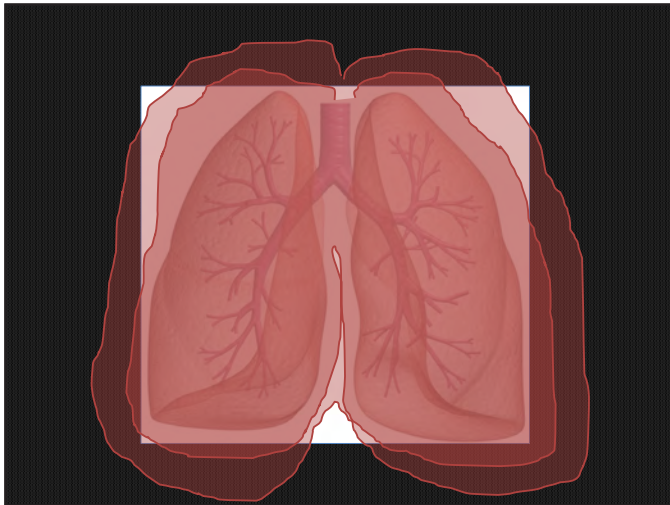
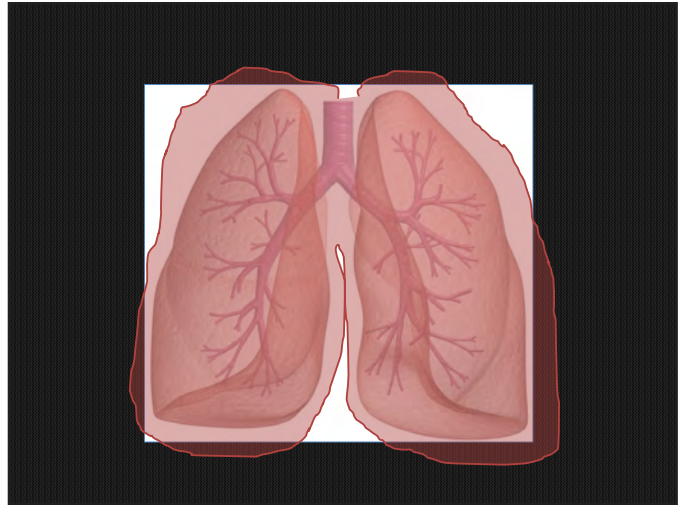
Other Options

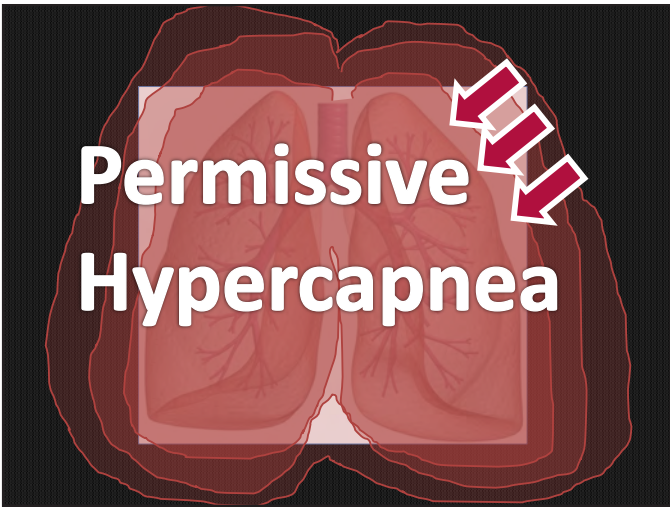
- Nebulized lidocaine
- Heliox
- Methylxanthines
- Bronchoscopy with tpa



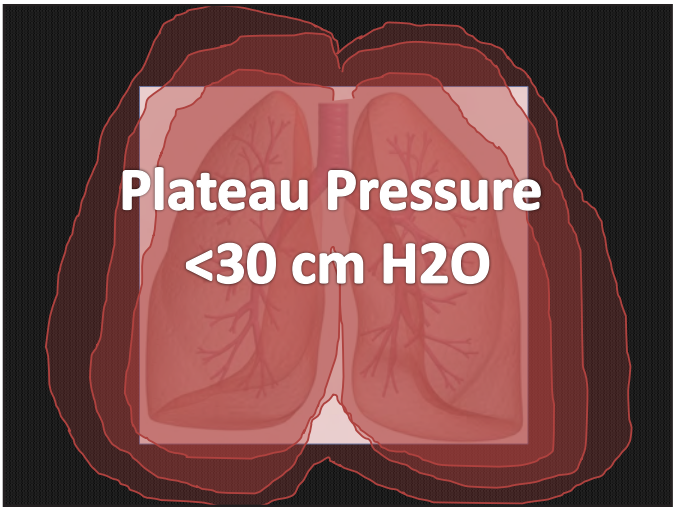
Who Gets The Plastic?

Continued **Progression**
to Resp Failure Despite
Maximal Therapy
10-20% mortality rate





**Permissive
Hypercapnea**



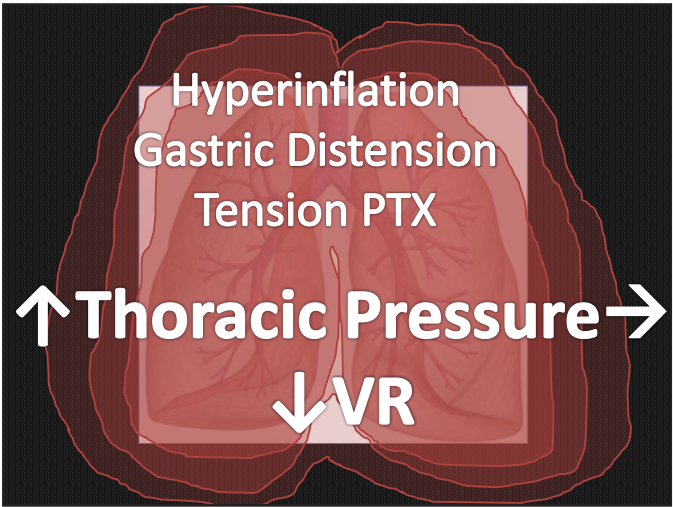
**Plateau Pressure
<30 cm H₂O**



Still Dying?

Inhaled Anesthetics

ECMO

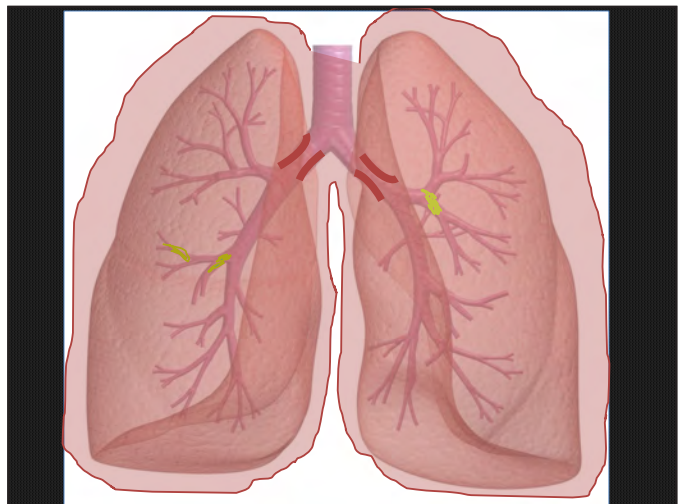


**Hyperinflation
Gastric Distension
Tension PTX**

**↑Thoracic Pressure→
↓VR**

Cardiac Arrest

1. Disconnect Vent—Apnea/Slow Bag
2. IVF Bolus
3. Chest Wall Compression
4. **B/L Needle/Chest Tubes**



Status Asthmaticus

Continuous **Albuterol**

Atrovent x3

Steroids

Magnesium

IVF

Parenteral Beta-agonist (epi or terbutalline)

Asthma Discharge

5 mg Albuterol neb = 8 puffs MDI

Dex is more cost effective, patient/family preferred, and has less side effects

5 mg prednisone = 1 mg dexamethasone

1 dose dex = 3 days of prednisone/prednisolone

2 dose dex (day 2 or 3) = 5-6 days pred

Dex 0.6 mg/kg (max 16-18 mg)

80% bioavailability

Asthma Updates

- Refill MDI (and teach how to admin)
- Educate patients
- Dexamethasone 1-2 doses
- Consider initiation of inhaled corticosteroids
 - Leukotriene modifiers
 - Anticholinergics
 - Biologics

Respiratory Distress

- **Consider** FB aspiration in stridor
- Give **steroids** to all croupers, **epi neb** with concern
- Bronchiolitis is a clinical diagnosis and is treated with suctioning
- Asthma still kills children. Be an education advocate

Thank You!

emilyros@usc.edu

SELF EVALUATION

Pediatric Respiratory Emergencies: Evidence-Based Assessment and Intervention

1. A 8 month old male presents with a runny nose, cough, and increased work of breathing. He has crackles on examination. What is the most effective ED intervention?
 - a. Amoxicillin
 - b. Albuterol
 - c. Nasal suctioning
 - d. Nebulized epinephrine
2. What is the best treatment for a 2 y/o male with an acute barky cough and stridor only when crying?
 - a. Amoxicillin
 - b. Albuterol
 - c. Dexamethasone
 - d. Nebulized Epinephrine
3. A 3-year-old child presents with sudden onset of coughing, wheezing, and unilateral decreased breath sounds. What is the most likely diagnosis?
 - a. Asthma exacerbation
 - b. Bronchiolitis
 - c. Foreign body aspiration
 - d. Croup
4. Which of the following is the most appropriate initial treatment for a child in moderate-to-severe croup?
 - a. Albuterol nebulizer
 - b. Oral amoxicillin
 - c. Nebulized epinephrine and dexamethasone
 - d. Chest physiotherapy
5. Which of the following is the most common cause of acute epiglottitis in an unvaccinated child?
 - a. Haemophilus influenzae type b
 - b. Streptococcus pneumoniae
 - c. Group A Streptococcus
 - d. Respiratory syncytial virus
6. In pediatric patients with status asthmaticus not responding to inhaled β_2 -agonists and corticosteroids, which next-line therapy is appropriate?
 - a. Oral antibiotics
 - b. Intravenous magnesium sulfate
 - c. Nebulized racemic epinephrine
 - d. Chest physiotherapy

Answer Key: 1. C, 2. C, 3. C, 4. C, 5. A, 6. B

FACULTY

Michael W. Donnino, MD

Michael W. Donnino, MD, of Suffolk County, Massachusetts, is a Professor of Emergency Medicine at Harvard Medical School, and an attending physician in the Department of Emergency Medicine and Division of Pulmonary/Critical Care Medicine at Beth Israel Deaconess Medical Center. His clinical practice spans both the intensive care unit as well as the emergency department. Dr. Donnino was the first person in the country to train in a 6-year combined emergency medicine, internal medicine, and critical care program leading to board certification in all three areas. Dr. Donnino is also the Director of the Center for Resuscitation Science and Director of Critical Care in Emergency Medicine. Dr. Donnino's research interests include clinical trials and clinical investigations in septic shock and cardiac arrest. In the field of cardiac arrest, Dr. Donnino is the lead investigator of a multi-center clinical trial evaluating the use of steroids in post-arrest shock and a multi-center trial evaluating thiamine as a metabolic resuscitator in septic shock. Other notable studies include an investigation in microcirculatory dysfunction post-arrest, an evaluation of the human metabolome in sepsis and post-cardiac arrest, and severity of illness scoring systems in post-cardiac arrest patients. Dr. Donnino is a member of the Advanced Cardiac Life Support (ACLS) Subcommittee at the American Heart Association and co-author of sections of the 2010 ACLS guidelines.

You may contact Dr. Donnino with your comments or questions at mdonnino@bidmc.harvard.edu.

Acute Respiratory Failure and Mechanical Ventilation

Michael W. Donnino, MD

Acute Respiratory Failure and Mechanical Ventilation

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Attending Physician Emergency and Critical Care Medicine
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Disclosures

- Consultant or speaker fees: NONE
- Research Grants: NIH, Foundational, Philanthropy, Day Zero Diagnostics

Objectives

- To review management of acute respiratory failure and mechanical ventilation
- To evaluate challenging cases in mechanical ventilation

Case

- 78 year old male admitted with pneumonia who had an episode of vomiting followed shortly thereafter by worsening respiratory status...
- When you walk into the room, you see an agitated patient with a respiratory rate of 30/min and oxygen saturation of 95% on non-rebreather mask. He has HR of 120 and BP of 90/60.
- Patient is pulling non-rebreather mask from his face and appears anxious

What Next?

Intubation

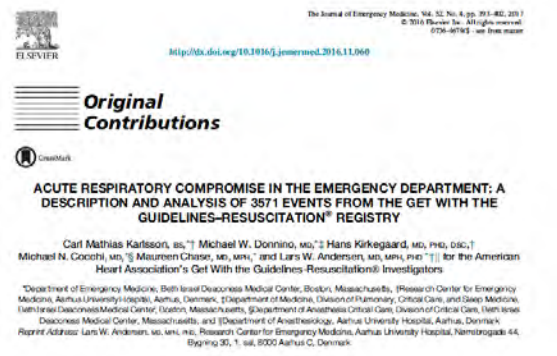
- More than just a “procedure” in this high-risk population
- Consideration of both an anatomically difficult and “physiologically” difficult airway

Acute Respiratory Failure → Cardiac Arrest

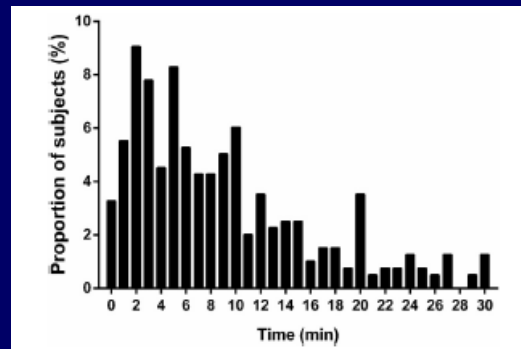
- Incidence:
 - Anesthesia Operating Rooms: 1 in 10,000
 - Emergency Department: 1-5%
 - In-hospital: 5-15%
- Possibly preventable
- Risk factors –

Acute Respiratory Failure → Cardiac Arrest

- Incidence:
 - Anesthesia Operating Rooms: 1 in 10,000
 - Emergency Department: 1-5%
 - In-hospital: 5-15%
- Possibly preventable
- Risk factors – hypotension, hypoxia



Time from Intubation to Cardiac Arrest



Is This Preventable? What Should We Do?

Optimize Pre-Oxygenation

- Non-rebreather
- BVM
- High-flow oxygen
- Non-invasive ventilation

Hemodynamic Management

- Optimize hemodynamic status
 - Fluids (almost always initiate fluid bolus)
 - Vasopressors (push-dose versus infusion if needed)
- Ensure optimal monitoring prior to intubation and continuing

Post-intubation Care

- Ensure tube placement (ETCO₂ – ideally, quantitative)
- Continue to optimize hemodynamics – remember that any push dose vasopressor has short half-life!
- Post-intubation monitoring – continuous ETCO₂ +/- arterial line
- Arterial blood gas within 15-30 minutes and optimize ventilator settings
- Sedation plan (pre-planning plus ‘right’ choice)

Acute Respiratory Failure Checklist

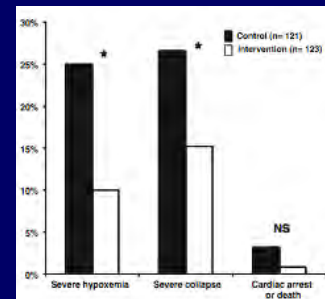
Table 1 Intubation care bundle management

Pre-intubation
1. Presence of two operators
2. Fluid loading (isotonic saline 500 ml or starch 250 ml) in absence of cardiogenic pulmonary edema
3. Preparation of long-term sedation
4. Preoxygenation for 3 min with NIPPV in case of acute respiratory failure (FiO ₂ 100%, pressure support ventilation level between 5 and 15 cmH ₂ O to obtain an expiratory tidal volume between 6 and 8 ml/kg and PEEP of 5 cmH ₂ O)
During intubation
5. Rapid sequence induction: etomidate 0.2-0.3 mg/kg or succinylcholine 1.5-3 mg/kg combined with rocuronium 1-1.5 mg/kg in absence of allergy, hyperkalemia, severe acidosis, acute or chronic neuromuscular disease, burn patient for more than 48 h and maxillofacial trauma
6. Sellick maneuver
Post-intubation
7. Immediate confirmation of tube placement by capnography
8. Norepinephrine if diastolic blood pressure remains <35 mmHg
9. Initiate long-term sedation
10. Initial “protective ventilation”: tidal volume 6-8 ml/kg of ideal body weight, PEEP <5 cmH ₂ O and respiratory rate between 10 and 20 cycles/min, FiO ₂ 100% for a plateau pressure <30 cmH ₂ O

NIPPV non-invasive positive pressure ventilation, PEEP positive end expiratory pressure, FiO₂ inspired oxygen fraction

(Jaber et al. Intensive Care Medicine 2010)

Pre- Post- Intervention



(Jaber S. Intensive Care Medicine 2010)

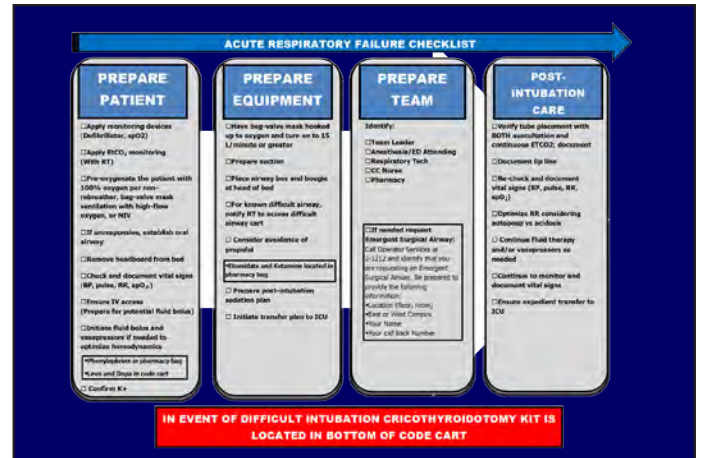
Wait – there is not enough time in an emergent situation for a checklist



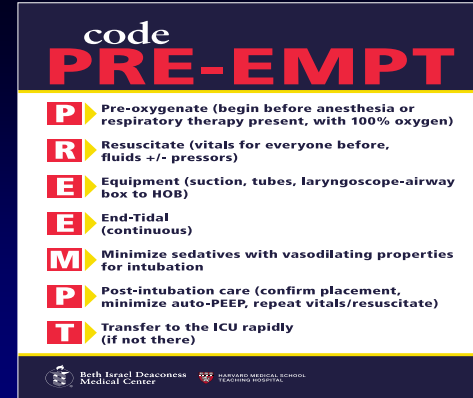
Captain Sullenberger: Hey, uh...this is Cactus 1549 – hit birds and have lost thrust in both engines...returning back towards LaGuardia



Approximately 10-15 seconds after the bird strike, the co-pilot begins the “double engine failure” checklist



However, Captain Sullenberger turned on the auxiliary engines within seconds and the co-pilot never actually finished the checklist before they hit the water...



Conclusions

- Acute respiratory distress/failure/compromise is a common occurrence
- Intubation during acute respiratory distress is more than just an “airway procedure” and a team-based approach is essential
- The key elements of success:
 - Optimize pre-oxygenation
 - Optimize hemodynamics
 - Anticipate difficult airways
 - Good post-intubation care
 - Consider “PRE-EMPT” or similar approach

Case - 21

78 year old male with unknown past medical history who presents with fever and a cough.

T 102.5 P 120 BP 110/84 RR 40-50

Oxygen Saturation : 92% on NRB

Gen: Respiratory distress with accessory muscle

Chest: Bilateral wheeze; focal LLL crackles

Patient is intubated with etomidate/succinyl

Case 21 - continued

Minutes after intubation, the blood pressure drops to 80/60...a repeat BP to confirm is 74/30...

In addition, the pulse oximetry no longer has a good waveform and is not detecting a saturation level

Thoughts? Next move (s)?

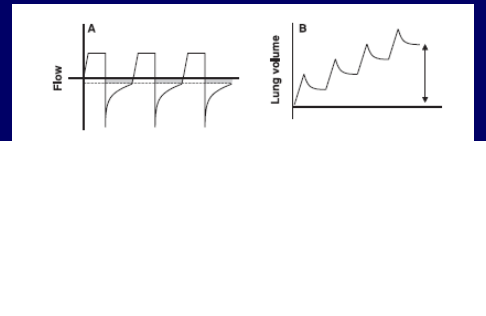
Case 21 - continued

Endotracheal tube placement is confirmed by both auscultation and end-tidal CO₂ detection.

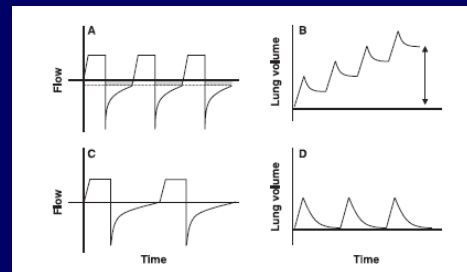
The blood pressure is now 60/30 and the pulse begins to drop rapidly 110 → 80 → 60 → 40

Thoughts? Next move (s)?

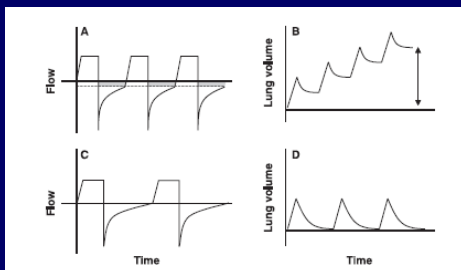
Auto-PEEP and Death by Ventilation



Answer: Auto-PEEP

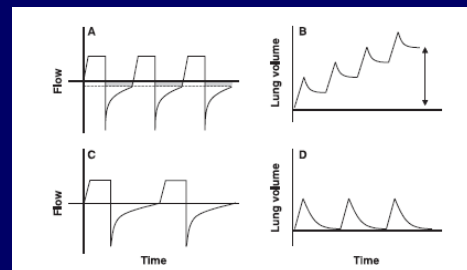


Answer: Auto-PEEP



Solution: Slow respiratory rate, increase exp. time

Answer: Auto-PEEP



Solution: Slow respiratory rate, increase exp. time
Pharmacologic solution: Sedate and/or Paralyze the patient

Auto-PEEP and Death by Ventilation

54 patients with PEA, 18 of unknown etiology

18 etiology unknown → (13/18) 71% had COPD *

36 etiology known → (4/36) 11% had COPD

* 3/13 unknowns with COPD had ROSC after code called

Lapinsky S, Leung R. Auto-PEEP and Electromechanical Dissociation. NEJM (1996)

Mechanical Ventilation – basic modes

- Volume Control (VC)
- Pressure-regulated volume control (PRVC)
- Pressure Control (PC)
- Pressure Support

Mechanical Ventilation – basic modes

- Volume Control (VC) - ok
- **Pressure-regulated volume control (PRVC)**
- Pressure Control (PC) – if in the hospital culture
- Pressure Support (Recommend not to use in the emergency department on ventilated patients)

VC or PRVC – what do I set?

- Fio_2
- PEEP
- Respiratory Rate
- Tidal Volume

VC or PRVC – what do I set?

- Fio_2 : Generally, 1.0 for ED course (theoretical exceptions was brain injury but RCTs not supporting)
- PEEP: Default 5 mmHg – could increase for oxygenation issues +/- body habitus
- Respiratory Rate: Generally, 14-18ish
- Tidal Volume: Generally, 6cc/kg – 8cc/kg

Respiratory Rate

- Generally, 14-18 breaths/minute
- Higher rates with metabolic acidosis and to compensate with low tidal volumes
- Tempting for higher rates with resp acidosis but be careful to balance with concerns for auto-PEEP in COPD and asthma (permissive hypocapnia ok – pH-7.2) so often actually lower

Tidal Volume

- Generally, 6cc/kg – 8cc/kg
- Lower tidal volume (6cc/kg) is for “lung protective” strategy and remember this is for the longer term – if you need to ventilate more in the ED, this is ok (controversial)
- Remember, lower tidal volume does NOT improve oxygenation and often conflated

An Agitated Vented Patient

- Nurse calls you to the bedside of an intubated patient with SAH because patient very agitated, tachypneic, and only has exhaled tidal volume of 150 despite set tidal volume of 500
- Vitals: T 36.8 P 90 BP 140/90 RR 30 Sat: 95%
- You ask for:
 - 1) Midazolam
 - 2) Propofol
 - 3) Ketamine
 - 4) Either #1 or #2 with additional short-acting NMB
 - 5) None of the above

Differential Diagnosis of Volume Loss on Vent

- 1) Accidental Extubation*
- 2) Machine Failure (or machine confusion)
- 3) Very high auto-PEEP **

* probably most common

** volume loss from auto-PEEP is generally not that high (probably around 50 cc as opposed to 350 ccs in this case)

Case

- 55 year old male who presents with shortness of breath/fever/cough and found to be in respiratory distress...
- PMH: High blood pressure
- Meds: HCTZ, Metoprolol
- Allergies: NKDA

Case

Temp 102 P 140 BP 90/60 RR 40-50 Sat:90%RA

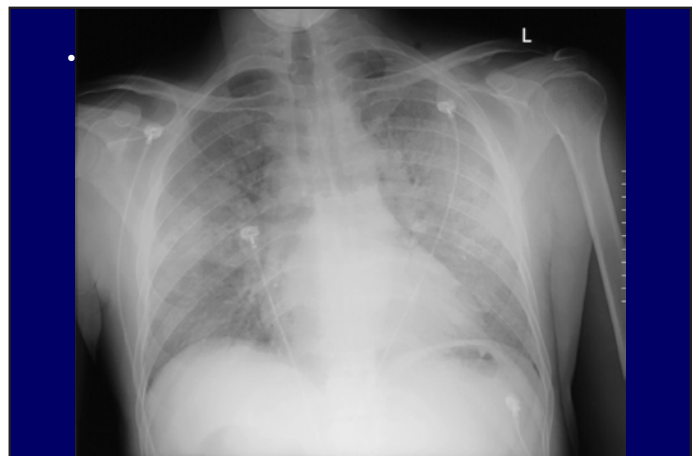
Gen: Severe respiratory distress; accessory muscle usage

Chest: Bilateral rhonchi/rales

Heart: S1 S2 regular, tachycardic

Abd: Soft, non-tender, non-distended

Extrem: Cool, clammy



Help - I Can't Oxygenate Him

- Fio2: 100% but sats are 80%

Help - I Can't Oxygenate Him

- Check all tubing, connections, ETT placement
- Take off the ventilator if needed – manually hook up oxygen
- Is the FiO2 at 100%?

I Can't Oxygenate the Patient

- Optimize PEEP
- PARALYZE the patient (gain control)
- Optimize hemodynamics
- Positioning or Prone Position

Heart-Lung Interactions

- Give fluids or run dry?

THE NEW ENGLAND JOURNAL OF MEDICINE

ORIGINAL ARTICLE

Comparison of Two Fluid-Management Strategies in Acute Lung Injury

The National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network*

Measured intravascular pressure (mm Hg)				MAP ≥ 60 mm Hg without vasopressors (except dopamine ≤ 5 μ g/kg/min)			
CVP		PACOP		Average urinary output <0.5 ml/kg/hr		Average urinary output ≥ 0.5 ml/kg/hr	
Conservative strategy	Liberal strategy	Conservative strategy	Liberal strategy	Ineffective Circulation Cardiac index <2.5 l/min/m ² or cold, mottled skin with capillary-refilling time >2 sec	Effective Circulation Cardiac index ≥ 2.5 l/min/m ² or absence of criteria for ineffective circulation	Ineffective Circulation Cardiac index <2.5 l/min/m ² or cold, mottled skin with capillary-refilling time >2 sec	Effective Circulation Cardiac index ≥ 2.5 l/min/m ² or absence of criteria for ineffective circulation
Range 1				1 Vasopressor ^a Fluid bolus ^c	2 KVO IV Dobutamine ^a Furosemide ^{a,1,2,4}	3 KVO IV Furosemide ^{a,1,2,4}	4 KVO IV Furosemide ^{a,1,2,4}
>13	>18	>18	>24				
Range 2				5 KVO IV Dobutamine ^a	6 KVO IV Furosemide ^{a,1,2,4}	7 KVO IV Dobutamine ^a	8 KVO IV Furosemide ^{a,1,2,4}
9-13	15-18	13-18	19-24				
Range 3				9 Fluid bolus ^c Vasopressor ^a	10 Fluid bolus ^c	11 Fluid bolus ^c	12 Liberal KVO IV
4-8	10-14	8-12	14-18				
Range 4				13 Fluid bolus ^c	14 Fluid bolus ^c	15 Liberal Fluid bolus	16 Conservative Furosemide ^{a,1,2,4}
<4	<10	<8	<14				

Fio2 at 1.0, PEEP optimized, paralyzed, and hemodynamics addressed

- Prone positioning (ARDS)
- ECMO (advanced planning at your center or transfer planning)

Conclusions

- Assess and manage the physiologically challenging as well as anatomically challenging airway
- Choose ventilatory settings based on underlying physiology and monitor

Back to our patient...Sat: 84%

- You confirm equipment and ensure the Fio2 is 1.0
- You increase the PEEP
- The patient is paralyzed...
- Patient's BP is 80/60 and HR 130 and he has received total of 250 cc of fluid...

Back to our patient...Sat: 84%

- You confirm equipment and ensure the Fio2 is 1.0
- You begin to optimize the PEEP
- The patient is paralyzed...
- You give a fluids and BP now 110/60, U/O picks up
- Now what?

Back to our patient...Sat: 84%

- You confirm equipment and ensure the Fio2 is 1.0
- You increase the PEEP
- The patient is paralyzed...
- You give a fluids and BP now 110/60, U/O picks up
- Now what?
- Optimize PEEP → Dr. Talmor
- Prone Positioning → Dr. Cocchi
- ECMO → Dr. Fauman

VC or PRVC – what do I set?

- Fio2
- PEEP
- Respiratory Rate
- Tidal Volume

43 year old male with pneumonia and ARDS who cannot oxygenate

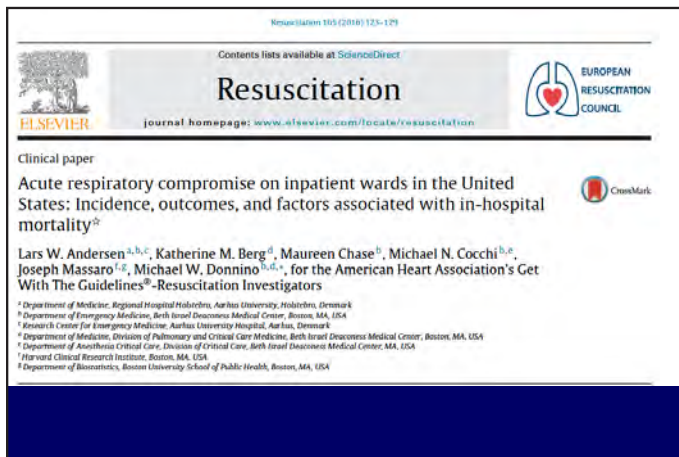
Michael W. Donnino, MD
Emergency Medicine and Critical Care
Assistant Professor, Harvard Medical School
Beth Israel Deaconess Medical Center
mdonnino@bidmc.harvard.edu

Acute Respiratory Failure → Cardiac Arrest

- Worst outcome as is oftentimes almost equal to in-hospital death
- Incidence:
 - Anesthesia Operating Rooms: 1 in 10,000
 - Emergency Department: 1-5%
 - In-hospital: 5-15%
- Possibly preventable
- Risk factors - hypotension, hypoxia

Acute Respiratory Failure

- Commonplace but one of the highest-risk conditions that we routinely manage
- Complications:
 - Failed airway
 - Severe Hypoxia
 - Cardiovascular collapse/hypotension
 - Cardiac arrest



Acute Respiratory Compromise

- Incidence: 45,000 cases/per year in-hospital the US (likely underestimate)
- In-hospital mortality: 39%

Bundle Elements

- 1) Equipment Confirmation
- 2) Optimal pre-oxygenation (and continued oxygenation) strategy
- 3) Optimize hemodynamics and monitoring
- 4) Approach to mechanisms of intubation/sedation strategy
- 5) Post-intubation hemodynamic optimization, monitoring, vent management

Heart-Lung Interactions

- Give fluids or run dry?

SELF EVALUATION

Acute Respiratory Failure and Mechanical Ventilation

1. What is a key risk factor for cardiac arrest during intubation in acute respiratory failure?
 - a. Hypertension
 - b. Hyperglycemia
 - c. Hypotension
 - d. Bradycardia
2. T/F - Intubation in critically ill patients should be viewed as a simple airway procedure.
3. What is the recommended initial FiO₂ setting in the emergency department for most intubated patients?
 - a. 0.21
 - b. 0.40
 - c. 0.60
 - d. 1.0
4. Which of the following is a common cause of sudden hemodynamic collapse after intubation due to ventilation issues?
 - a. Pulmonary embolism
 - b. Auto-PEEP
 - c. Pneumothorax
 - d. Bronchospasm
5. T/F - Pressure support ventilation is recommended for use in intubated patients in the emergency department.

Answer Key: 1. C, 2. F, 3. D, 4. B, 5. F

FACULTY

David M. Yousem, MD, MBA

David M. Yousem, MD, MBA earned his M.D. from the University of Michigan, completed his radiology residency at Johns Hopkins, and a neuroradiology fellowship at the University of Pennsylvania. An internationally recognized expert in neuroradiology, he has authored or edited four textbooks, published more than 350 peer-reviewed articles, and lectured on five continents. He received the RSNA Educator Award and the Gold Medal of the American Society of Neuroradiology. Dr. Yousem is a past President of the American Society of Neuroradiology and remains active in national and international radiologic leadership.

You may contact Dr. Yousem with your questions or comments at dyousem1@jhu.edu.

Vascular Imaging in the Emergency Department

David M. Yousem, MD, MBA

Vascular Imaging in the Emergency Department

David M. Yousem, MD, MBA
Johns Hopkins University School of Medicine

Disclosures

○ None specific to this talk

- Elsevier: Neuroradiology: The REQUISITES, Head and Neck, Neuroradiology, NIS Case Review (CRS series editor), Radiology Business Practice royalties on sales
- Consulting (medicolegal)
- MRIOne.com/Medality/TrueLearn: consultant fees, speakers' fees, board member, stockowner

Clear Indications for CTA/MRA

- Stroke
 - ❖ WHOL (w or w/o suspicious CT?)
 - ❖ SAH, Non-aneurysmal SAH, RCVS
 - ❖ Sinus thrombosis (w or w/o suspicious CT?)
 - ❖ IIH w or w/o ancillary findings or LP OP
- H&N
 - ❖ C spine fractures, expanding hematoma, penetrating trauma, Horner's, high risk infections

Stroke Scenario

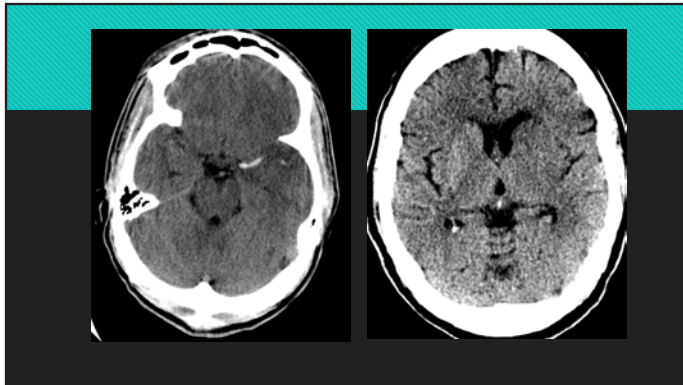
- NCCT, CTA, CTP with Perfusion Analysis applies to most anterior circulation strokes
- Fast, efficient.....and over-used IMHO
 - ❖ Found down, LOC, AMS, Dizzy
- CTV even more overutilized (IIH)
 - ❖ Rare cause of stroke in negative CT

Stroke Scenario

- It depends: Do you do a NCCT first? If so, I'd recommend MRI in setting of.....
 - ❖ Significant SVID, vertebrobasilar disease, prior strokes, suspected lacune
 - ❖ Demyelinating disease in DDX
 - ❖ Meningitis in DDX

Stroke Scenario

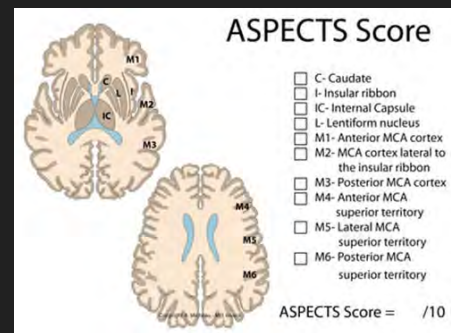
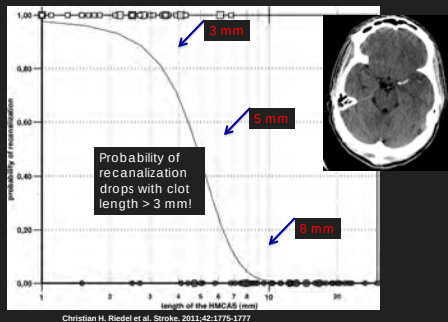
- Value of CTA/CTP being suspected
- Value of not intervening on even large strokes being questioned
- Value of not intervening even with bad GCS being questioned



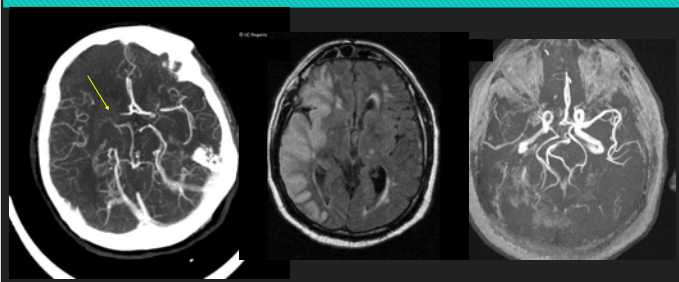
Stroke: CT

- Dense MCA
 - Perfusion deficit
 - Gray white blurring
 - ❖ Insular ribbon sign
 - ❖ Basal ganglia sign
 - Low density
 - Mass effect
- > 1/3 MCA territory
 - Hemorrhage
 - Mismatch
 - Herniation

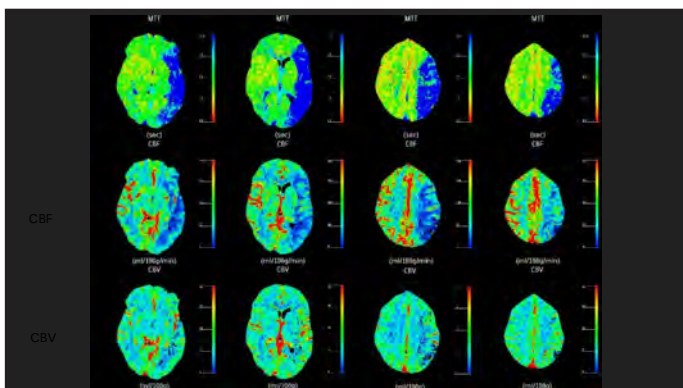
Probability for successful recanalization of occluded vessels by intravenous thrombolysis (IVT) depending on thrombus length



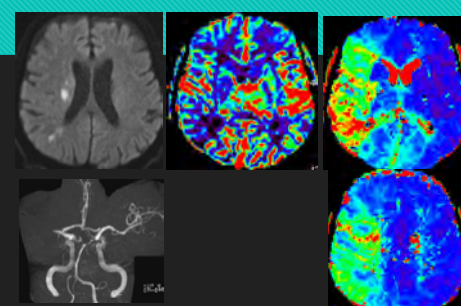
CTA / MRA findings in Stroke



CT Angiography Collateral Assessment



MRI DWI-PWI Mismatch

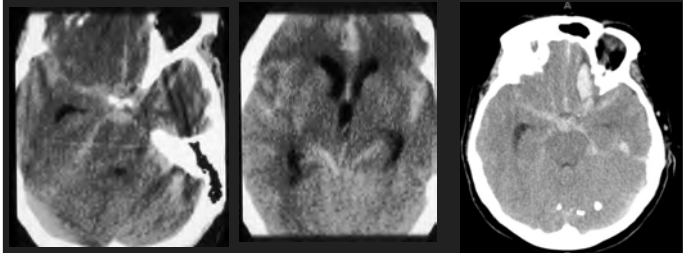




Worst Headache of Life in Non-Migraineur

- 10/10 headache
- Thunderclap headache
- New onset headaches
- Different headache from usual migraine

Aneurysmal SAH Prediction of site of bleed



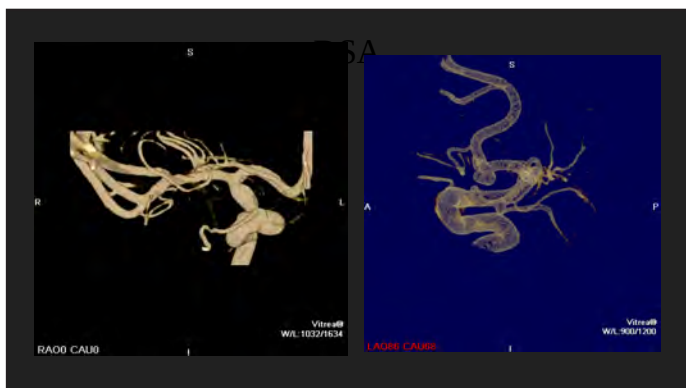
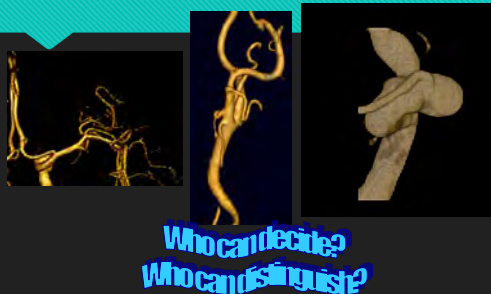
Risk Factors for Aneurysm Occurrence, Rupture and Growth

- | ○ Patient | Aneurysm |
|---------------------|---------------|
| ❖ Age (2-3% per yr) | - Size |
| ❖ Smoking | - Growth |
| ❖ HTN | - Prior bleed |
| ❖ Fam Hx | - Morphology |
| ❖ Coagulopathy | - Multiple |
| ❖ Female | |

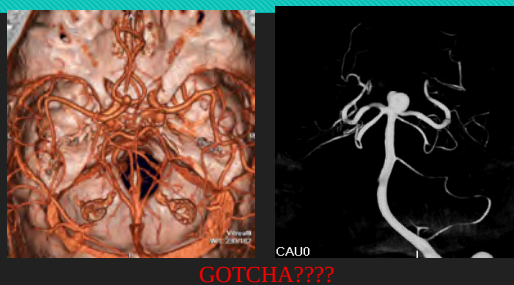
Non-traumatic SAH

- CTA > MRA except in children
- ?large volume SAH that is hyperdense
- CTA neck to guide therapeutic approach?

Imaging Vascular Anatomy: DSA, CTA, MRA



CTAs for Aneurysms



Non-aneurysmal Perimesencephalic SAH

○ Venous etiology and benign Px

- ❖ Criteria for non-aneurysmal perimesencephalic SAH, which if fulfilled, in the presence of a negative CTA negates the need for DSA:
- ❖ SAH in perimesencephalic cisterns anterior to midbrain
- ❖ If SAH extension into the anterior ICH, not extending into all of the fissure
- ❖ If SAH extension into the medial Sylvian fissure not extending into the lateral fissure
- ❖ If layering intraventricular extension, no IVH
- ❖ No intraparenchymal hemorrhage

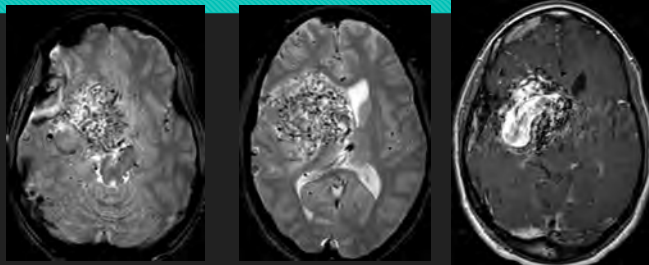


Non-aneurysmal Perimesencephalic SAH

- "In patients with perimesencephalic SAH (71 patients), 2 aneurysms (3%) and 1 case of vasculitis/vasculopathy (1.5%) were identified. However, no source of the hemorrhage was identified in 68 of these patients (96%)"

○ Cerebral Angiography for Evaluation of Patients with CT Angiogram-Negative Subarachnoid Hemorrhage: An 11-Year Experience J.J. Heit, G.T. Pastena, R.G. Nogueira, A.J. Yoo, T.M. Leslie-Mazwi, J.A. Hirsch and J.D. Rabinov American Journal of Neuroradiology February 2016, 37 (2) 297-304

Arteriovenous malformations



Reversible Cerebral Vasoconstriction Syndrome (RCVS)

Noncontrast CT, CT angiography

Detection of cerebral vasoconstriction

Evaluation for complications such as SAH

Provide plausible alternative diagnoses such as cerebral aneurysm

MR imaging, MR angiography

Detection of cerebral vasoconstriction

Evaluation for complications such as ischemic stroke

Provide plausible alternative diagnoses such as cortical vein thrombosis

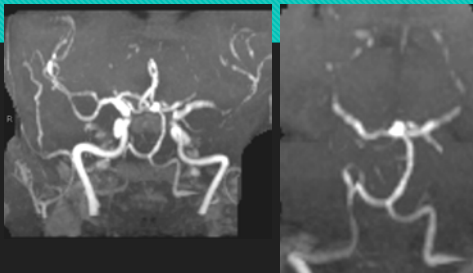
Vessel wall imaging

Catheter angiography

Risk Factors:

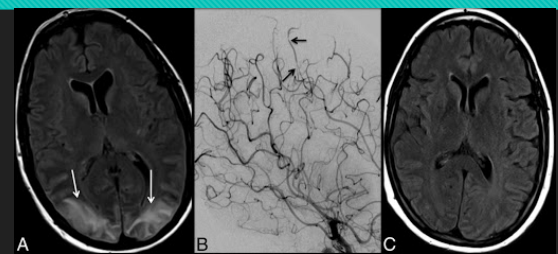
Use of vasoactive drugs
Post Partum
Migraineur
Dissection
Cannabis use

RCVS in Cocaine user



RCVS Simulating PRES

T.R. Miller, R. Shivashankar, M. Mossa-Basha and D. Gandhi
American Journal of Neuroradiology August 2015, 36 (8) 1392-1399.



RCVS in the ED

Reversible Cerebral Vasoconstriction Syndrome, Part 2: Diagnostic Work-Up, Imaging Evaluation, and Differential Diagnosis

T.R. Miller, R. Shivashankar, M. Mossa-Basha and D. Gandhi
American Journal of Neuroradiology September 2015, 36 (9) 1660-1668 DOI: 10.3171/ajnr.14411

- CTA and MRA have sensitivity of 80% for RCVS related vasoconstriction

- ❖ cerebral vasoconstriction may not be visualized in up to one-third of patients with RCVS during the first week following symptom onset
- ❖ Peak vasoconstriction at 16 days

RCVS in the ED

Yield of Computed Tomography (CT) Angiography in Patients with Acute Headache, Normal Neurological Examination, and Normal Non Contrast CT: A Meta-Analysis

Imanda M.E. Alons, MD, Ben F.J. Goudsmit, MD, Korne Jellema, MD, PhD, Marianne A.A. van Walderveen, MD, PhD, Marieke J.H. Werner, MD, PhD, and Ale Algra, MD, PhD (9)

- 54/729 (7.4%) had an abnormality on CTA

- ❖ 42 aneurysms (33 had SAH on LP); 9/729 (1.2%)

- ❖ 4 RCVS, 3 CVT, 2 moyamoya, 2 cervical dissection

- "It is likely that CTA is not the ideal modality for diagnosing this condition. Also it is postulated that RCVS may only be seen on imaging in a later stage, and repeated imaging improves sensitivity"

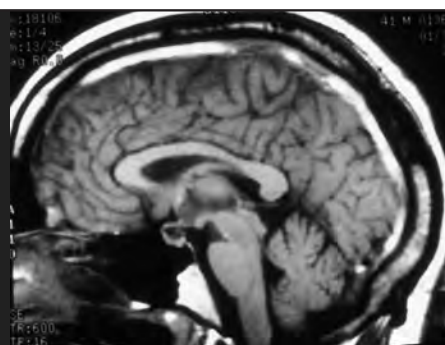
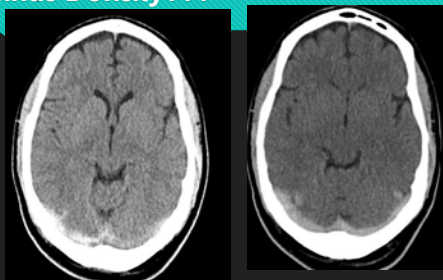
RCVS

- TCD?
- If at all, CTA >>> MRA
 - ❖ Peripheral vasculature
- But MRI for "PRES"-like appearance

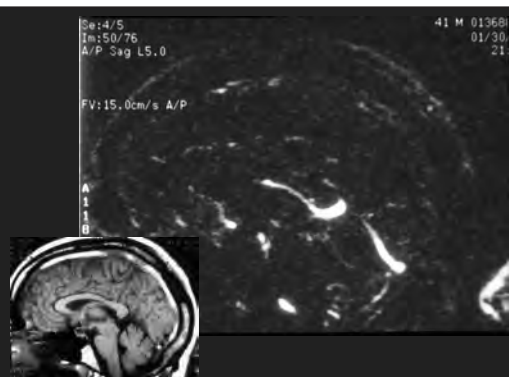
Sinus / Cortical Vein Thrombosis

- If NCCT has been performed, then CTV
- De novo and for children, MRI and MRV

Sinus Density???



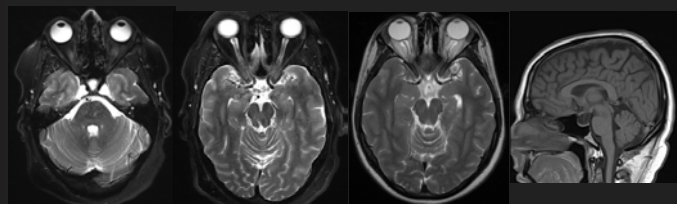
MRI & Clots



Idiopathic Intracranial Hypertension

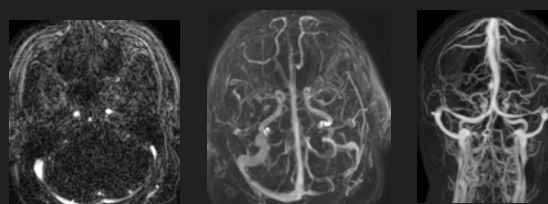
- NCCT to start given the headache work-up
- IMHO, lumbar puncture to assess opening pressure, confirm Dx
- Ophthalmologic examination
- MRI brain, MRI orbits (superfluous if good ophth), CE MRV if available: if not, CTV
 - ❖ I see no value in non-contrast MRV
 - ❖ Arachnoid granulations on T2W
 - ❖ YOUNG PATIENTS!

Idiopathic Intracranial Hypertension = Pseudotumor Cerebri

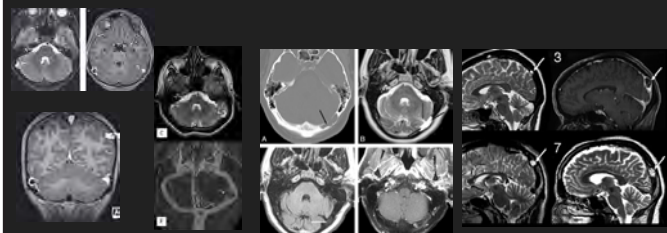


Papilledema, dilated optic nerve sheath complex, tortuous ONSC, empty sella, dilated CSF spaces, collapsed venous sinuses, ? Vents, +DWI at papilla, big arachnoid pits, obesity

Idiopathic Intracranial Hypertension = Pseudotumor Cerebri



Idiopathic Intracranial Hypertension Potential Pitfall: Arachnoid Granulations



Name of Screening Criteria	Patients to Be Screened						
	<table><tr><th>Signs/Symptoms of BCVI</th><th>Risk Factors of BCVI</th></tr><tr><td>Modified Dreyer Criteria¹⁴ - Arterial hemorrhage (from nose, neck, or mouth) - Cervical bruit (in younger than 50 yr of age) - Expanding cervical hematoma - Focal neurologic deficit: TIA, hemiparesis, cerebellar/brainstem symptoms, Horner syndrome - Stroke on CT or MRI - Neurologic deficit inconsistent with head CT </td><td> - High energy transfer mechanisms with the following: - Left I or II fracture - Basilar skull fracture involving carotid canal - Cervical vertebral body or transverse foramen fracture subluxation, or ligamentous injury at any level, any fracture at C1-C3 - Closed head injury consistent with DAI and GCS <4 - Near hanging with asphyxia - Cervical-type injury or seat belt abrasions with significant swelling, pain, or altered mental status </td></tr><tr><td>Memphis Criteria¹⁵ - Cervical spine fracture - Neurologic exam not explained by brain imaging - Horner syndrome - Left I or II facial fractures - Skull base fractures involving the foramen lacerum - Neck soft-tissue injury (eg, seat belt injury or hanging) </td><td></td></tr></table>	Signs/Symptoms of BCVI	Risk Factors of BCVI	Modified Dreyer Criteria¹⁴ - Arterial hemorrhage (from nose, neck, or mouth) - Cervical bruit (in younger than 50 yr of age) - Expanding cervical hematoma - Focal neurologic deficit: TIA, hemiparesis, cerebellar/brainstem symptoms, Horner syndrome - Stroke on CT or MRI - Neurologic deficit inconsistent with head CT	- High energy transfer mechanisms with the following: - Left I or II fracture - Basilar skull fracture involving carotid canal - Cervical vertebral body or transverse foramen fracture subluxation, or ligamentous injury at any level, any fracture at C1-C3 - Closed head injury consistent with DAI and GCS <4 - Near hanging with asphyxia - Cervical-type injury or seat belt abrasions with significant swelling, pain, or altered mental status	Memphis Criteria¹⁵ - Cervical spine fracture - Neurologic exam not explained by brain imaging - Horner syndrome - Left I or II facial fractures - Skull base fractures involving the foramen lacerum - Neck soft-tissue injury (eg, seat belt injury or hanging)	
Signs/Symptoms of BCVI	Risk Factors of BCVI						
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Note: DAI indicates diffuse axonal injury; GCS, Glasgow Coma Scale.

¹⁴Suggested exposures: bicycling (cervical, mandibular fractures), traumatic brain injuries with thoracic injuries, scuba diving, thoracic vascular injuries, and blunt ocular trauma.¹⁵

Notes: DAI indicates diffuse axonal injury; GCS, Glasgow Coma Scale.
¹⁴Suggested expansion: occipital condyle fractures, mandibular fractures, traumatic brain injuries with thoracic injuries, scalp degloving, serious vascular injuries, and blunt cardiac rupture.¹⁵

Boston Criteria¹² for BCVI

First Tier ^a	Second Tier ^b
Skull base fractures: petrous and basilar fractures	DAI
Any cervical spine fractures	Complex facial fractures with midface instability
Cervical spine injury (cord, vertebral body, or ligaments)	Combined significant head and chest trauma
Soft-tissue injury to anterior neck with swelling/echymosis/hematoma/or bruit	Near-hanging
Significant neurologic deficit: lateralizing neurologic deficit, TIA, Horner syndrome	Seat belt abrasions on neck
Evidence of brain infarct on CT	Other unexplained neurologic deficits: vertigo, tinnitus, or GCS ≤6

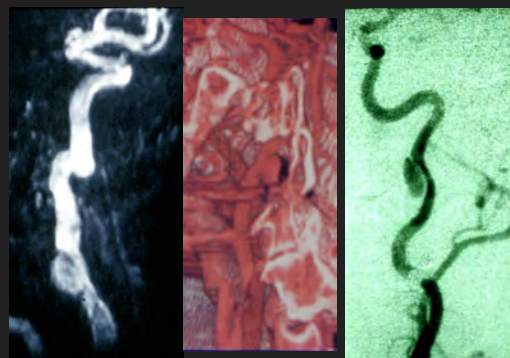
Literature review to follow

Screening for Penetrating Cerebrovascular Injury

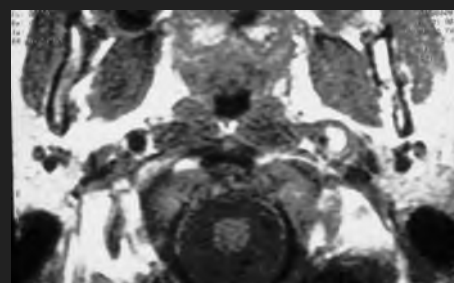
Hard Signs of Vascular Injury	Hard Signs of Aerodigestive Injury
Shock	Airway compromise
Pulsatile bleeding	Bubbling wound
Expanding hematoma	Extensive subcutaneous emphysema
Audible bruit	Stridor
Palpable thrill	Significant hemoptysis or hematemesis
Nonpalpable pulse	
Signs of cerebral ischemia/stroke	

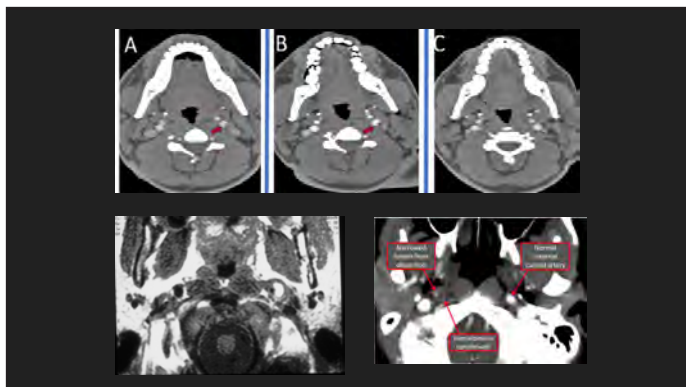
Trauma Scenario

- Severe trauma with neurologic deficits, neck pain (not spine pain)
- CTA favored over MRA
 - Fatsat MRA for equivocal CTA for dissections
 - MRA neck added to MRI cervical spine for ligamentous injuries rather than CTA spine trauma
- Can you scan once? Esp in young patients?



Dissection





Biffi Scale for Carotid Dissection

- ✕ Grade I, irregularity or dissection with <25% stenosis
- ✕ Grade II, dissection with >25% luminal narrowing or a raised intimal flap
- ✕ Grade III, pseudoaneurysm
- ✕ Grade IV, complete occlusion
- ✕ Grade V, ICA transection, active contrast extravasation

Grade-based treatment, follow-up, and suggested management of BCIS

Grade	Initial Treatment	Range of Endovascular Treatment	Follow-Up	Long-Term Treatment
I	Aspirin/antiplatelet therapy (typically aspirin/antiplatelet) (avoid warfarin or other anticoagulation) (avoid surgery)	Not needed	7-14 days, then 3-6 mo (if needed)	Aspirin/antiplatelet
II	Aspirin/antiplatelet therapy	Need of coverage symptoms or progression of dissection	7-14 days, then 3-6 mo (if needed)	Long-term aspirin/antiplatelet (avoid surgery or other treatment)
III	Need of coverage symptoms or size >1 cm	7-14 days and then 3-6 mo or longer	Long-term aspirin/antiplatelet (avoid surgery or other treatment)	Long-term aspirin/antiplatelet (avoid surgery or other treatment)
IV	Typically self-limited	Based on symptoms	Based on symptoms	Life-long aspirin/antiplatelet (if data) (symptomatic)
V	Direct pressure on laceration actively bleeding	Based on symptoms	Based on symptoms	Life-long aspirin/antiplatelet (if data) (symptomatic)

Horner's

- CTA is the next step
- Then: Brain & C spine MR
 - ❖ Hypothalamus
 - ❖ Brainstem
 - ❖ Cervical cord
- Chest CT: Lung apex (Pancoast tumor)



Head and Neck Emergencies

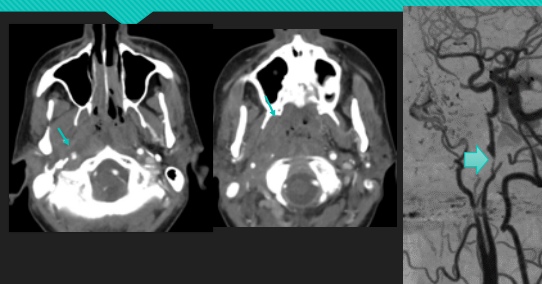
- Expanding hematoma
- Carotid blow-out
 - ❖ Usually post treatment, post XRT
 - ❖ Post-trauma pseudoaneurysm
- Invasive fungal sinusitis into cavernous sinus
- Necrotizing fasciitis
- Epidural abscess from otomastoiditis and/or sinusitis
 - ❖ Risk of sinus thrombosis

Expanding hematoma

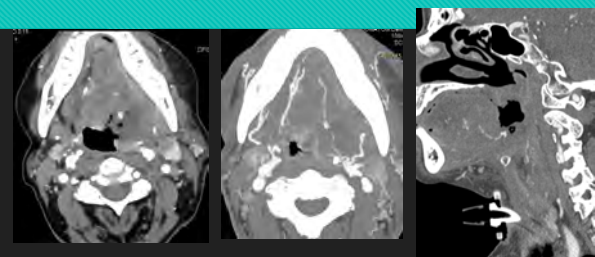
- CTA followed, when appropriate DSA for treatment



Carotid Blow Out After H&N CA



Carotid Blow Out After H&N CA Pseudoaneurysm and Bleed

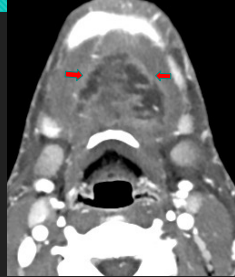


Penetrating Neck Injury



Ludwig Angina

- Extension of odontogenic abscess into bilateral submandibular and sublingual spaces may lead to Ludwig angina symptoms of which include fever, firm neck swelling, edema and difficulty swallowing
- And sometimes arteritis and/or phlebitis



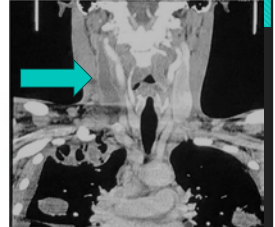
Lemierre's Syndrome

Oropharyngeal primary infection:

- pharyngitis
- tonsillitis
- peritonsillar infection/abscess
- dental
- EBV (mono co-infection)

Bacterial endotoxin induces platelet aggregation and septic thrombus formation

Septic emboli lodge in lungs, liver, endocardium, and/or joints

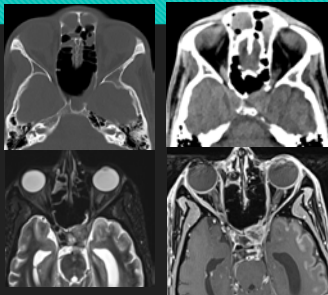


Invasive Fungal Sinusitis

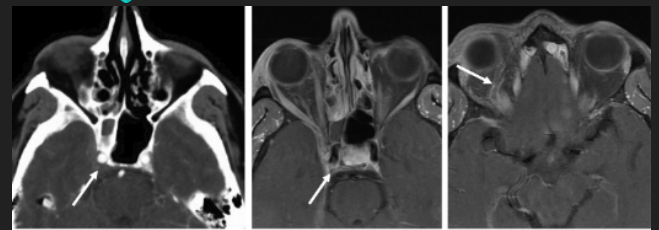
Bone destruction

Soft tissue infiltration outside sinonasal cavity

Cavernous sinus invasion = Poor Px



Fungal Sinusitis with Cavernous Sinus and SOV thrombosis



Brain Death

- CT / CTA due to ICU state

Vertebrobasilar Insufficiency / Dizzy-Vertigo

- Use ABCD2 score for risk assessment
- Central vertigo (surroundings are moving when they are stationary) with ABCD > 4
- MRI/MRA > CT/CTA

ABCD2 SCORE FOR TIA			
THE RISK OF STROKE IN TRANSIENT ISCHEMIC ATTACK			
Age	1 point: Age > 60 years		
BP	1 point: BP > 140/90		
Clinical Feature	1 point: Speech disturb. without weakness		
	2 points: Unilateral weakness		
Duration	1 point: 10-59 minutes		
	2 points: ≥ 60 minutes		
Diabetes	1 point		
Score		Stroke Risk	
		Day 2	Day 7
0-3: Low		1%	3.1%
4-5: Mod		4.1%	9.8%
6-7: High		8.1%	17.8%

Role of Ultrasound

- High grade carotid stenoses based on calcified plaque in 100/2114 = 4.7% of CSCT: Rec OPT DUS
- ? TCD if available for RCVS acutely
- Outside the US? NHS says DUS is most cost effective

GRACE CLINICAL PRACTICE GUIDELINE

Guidelines for reasonable and appropriate care in the emergency department 3 (GRACE-3): Acute dizziness and vertigo in the emergency department

Joseph A. Taylor MD¹, Christopher Carpenter MD, MS², Matthew Ashby MD³, George Mouslop MD⁴, Eyle Marudis MD⁵, William J. Meurer MD⁶, David Murrell MD⁷, James G. Nagler MD⁸, Robert Olin MD⁹, MHA, MS¹⁰, Rodney Orman MD, MPH¹¹, Sumner Stuart MD, IDH¹², Marc Stolt MD¹³, Steven Updell MD, MS¹⁴, Lucan Oliveira A. Silva MD, MS¹⁵, Ella Sundberg MD¹⁶, Karen Tarr PI¹⁷, Simone Varot MD¹⁸, David C. Newton Baker MD, PhD¹⁹, Fernando Rodriguez MD, MS²⁰

ABSTRACT

OBJECTIVE: To provide evidence-based recommendations for the management of acute dizziness and vertigo in the emergency department.

DESIGN: Systematic review of the literature.

SETTING: Emergency department.

PATIENTS: Adults with acute dizziness and vertigo.

INTERVENTIONS: History, physical examination, laboratory tests, imaging, and treatment.

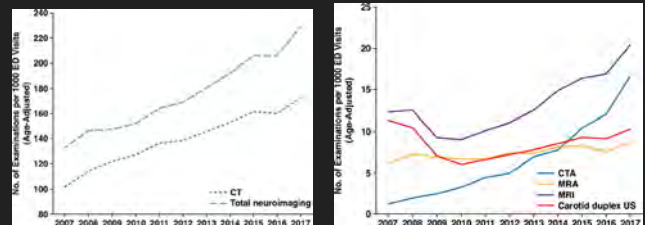
MEASUREMENTS AND MAIN RESULTS: The most common cause of acute dizziness and vertigo is benign paroxysmal positional vertigo (BPPV). Other causes include vestibular neuritis, labyrinthitis, and stroke. The most common treatment for BPPV is the Epley maneuver. Other treatments include vestibular rehabilitation, corticosteroids, and antiemetics.

CONCLUSIONS: The most common cause of acute dizziness and vertigo is BPPV. The most common treatment for BPPV is the Epley maneuver. Other treatments include vestibular rehabilitation, corticosteroids, and antiemetics.

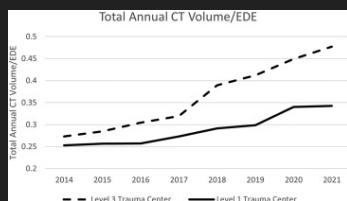
Vascular Imaging in the ED: When NOT to Use MRA, CTA and DSA

David M. Yousem, MD, MBA
Johns Hopkins University School of Medicine

CTA utilization: ElHabr A et al. AJR 2022

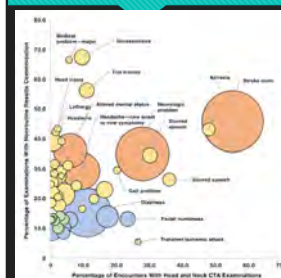


CTA utilization: Poyiadji N et al. JACR 2023



CTA head and neck examinations demonstrated one of the greatest percentage increases over time, at 536.4% and 1,669.1%

H&N CTA: Tu LH et al. AJR 2021



Head and neck CTA was ordered in 2.5% (17,903) of 708,145 ED visits in 236,476 patients (mean age, 49.8 ± 20.5 [SD] years; 110,952 men, 125,521 women, 3 unknown sex).



A survey study on imaging overuse in the emergency department was conducted among 66 radiologists and 425 emergency physicians. Five-point Likert scales (not a problem at all/strongly disagree [score 1] to very serious problem/strongly agree [score 5]) were used to score the various aspects of overimaging.

The form of medical insurance in the Netherlands is a system of mandatory, private health insurance with a government-regulated basic package and the option for supplementary insurance. Every resident must have basic coverage, which includes services like general practitioner visits, hospital care, and medication, though the specific benefits are identical for all insured.

Both radiologists and emergency physicians gave a median score of 4 to the question if imaging overuse is a problem in their emergency department. CT accounts for the vast majority of imaging overuse, according to both radiologists (84.8%) and emergency physicians (75.3%). Defensive medicine/fear of malpractice, the presence of less experienced staff, and easy access to imaging all were given a median score of 4 as factors that influence imaging overuse, by both physician groups. Median ratings regarding the influence of pressure from patients and a lack of time to examine patients on imaging overuse varied between 3 and 4 for radiologists and emergency physicians. Pressure from consultants to perform imaging, the use of imaging to decrease turnaround time in the emergency department, a lack of space in the emergency department, a lack of proper medical education, and inability to access outside imaging studies, were also indicated to give rise to imaging overuse.

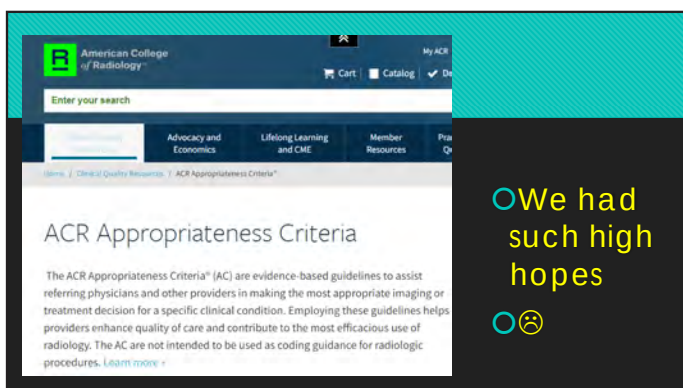


What is the Compliance Rate with ACR Appropriateness Criteria?

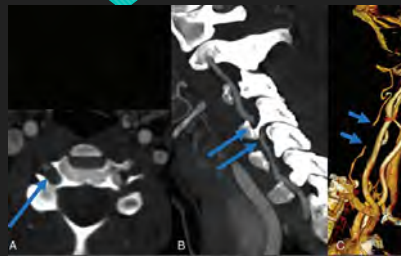
- Overall, out of 2932 clinical scenarios, 1229 (37.99%) were addressed by EURO-2000 and 1081 (36.37%) were addressed by the ACR appropriateness criteria (McNemar test, $p = 0.12$). (Simoni et al Acad Rad 2023)
- This study highlighted that most non-compliant imaging orders benefited the patient. Klein RP et al. Emerg Radiol 2021
- Of the MRIs, 57% (108 knees) had "usually appropriate" and 43% had "usually not appropriate" (ie, 1-3) AC scores ($P > .1$). Gonzalez FM et al. JACR 2019
- Of all Incidental Findings, 347 (67.5 %) recommendations were concordant with societal guidelines and 167 (32.5 %) were discordant. 39.8 % of CT recommendations were discordant, while 19.5 % of US recommendations were discordant ($p < 0.0001$). Hanna TN Emerg Radiol 2016

We had such high hopes

☹️



CTA in Strangulation: BIFFL 1



Grade I, irregularity or dissection with <25% stenosis
Grade II, dissection with >25% luminal narrowing or a raised intimal flap
Grade III, pseudoaneurysm
Grade IV, complete occlusion
Grade V, ICA transection, active contrast extravasation

Others Research



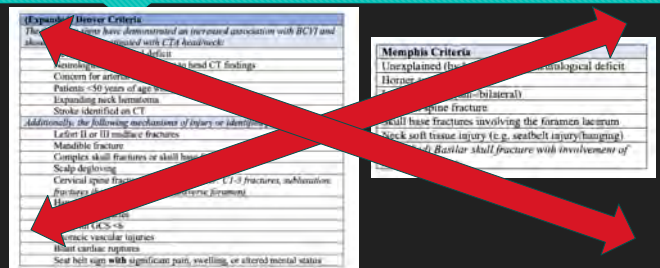
1. Vascular injury was present in 3/425 (0.7%) of cases
 2. No immediate or delayed complications
- Johns Hopkins 6 year strangulation positive rate is 0.7%

My Own Research

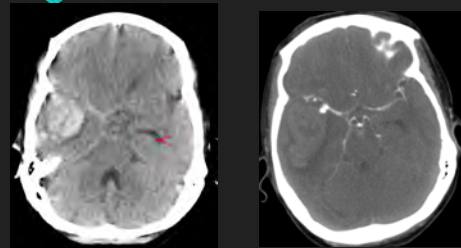


1. CTA/MRA of the neck was NEVER positive
 2. 2% (1/49) yield in patients > 75. ↓ with BG, BS
- Highest yield in younger patients with lobar bleeds, 46-75 y/o
 - The presence of SAH and/or IVH increases the yield
 - NR ability to predict the study will be negative based on age and NCCT findings was 96%

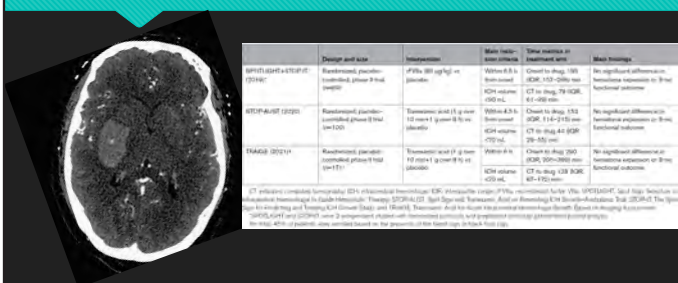
Screening for Blunt Cerebrovascular Injury



Parenchymal Hemorrhage



Ongoing Hemorrhage: Spot Sign Of What Value, Really?



Spot Sign in IPH: Critical Reappraisal

Pensato U et al. Stroke 2025;56:1612-24

- "The spot sign was initially enthusiastically embraced as a promising radiological marker for predicting HE with the potential to guide acute decision-making and imaging protocols for hemorrhagic stroke. However, the lack of efficacy demonstrated in clinical studies investigating anti-HE treatments in patients selected based on spot sign status has raised doubts about the utility of this sign, and its assessment requires time, resources, and radiation exposure. Therefore, a shift in patient selection for anti-HE trials has occurred, whereby early presentation time is now prioritized over imaging features..."

My Own Research

Neurologic Clinics

Volume 40, Issue 1, August 2012, Pages 475-489

Neuroimaging of Headache: Indications and Controversies

Shadi Al-Zahrani MD, David M. Yousem MD, MBA, Robert H. Yoon MD, PhD

Table 2. American College of Radiology Appropriateness Criteria variants and initial imaging

Variant	Contrast	MD of Head With or Without Intravenous Contrast
1. Sudden, severe headache or worse	Usually appropriate	Usually not appropriate
2. New headache with prior diagnosis	Usually appropriate	Usually appropriate
3. New or progressively worsening headache with new or more of the red flags	Usually appropriate	Usually appropriate
4. New headache, classic migraine or tension-type primary headache, normal neurological examination	Usually not appropriate	Usually not appropriate
5. New primary headache of suspected idiopathic origin	Usually not appropriate	Usually appropriate
6. Chronic headache, no new features, no neurologic deficit	Usually not appropriate	Usually not appropriate
7. Chronic headache, new features or increasing frequency	May be appropriate	Usually appropriate

WHOL in Migraineur

"Worst Headache of Life" in a Migraineur: Marginal Value of Emergency Department CT Scanning

Sahar Salzman, MD, Elham Behroozian, MD, Arya Haj-Mirzaian, MD, MPH, Matthew D. Alsin, MD, MBA, MS, MA, David M. Yousem, MD, MBA

TAKE-HOME POINTS

- The rate of NCCT-detected SAH in migraineurs reporting WHOL or TCH with no histories of intracranial pathology, cancer or immunosuppressing disease, or recent head trauma was 0%.
- The value of repetitive scanning of migraineurs with WHOL or TCH is limited unless they have known intracranial pathology, cancer, or recent head trauma.

NCCT and CTA for Headaches

AAEM Clinical Practice Committee Statement

CTA of the Brain is a Reasonable Option to Consider to Help Rule Out Subarachnoid Hemorrhage in Select Patients (12/12/2014)

Chair: Steven Rosenbaum, MD FAEM
 Authors: William Mayes, MD FAEM, Brian Walsh, MD MSA FAEM
 Reviewers: Michael Heller, MD FAEM, Zachary Sancy, DO FAEM, Robert Drennon, MD FAEM

Reviewed and approved by the AAEM Board of Directors (12/12/2014)

“CTA is very sensitive and specific for the detection of aneurysms in the setting of SAH. A recent study showed 64-slice CTA to be 98% sensitive and 100% specific for detecting aneurysms larger than 3 mm. 85% of SAH are caused by AVMs or aneurysms. SAH from other causes tend to carry a better prognosis. CTA is a reasonable strategy to consider for excluding SAH in select patients in those hospitals where CT angiography is available. It may be an appropriate alternative in those patients at higher risk for SAH after a negative NCCT and in those situations where a diagnostic LP is either refused by the patient or the results of the LP equivocal.”

NCCT and CTA for Headaches

Clinical Neurology and Neurosurgery

Journal homepage: www.elsevier.com/locate/clinneurol

Cost-effectiveness analysis of CTA and LP for evaluation of suspected SAH after negative non-contrast CT

Xiao Wu, Vivek B. Kalra, Howard P. Forman, Ajay Mathotra

Department of Diagnostic Radiology, Yale School of Medicine, New Haven, CT

“Results: CTA was associated with an expected cost of \$747 and an expected utility of 0.798603029. In comparison, LP was associated with a cost of \$504 and an expected utility of 0.799259526, making it the optimal strategy from both the cost and the utility perspectives. LP was also the more cost-effective strategy in all iterations in the Monte Carlo simulation.”

NCCT and CTA for Headaches

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Department of Diagnostic Radiology, Yale School of Medicine, New Haven, CT

Conclusion:

“LP following a negative initial non-contrast CT is the dominant strategy for diagnosing SAH in patients with thunderclap headache in the ED. In this clinical scenario CT/CTA is not an effective replacement from a utility or cost perspective.”

Literature

The American Journal of Emergency Medicine

Volume 31, Issue 4, April 2010, Pages 737-742

Aggressive imaging protocol for hanging patients yields no significant findings: Over-imaging of hanging injuries ☆

Shirley M. Schuchman MD, PhD, Joseph A. Glick MD, PhD, Kenneth Walsh MD, PhD

1.0/78 had neurovascular lesions

- 85% of patients got a CTA
- we recommend that a higher level trauma activation and CT of the head, CT/CTA of the neck and CXR should be reserved for patients with judicial hangings (drop greater than or equal to the patient's height), GCS < 15, cervical spine tenderness, symptoms of neurological, vascular or airway injury and those with abnormal vital signs
- Hopkins none in 6 years without c spine fracture

CTA utilization

In a study of 17,903 CTAs ordered in the ED, Tu et al. (2021) found that the top 5 reasons for ordering a CTA head/neck were suspected stroke, neurologic problem, dizziness, headache with new/concerning symptoms, and altered mental status.

My Own Research

European Journal of Radiology

Journal homepage: www.elsevier.com/locate/ejrad

Value of acute neurovascular imaging in patients with suspected transient ischemic attack

Reza Jafarizadeh, Joseph H. Hensley, Matthew D. Alsin, Stephanie Hauer, Nubila AD, Victor Orutu, Farooq Ghani Sherwal, Pamela T. Johnson, David M. Yousem, Vivek Vedula

Table 2. Positive Neurovascular Imaging Rate by Severity and DWI Result in 246 Patients Who Underwent Brain MRI

	Total (%)	Based on DWI (%)
Stroke	1.7%	0.4%
Stroke	5.8%	6.3%
Stroke	10.3%	7.8%

Table 3. Baseline variables identified by final diagnosis

	TIA cases (%)	Stroke cases (%)
Male	128 (14.4)	44 (10.2)
Female	118 (13.2)	48 (10.7)
Age of TIA/Stroke	68 (20.4)	35 (21.2)
Brain CT performed	217 (18.4)	144 (10.8)
Brain MRI performed	244 (16.1)	102 (11.1)
Brain MRI performed	201 (17.1)	89 (20.2)
Stroke MRI performed	198 (16.1)	83 (14.1)
Stroke MRI performed	181 (15.1)	44 (10.2)
Stroke MRI performed	181 (15.1)	45 (10.2)
Stroke MRI performed	171 (15.1)	34 (10.2)
> 70% Neck Vascular Disease	2 (0.7)	2 (2.7)
Subsequent Stroke in 90 Days	2 (0.6)	0 (0)

Patients with positive DWI scans had significantly higher rates of severe vascular stenosis (24.4% versus 7.8% intracranially and 2.4% versus 0.9% in the neck) compared to those with negative DWI scans. In patients presenting with TIA-like symptoms and DWI negative scans, the overall rate of positive neurovascular studies is very low. Triaging with DWI can reduce the frequency of unnecessary neurovascular imaging.

My Own Research



- Our results show that TIA mimics outnumber true TIA diagnoses by nearly 3:1 in our ED populations being evaluated for suspected TIA. We believe that screening with a two minute DWI MR sequence 1) would help predict neurovascular TIA from TIA mimics as the cause of the ED patient's neurologic deficit, 2) could predict the likelihood of vascular stenosis, and 3) could be used to triage patients with suspected TIA for subsequent ED-based neurovascular imaging. Deferring vascular studies in DWI-negative patients, particularly neck vascular studies, to a non-acute lower cost outpatient setting seems a justifiable option. We also note that in our cohort, patients with the final diagnosis of TIA and positive or negative vascular stenoses were all placed on the same medical therapy regimen with no immediate surgical interventions.

CTA utilization

- In a study of 24,892 ED visits, Among 24,892 emergency department visits, 2264 (9.1%) underwent head and neck CTA imaging. The percentage of patients who received a scan over the study period increased from 7.89% (422/5351) in 2017 to 13.24% (662/5001) in 2021, representing a 67.4% increase from baseline (OR, 1.14; 95% CI 1.11–1.18; $P < .001$). The positivity rate, or the percentage of scans ordered that revealed attributable acute pathology, dropped from 16.8% (71/422) in 2017 to 10.4% (69/662) in 2021 (OR, 0.86; 95% CI 0.79–0.94; $P = .001$), a 38% reduction in positive examinations.

Rigney, G.H., King, A.H., Chung, J. *et al.* Trends in non-focal neurological chief complaints and CT angiography utilization among adults in the emergency department. *Intern Emerg Med* (2024). <https://doi.org/10.1007/s11739-024-03569-9>

IMHO

- CTA/ MRA should NOT be performed for "routine" evaluation of patients for seatbelt sign, strangulation, hanging, neck pain after trauma without a neurologic deficit, or instead of a LP with a negative NCCT
- Low yield of head CTA for > 75 HTN patient with BG, BS IPH
 - No value of neck vascular imaging
- Conducting a CTA after MRA or vice versa should be at the discretion of the NR for problem solving and is rarely needed
- Engage your ED physicians and provide data

Having Fun At Work



SELF EVALUATION

Vascular Imaging in the Emergency Department

1. A 45-year-old woman presents with sudden onset “worst headache of her life.” NCCT shows subarachnoid hemorrhage confined to the perimesencephalic cisterns with no extension into the lateral Sylvian fissures or intraparenchymal hemorrhage. CTA is negative. What is the most appropriate next step?
 - a. Emergent DSA to evaluate for aneurysm
 - b. MRA to further evaluate for aneurysm
 - c. No further vascular imaging required
 - d. Repeat CTA in 24 hours
2. A 32-year-old woman presents with thunderclap headache 5 days after childbirth. She has a history of migraines and recent cannabis use. CTA performed on day 2 of symptoms was normal. What is the most likely explanation?
 - a. The CTA definitively rules out vascular pathology
 - b. Vasoconstriction in RCVS may not be visible in the first week
 - c. MRA should have been performed instead of CTA
 - d. The patient does not have RCVS risk factors
3. Which of the following clinical scenarios has the LOWEST yield for CTA and is considered an overutilization of vascular imaging?
 - a. Occipital condyle fracture
 - b. Strangulation without neurologic deficit
 - c. Penetrating neck injury
 - d. Horner’s syndrome
4. An 82-year-old man with long-standing hypertension presents with acute left hemiparesis. NCCT shows a 3 cm right basal ganglia hemorrhage without subarachnoid or intraventricular extension. What is the expected yield of CTA/MRA of the neck in this patient?
 - a. High yield – vascular imaging should be performed urgently
 - b. Moderate yield – approximately 20% will have positive findings
 - c. Low yield – approximately 2% will have positive findings
 - d. Zero yield – neck vascular imaging is never positive in this scenario
5. A patient presents with suspected TIA. MRI with DWI is negative. Compared to DWI-positive patients, what is the expected rate of intracranial stenosis on neurovascular imaging in DWI-negative patients?
 - a. 24.4%
 - b. 15.2%
 - c. 7.8%
 - d. 0.7%

Answer Key: 1. C, 2. B, 3. B, 4. D, 5. C

Approach to the Comatose Patient: Differentiating Causes and Avoiding Pitfalls

Jonathan A. Edlow, MD

Approach to the Comatose Patient: Differentiating Causes and Avoiding Pitfalls

Jonathan A. Edlow, MD

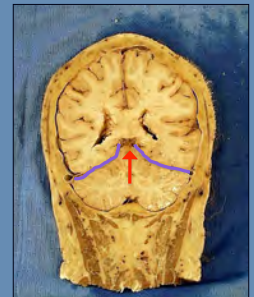
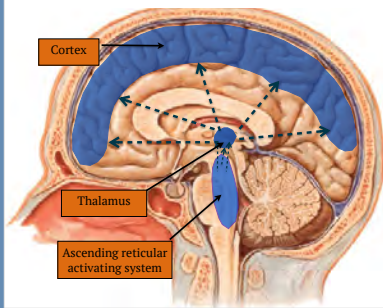
Department of Emergency Medicine, BIDMC
Professor of Emergency Medicine
Harvard Medical School



Coma

- Unaware (of environment)
- Unresponsive (to external stimuli)
- Unarousable (by the examiner)

Cerebrum - Brain in Situ Anatomic basis of coma



Physiologic Basis of Coma

- Diffuse neuronal dysfunction
- Structural brain disease
- (Rarely) psychiatric disease

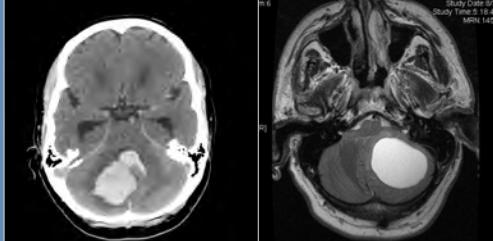
Mimics

- Locked-in syndrome (ventral pons)
- Akinetic mutism (bilateral frontal disease)

Psychiatric Causes of Coma

- As with conversion reaction, BE VERY CAUTIOUS about making this diagnosis in the ED
- Patients with psych history can present with
 - Drug OD
 - Drug side effects
 - Neuroleptic malignant syndrome (dopamine blockers) and serotonin syndrome (SSRIs)
- Structural brain disease (artery of Percheron stroke) have been misdiagnosed as conversion reactions

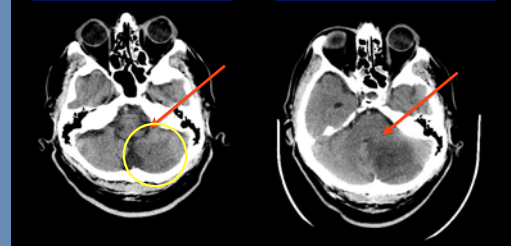
Effect of Timing: Rapidity of Onset



Effect of timing: evolution over time

8 hours after symptom onset

48 hours after symptom onset



Diffuse Neuronal Dysfunction

- Same principles of timing apply
- Think hyponatremia (rapidity of development)
- Onset, evolution and magnitude of abnormalities are always key in explaining the degree of symptoms in neurological emergencies
- Long list of causes (O₂, CO₂, Na, Ca, glucose, drugs & toxins, renal or liver dysfunction, etc.)

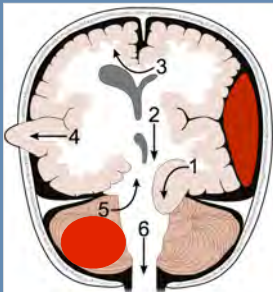
Structural Brain Disease



Key Point:
Uni-hemispheric disease does NOT cause coma . . . unless it causes tissue shifts affecting the brainstem.

Herniation Types

1. Uncal (tentorial)
2. Central (downward)
3. Sub-falcine
4. External
5. Upward
6. Tonsillar



Herniation Types

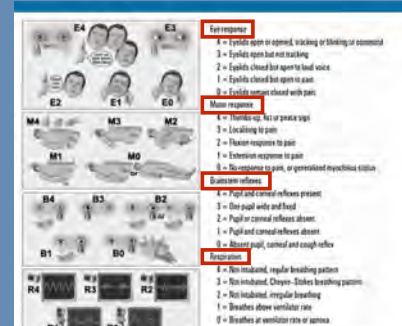
	Physical findings	Comments
Subfalcine	Progressive decrease in level of consciousness, generally in patients with hemispheric deficits (eg, hemiparesis, ipsilateral forced gaze deviation)	Midline shifts of >5 mm are associated with drowsiness; increasing shift causes increasing changes in consciousness. Pericallosal and callosomarginal arteries can be compressed against falx.
Central	Fixed midposition pupils and variable motor responses. Pontine reflexes usually remain intact.	Caused by downward pressure on the thalamus, buckling the brainstem.
Uncal transtentorial	Ipsilateral dilated pupil followed by contralateral paresis. Decreased consciousness due to thalamic pressure. Later, the contralateral pupil is affected.	Caused by compression of the midbrain by the temporal uncus. The posterior cerebral artery can be compressed against the tentorium.
Brainstem compression from infratentorial lesion	Bilateral miosis and loss of corneal and oculocervical reflexes.	Typically caused by a cerebellar mass. Specific reflexes lost will depend on location of lesion and amount of compression. Can be associated with obstructive hydrocephalus. Intrinsic brainstem disease can have similar physical findings.
Tonsillar	Respiratory arrest with loss of medullary function (cough reflex).	

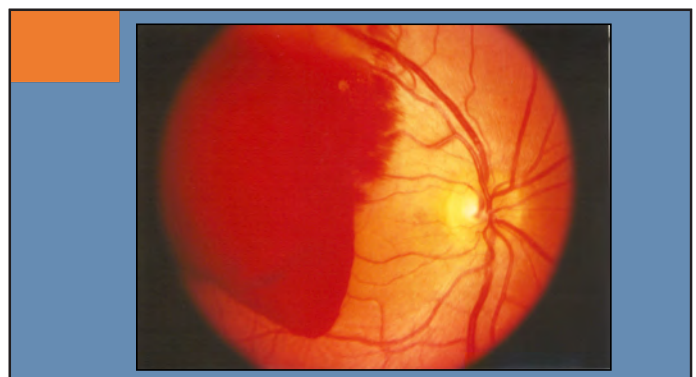
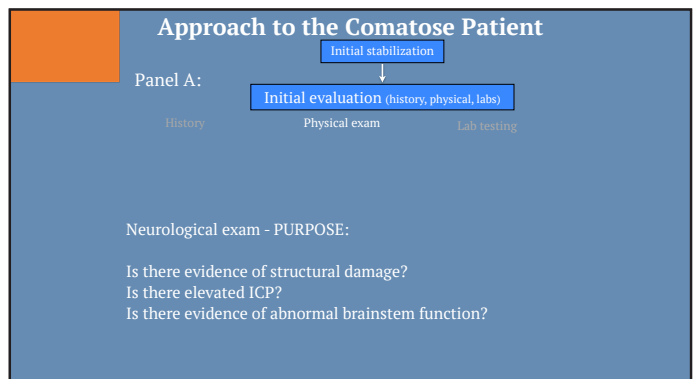
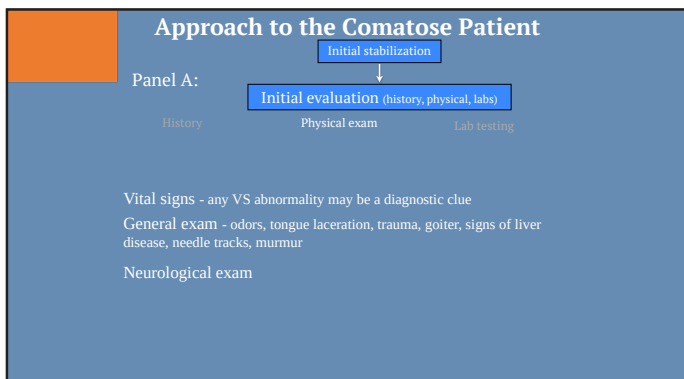
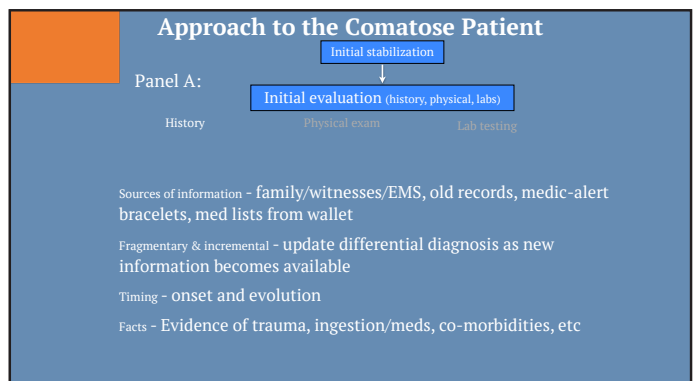
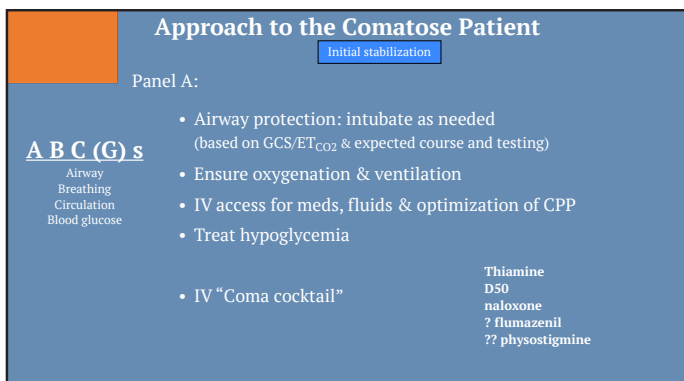
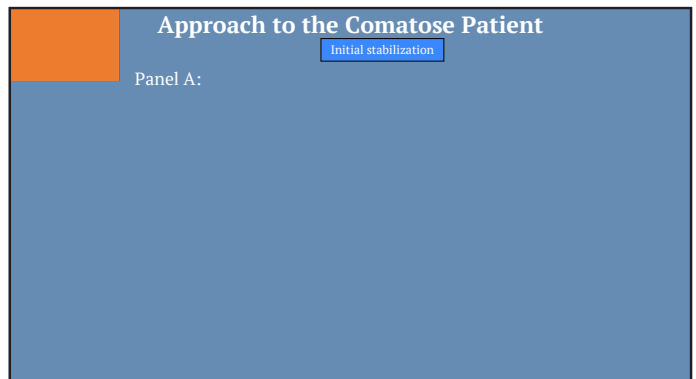
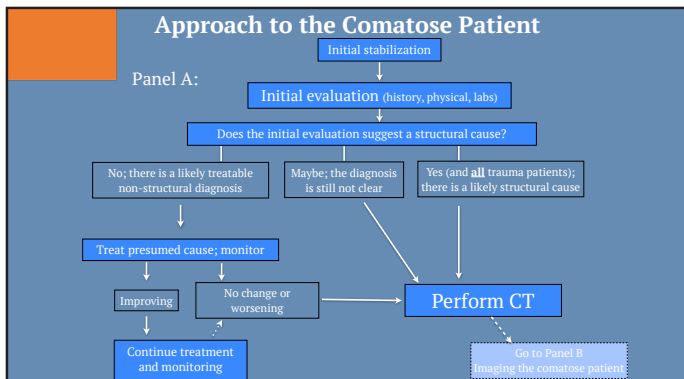
Degrees of Coma

- Lethargic, stuporous, comatose
- GCS (developed for head trauma, not as accurate for non-traumatic neurological problems)
- FOUR

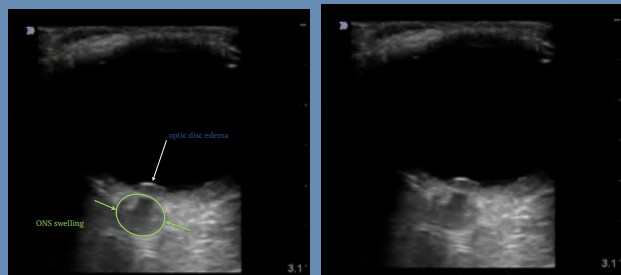
Best is to describe what you are seeing. "The patient is lying still with eyes closed. He reacts/does not react to fingernail pressure by (withdrawing) or (moving contralateral hand to push me away). He does/does not respond to asking him to give me a 'thumbs up' sign."

Full Outline of UnResponsiveness

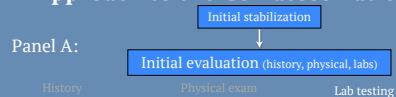




Optic Nerve Sheath Diameter



Approach to the Comatose Patient



All patients: CBC, chem-7, LFTs, VBG, Thyroid tests

Some patients: NH₄, Toxic screen

Metabolic acidosis = KULT

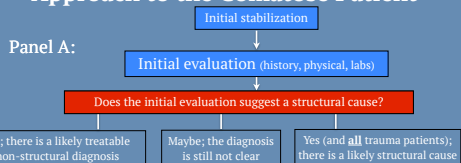
Ketones (uremia, alcoholic)

Uremia (usually late in course)

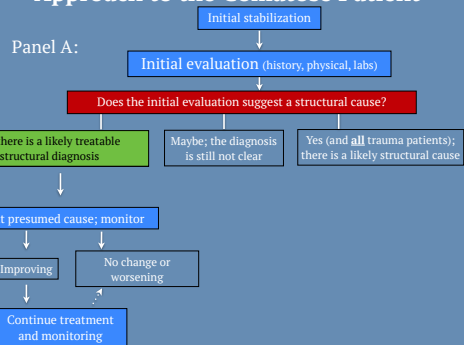
Lactate (hypo-perfusion, sepsis, Wernicke's, some toxins)

Toxins (methanol, ethylene glycol, ASA, others)

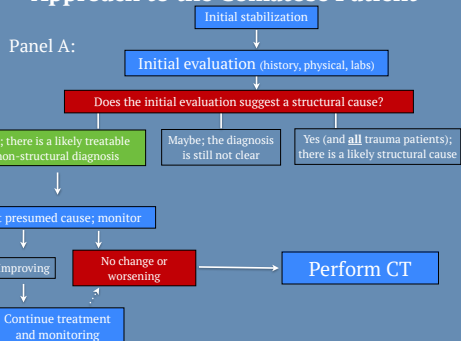
Approach to the Comatose Patient



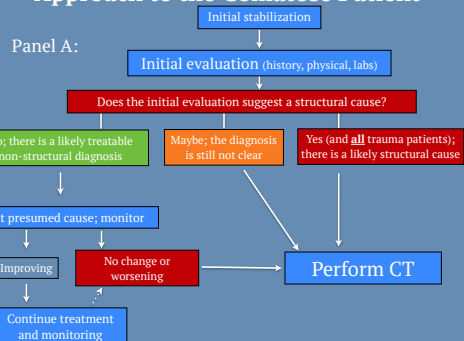
Approach to the Comatose Patient



Approach to the Comatose Patient



Approach to the Comatose Patient

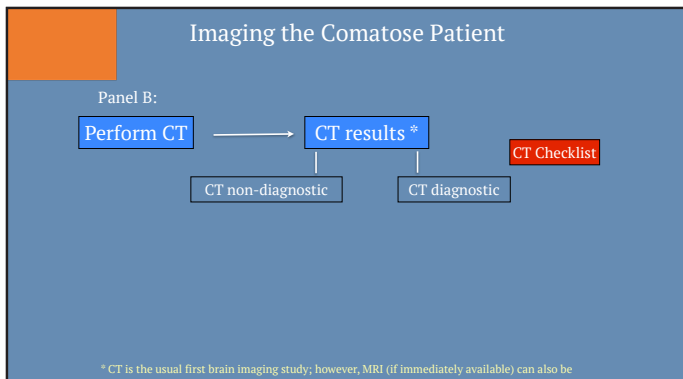


Is Brain Imaging Required in all Comatose Patients?

- In 3 large studies of non-traumatic ED coma patients, 42-58% of patients had CT
- In the largest study (N=875), 42% had CT
- 633 had metabolic causes: 151/633 (23%) had CT Of these, 4.6% were abnormal
- 242 had structural cause: 217/242 (90%) had CT Of these, 84% were abnormal

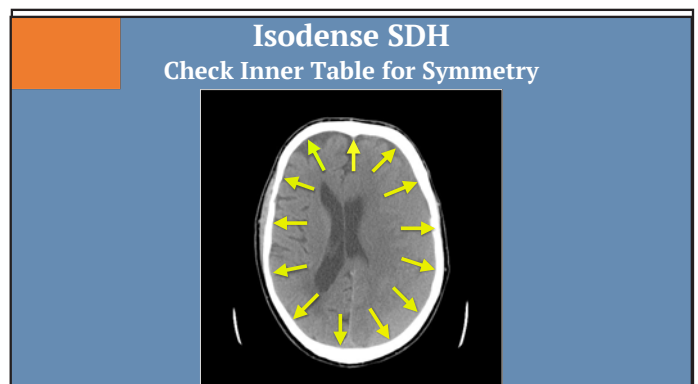
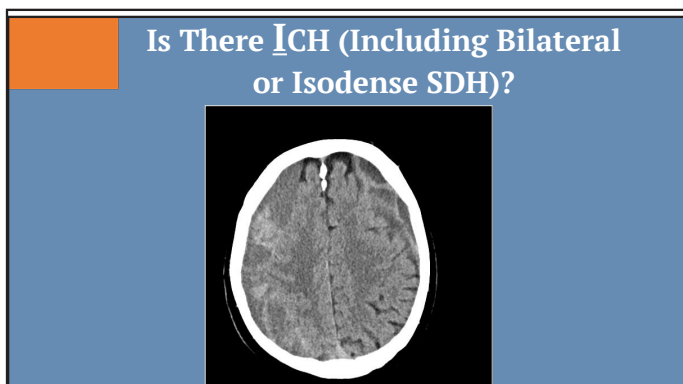
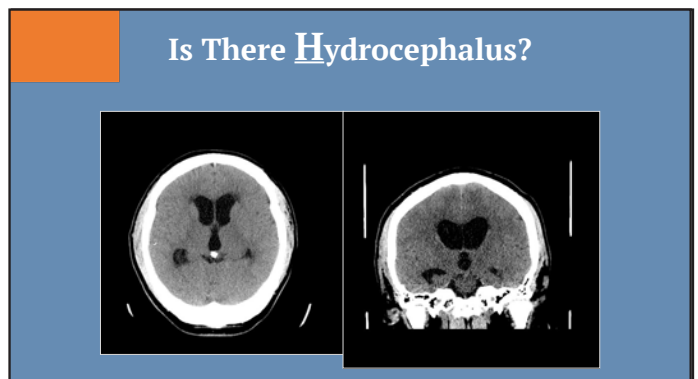
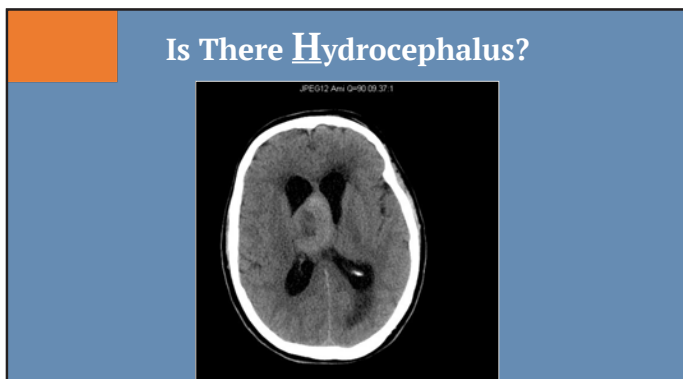
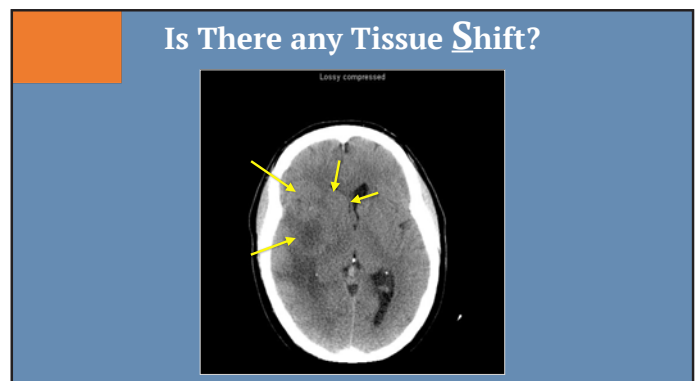
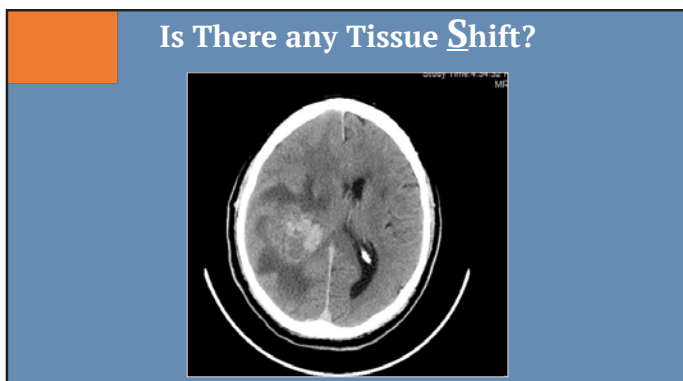
Which Comatose Patients Might Not Require Brain Imaging?

- Diabetic patient with a low blood sugar or DKA
- College student with alcohol intoxication and no history of trauma
- Elderly patient with fever, infected urine and mild hypotension
- Cirrhotic patient with prior encephalopathy, not coagulopathic, who stopped taking his lactulose

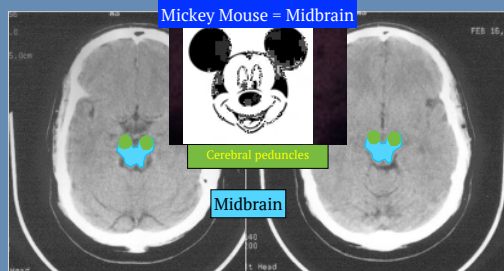


**CT (or MRI) Checklist
STICHH**

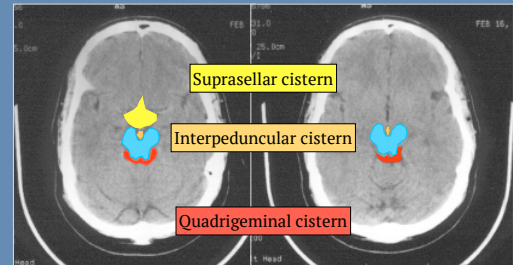
- Is there any tissue **S**hift?
- Is there **T**halamic pathology?
- Is there **I**CH, including bilateral or isodense SDH?
- Are the basal **C**isterns obliterated ("ring around the brainstem")?
- Is there **H**ydrocephalus?
- Is there a **H**yperdense basilar artery?



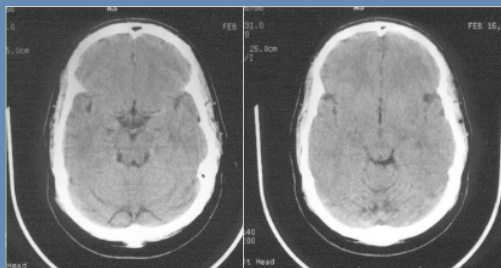
Are the Basal Cisterns Obliterated?



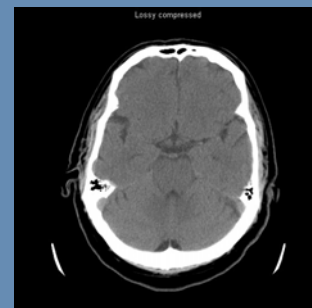
Are the Basal Cisterns Obliterated?



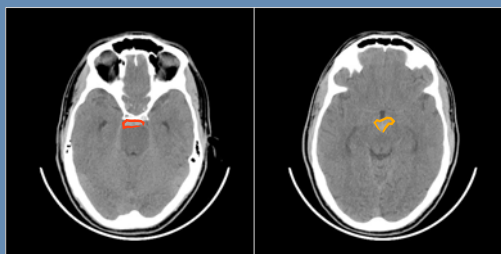
Are the basal Cisterns obliterated?



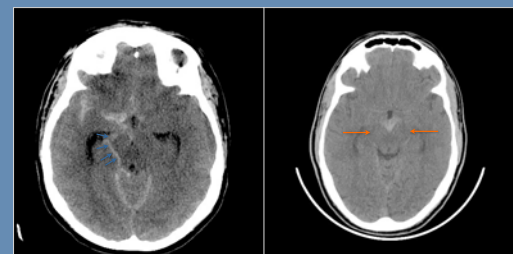
Are the basal Cisterns obliterated?



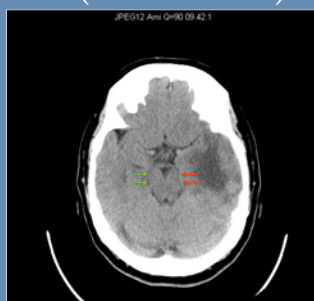
Are the Basal Cisterns Obliterated (or Blood Filled)?



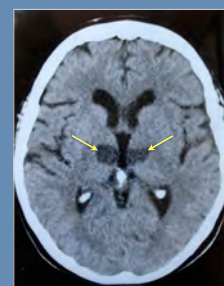
Are the Basal Cisterns Obliterated (or Blood Filled)? What Do You Not See??



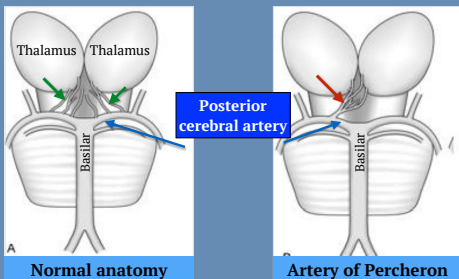
Are the basal Cisterns obliterated (or blood filled)?



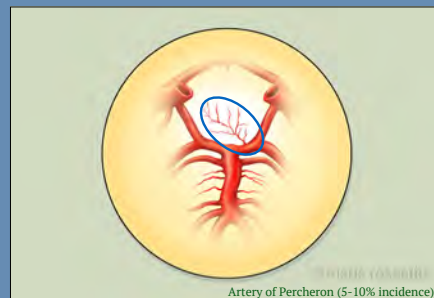
Are There Abnormalities of the Thalamus?



Are there abnormalities of the Thalamus?



Are There Abnormalities of the Thalamus?

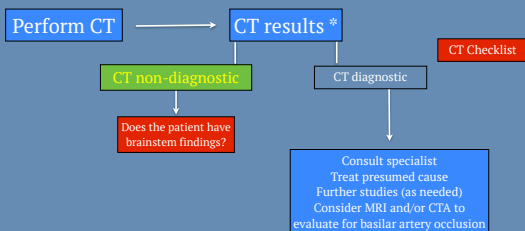


Is There a Hyperdense Basilar Artery?



Imaging the Comatose Patient

Panel B:

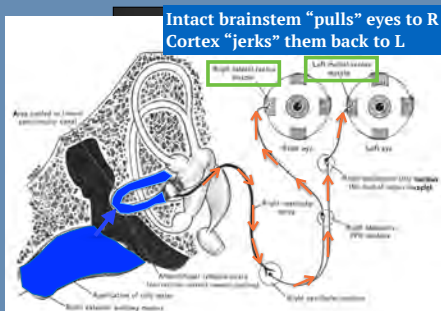


* CT is the usual first brain imaging study; however, MRI (if immediately available) can also be done

Does the Patient Have Brainstem Findings?

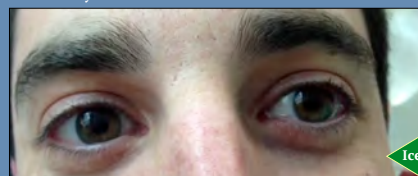
- Anisocoria (especially decreased constriction to light), dilated pupil or pinpoint pupils
- Ophthalmoplegia or central (vertical, torsional or direction-changing) nystagmus
- Skew deviation (vertical misalignment of the eyes)
- Flexor or extensor posturing
- Abnormal breathing pattern
- Abnormal **cold caloric testing** (or oculoccephalic reflex - doll's eyes - if C-spine has been cleared)

Cold Caloric Testing



Cold caloric testing

- Ensure external canal is clear & without trauma
- Elevate head of bed 30 degrees
- Gently infuse 20-30 cc's of ice water into canal



"Cold opposite - warm same"
= direction of fast-phase of nystagmus

Cold caloric testing

What do the eyes do?

Nothing - eyes do not move

Eyes move tonically towards cold water, no nystagmus

Eyes move tonically towards cold water, then fast phase of nystagmus beats away from it ("cold opposite")

What does it mean?

Brainstem (midbrain & pons) not working

Brainstem intact but cortex is not working

Both brainstem & cortex are intact - psychogenic coma

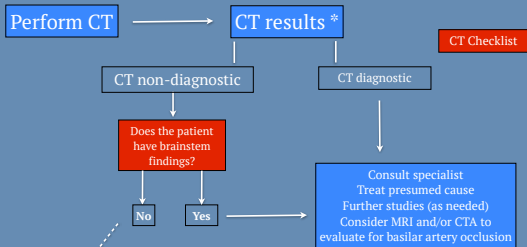
Brainstem Reflexes

Table 1.3 Cranial Nerve Reflexes

Reflex	Afferent Limb	Efferent Limb	Central Lesion Location*
Pupillary light	CN II	CN III	Upper midbrain
Corneal	CN V	CN VII	Lower midbrain to upper pons
Oculocephalic	CN VIII	CN III, IV, VI	Upper midbrain to lower pons
Gag	CN IX	CN X	Medulla
Cough	CN X	CN X	Medulla to cervical spinal cord

Imaging the Comatose Patient

Panel B:



CT Checklist

Panel C: Diagnostic checklist

* CT is the usual first brain imaging study; however, MRI (if immediately available) can also be done

Diagnostic Checklist for Patients With Non-Diagnostic CT & Labs *

Panel C:

- Does the patient have a condition that needs MRI or vascular imaging?
- Does the patient need treatment for a poisoning?
- Does the patient need a LP and IV antimicrobials?
- Does the patient need an emergent EEG?
- Does the patient need hormone or thiamine replacement?

* including CT that has an incidental positive finding or lab tests that may be abnormal but not etiologic

Diagnostic Checklist for Patients With Non-Diagnostic CT & Labs *

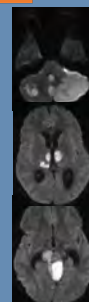
Panel C:

Does the patient have a condition that needs MRI or vascular imaging?

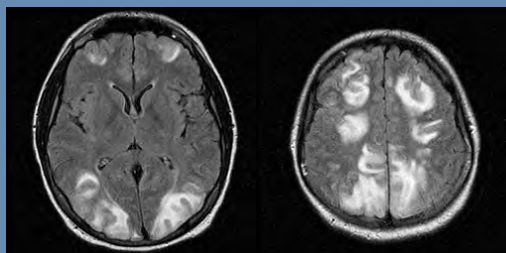
1. Does the patient have brainstem findings suggestive of a basilar occlusion?
2. Was there abrupt onset (? artery of Percheron)
3. Does the context suggest PRES, severe CVST (e.g., seizures, pregnant or post-partum) or RCVS?

Advanced imaging, neurology consultation

Altered mental status, vomiting, seizures ... and anisocoria



Post-Partum Woman With Seizure, Visual Disturbance, Headache, and Altered Mental Status



Diagnostic Checklist for Patients With Non-Diagnostic CT & Labs *

Panel C:

Does the patient need treatment for a poisoning?

1. Look for a toxidrome
 - History & context
 - Physical exam
 - Labs
2. Treat as indicated

Diagnostic Checklist for Patients With Non-Diagnostic CT & Labs *

Panel C:

Does the patient need a LP and IV antimicrobials?

1. Is there fever, neck stiffness, h/o bacteremia or other suggestion of CNS infection (meningitis, encephalitis or brain abscess)? NB: abscess causing coma with a normal CT would be exceptionally rare (avoid LP)
2. Remember to consider acyclovir (for possible HSV encephalitis) or doxycycline (for possible tick-borne diseases)
3. Consider sepsis (from non-CNS source)

LP and/or empiric antimicrobials

Diagnostic Checklist for Patients With Non-Diagnostic CT & Labs *

Panel C:

Does the patient need an emergent EEG?

1. NCSE occurs in ~ 8% of comatose ICU patients.
2. Is there h/o seizures?
3. Other suggestive findings
 - nystagmoid movements
 - myoclonic jerks
 - lip smacking and other odd movements

Remember: seizure patients given NM blockers may continue to have electrical seizures without overt motor movements.

EEG and/or empiric AEDs

Diagnostic Checklist for Patients With Non-Diagnostic CT & Labs *

Panel C:

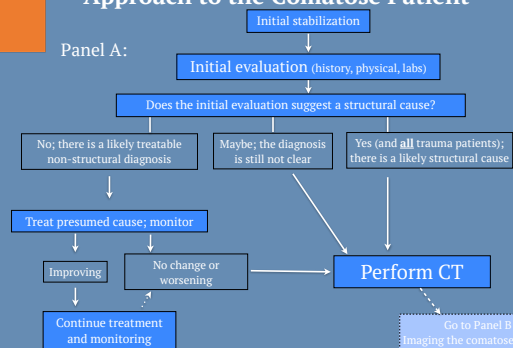
Does the patient need hormone or thiamine replacement?

1. Are there clues to thyroid disease (high or low)?
2. Is there any suggestion of Addison's?
3. Are there physical findings associated with pan-hypopituitarism?
4. Are there clues to Wernicke's?

Empiric treatment

Approach to the Comatose Patient

Panel A:



Thank You



SELF EVALUATION

Approach to the Comatose Patient: Differentiating Causes and Avoiding Pitfalls

True/False

1. The most common physiological basis of coma is due to either diffuse neuronal dysfunction involving both cerebral hemispheres or structural brain disease with brainstem compression.
2. Terms like lethargy and stupor best communicate a patient's level of consciousness.
3. Every patient with coma must have a brain CT.
4. Every patient with coma must have their blood sugar checked.
5. Anisocoria in a comatose patient is usually due to a structural central cause.
6. In a patient who presents with a grand mal seizure, which has been successfully treated, but is still unconscious, an EEG may disclose a treatable diagnosis.

Answer Key: 1. T, 2. F, 3. F, 4. T, 5. T, 6. T

FACULTY

Deepak S. Patel, MD, FAAFP, FACSM

Deepak S. Patel, MD, FAAFP, FACSM, is a family and sports medicine physician and serves as Medical Director of Rush Copley Sports Medicine and Assistant Professor at Rush Medical College in Chicago. He maintains an active clinical practice and has held numerous leadership roles in medical education, including Director of Sports Medicine for the Rush Copley Family Medicine Residency. Dr. Patel is a nationally recognized expert in sports and musculoskeletal medicine, has authored and edited multiple publications and textbooks including *Concussion Management in Primary Care* and regularly presents at national and regional CME conferences. He serves as a subject matter expert and chair for multiple AAFP CME programs and is a member of the AAFP Education Advisory Panel for Emergency and Urgent Care.

You may contact Dr. Deepak with any questions or comments at Deepak_S_Patel@Rush.edu.

Understanding Pediatric Overuse Injuries

Deepak S. Patel, MD, FAAFP, FACSM, CIC

Understanding Pediatric Overuse Injuries

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Family Medicine and Sports Medicine, Yorkville Primary Care, Yorkville, IL
Chair/Subject Matter Expert for AAFP Sports Medicine and Musculoskeletal Medicine CME

† AAFP

Learning Objectives

1. Identify risks for pediatric overuse injuries.
2. Determine the most effective diagnostic physical exam and imaging modalities in pediatric overuse injuries.
3. Educate patients and parents on the most effective treatment and return to play strategies for pediatric overuse injuries.

† AAFP Pediatric Sports Med Injuries Overview



† AAFP

Overuse Injury Risk Factors

- Prior injury
- Rapid grow (spurts)
- Sudden or high training
- Other possible:
 - Improper Equipment
 - Limited rest periods



DiFiore JP, Benjamin HJ, Brenner J, Gregory A, Jayanthi N, Landry GL, & Lake A. Overuse injuries and burnout in youth sports: a position statement from the American Medical Society for Sports Medicine. Clin J Sport Med. 2015 Jan 1;24(1):3-20.
Amoroso Arnold, A. et al. Overuse Physical Injuries in Youth Athletes: Risk Factors, Prevention, and Treatment Strategies. Sports Health. (9):2:139-147 March 1, 2017. <https://doi.org/10.1177/1941738117696942>

† AAFP Female Soccer injury risks

- Inc. knee valgus = 3.2-fold increased risk of knee injury.
- Incr. strength reduced overuse knee injuries:
 - hamstring = 35%
 - quadriceps = 30%
 - hip flexor = 28%
 - Hip external rotation = 35%
- >1 soccer team = 2.5 x incr. knee injuries,
- Playing other sports/exercise = 61% decr. risk

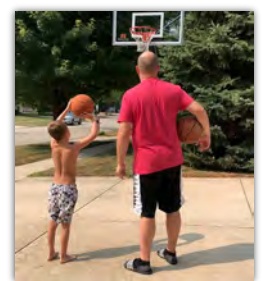


O'Kane, J. et al. Risk Factors for Lower Extremity Overuse Injuries in Female Youth Soccer Players. Orthopaedic Journal of Sports Medicine 2017 (5): 10; Oct 1, 2017. <https://doi.org/10.1177/2325967117733963>

† AAFP

Children ≠ Small Adults

- Overuse injuries @ weakest link (muscle, tendon, bone)
- Adults: tendon= tendonitis/tendinosis
- Children: apophysis= apophysitis



† AAFP

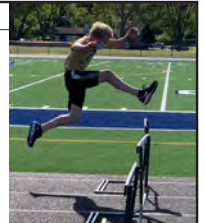
Foot Pain

† AAFP

11 y/o Lateral Foot Pain



- Runner
- Chronic pain on lateral foot
- Increased w/ running
- Occasional edema
- Tender based of 5th MT
- Pain w/ inversion
- Pain/weakness w/ resisted eversion



† AAFP

Radiology read as avulsion fracture of 5th Metatarsal

Fracture?



† AAFP

11 y/o Lateral Foot Pain

- Iselin's Disease
- Base of 5th MT apophysitis
- Distal peroneus tendon tenderness
- Pain/weakness with resisted eversion



† AAFP

11 y/o Lateral Foot Pain

- Analgesics, rehab
- Post op shoe or Walking boot in severe cases
- Avg return to play 38 days



† AAFP

Heel Pain

† AAFP

16 y/o Male FB Heel Pain

- Atraumatic pain after 2nd week of practice
- ↑ w/ running, jumping, lineman
- stance and push off
- ↓ w/ ice, ibuprofen
- Pain in low Achilles, base of heel

- PE:
- Tender distal achilles, Prox calcaneus
- ↓ ROM: Active dorsiflex,
- Pain w/ Passive dorsiflex and resisted plantar flex



† AAFP

Question: 16 y/o Male FB Heel Pain

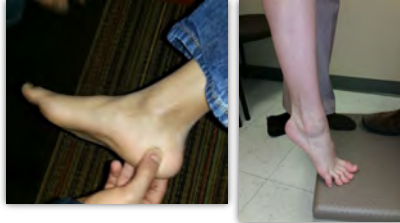
Most likely diagnosis is?

- Achilles tendonitis
- Calcaneus apophysitis (Sever's dis.)
- Calcaneus stress fracture
- Plantar fasciitis



† AAFP **Sever's Disease-Dx**

- Exam Sensitivity:
- One-leg heel stand =100%
- Squeeze test= 97%;
- palpation test= 80%.
- All 100% specificity.



Perhamme, S. et. al. Sever's Disease: A Clinical Diagnosis. J Am Podiatr Med Assoc Sep-Oct 2013 103(5): 361-368, 2013

† AAFP **Sever's Disease - Imaging**

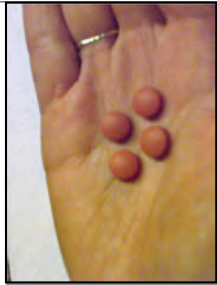
- X-ray often normal
- Not required (SOR: C)
- Partial fragmentation & inc. density of calcaneus in 90%
- Asymptomatic 50 %



Perhamme, S. et. al. Sever's Disease: A Clinical Diagnosis. J Am Podiatr Med Assoc Sep-Oct 2013 103(5): 361-368, 2013
 Tu, P. Heel Pain: Diagnosis and Management. Am Fam Physician. 2018 Jan 15;97(2):386-93.
 Hernandez-Lucas, Pablo, et al. "Conservative treatment of Sever's Disease: a systematic review." Journal of Clinical Medicine 13.5 (2024): 1391.
 Yun, Lisa, and Daniel M. Fein. "Osgood-Schlatter and Sever diseases." (2024): 422-424.
 Rakesh, Rakesh D. "Sports-Related Injuries in Adolescents: Prevention, Treatment, and Long-Term Outcomes." Scholar's Digest: Journal of Orthopedics 1.1 (2025): 115-133.
 Linmer LJ, Swisher J, Sinton ZE. Childhood and Adolescent Sports-Related Overuse Injuries. Am Fam Physician. 2023 Dec;108(6):544-553.

† AAFP **Sever's Disease - Tx**

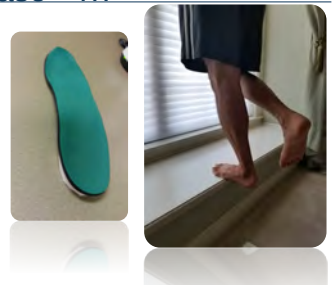
- Conservative (SOR:C)
- Acetaminophen/ NSAIDS prn (SOR:C)
- Stretch/strength (SOR:C)
- May resume activity gradually as tolerated (SOR:C)



Tu, P. Heel Pain: Diagnosis and Management. Am Fam Physician. 2018 Jan 15;97(2):386-93.
 Perhamme, S. et. al. Sever's Disease: A Clinical Diagnosis. J Am Podiatr Med Assoc Sep-Oct 2013 103(5): 361-368, 2013
 Tu, P. Heel Pain: Diagnosis and Management. Am Fam Physician. 2018 Jan 15;97(2):386-93.
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 Yun, Lisa, and Daniel M. Fein. "Osgood-Schlatter and Sever diseases." (2024): 422-424.
 Rakesh, Rakesh D. "Sports-Related Injuries in Adolescents: Prevention, Treatment, and Long-Term Outcomes." Scholar's Digest: Journal of Orthopedics 1.1 (2025): 115-133.
 Linmer LJ, Swisher J, Sinton ZE. Childhood and Adolescent Sports-Related Overuse Injuries. Am Fam Physician. 2023 Dec;108(6):544-553.

† AAFP **Sever's Disease - Tx**

- 101 pts
- Wait & see = insoles = eccentric PT



Wierginck, Johannes L, et al. "Treatment of calcaneal apophysitis: wait and see versus orthotic device versus physical therapy: a pragmatic therapeutic randomized clinical trial." Journal of Pediatric Orthopedics 36.2 (2016): 152-157.

† AAFP **Sever's Disease Tx- Orthotics vs heel lift**

- 124 pts
- Heel lift vs prefab orthosis
- 1st 2-mo, slight benefit of the shoe insert (heel lift)
- By 6, 12-mo No benefit



- 208 pts
- Store heel lifts vs custom made orthotics
- 12 wk random allocation.
- Custom orthotics better than heel lifts.

James, A. et. al. "Effectiveness of footwear and foot orthoses for calcaneal apophysitis: a 12-month factorial randomised trial." British journal of sports medicine (2016): Br J Sports Med doi:10.1136/bjsports-2015-094986
 Albano-Santade, Javier, et al. "Effectiveness of Custom-Made Foot Orthoses vs. Heel-Lifts in Children with Calcaneal Apophysitis (Sever's Disease): A CONSORT-Compliant Randomized Trial." Children 8.11 (2021): 963.

† AAFP

Knee Pain

† AAFP

14 y/o Female VB Knee Pain



- Atraumatic pain after 2nd week of practice
- Incr w/ running, jumping, deep squat
- ↓ w/ rest, ice, ibuprofen
- Mild edema
- Pain in below knee cap

- PE:
- FROM
- Tender distal pole patella/proximal patellar tendon
- No jt line tenderness
- No plica

† AAFP

Question: 14 y/o Female VB Knee Pain DDX

Most likely diagnosis is?

- Patellar tendonitis
- Osgood-Schlatter Disease
- Sinding-Larsen-Johansson Disease
- Tibial stress fracture
- Patellofemoral syndrome



† AAFP **Sinding-Larsen-Johansson (SLJ) Disease**

- Apophysitis
- Inf. pole patella
- Less common
- Dx/Tx: same as OSD
- No X-ray
- RF/VL stiffness predisposing OSD?



Enomoto, Shota, et al. "Muscle stiffness of the rectus femoris and vastus lateralis in children with Osgood-Schlatter disease." *The Knee* 32 (2021): 140-147.
Purcell L, et. Al. Tests and treatments to question in pediatric sport and exercise medicine. *Can Fam Physician*. 2023 Jan;69(1):34-38. doi: 10.46747/cfp.690134. PMID: 36693750; PMCID: PMC9873285.

† AAFP **OSD (& SLJ) - Treatment**

- Conservative - ice, analgesics, stretching (SOR: B)
- Relative rest - avoid/limit high impact activities: running/jumping (SOR: B)
- Strengthening - ?eccentric vs. concentric
- Chopat strap: ± (consider)
- Surgery is rarely indicated
- Tib. Tuberosity prominence may persist for life



Circi, E., Atalay, V. & Breyazdeoglu, Treatment of Osgood-Schlatter disease: review of the literature *T. Musculoskelet Surg* (2017) 101: 195. <https://doi.org/10.1007/s12206-017-0479-7>
Pehnam, S. et. al. Sever's Disease: A Clinical Diagnosis. *J Am Podiatr Med Assoc* Sep-Oct 2013 103(5): 361-368, 2013
Yun, Lisa, and Daniel M. Fein. "Osgood-Schlatter and Sever diseases." (2024): 422-424.
Rahesh, Rahesh Dr. "Sports-Related Injuries in Adolescents: Prevention, Treatment, and Long-Term Outcomes." *Scholar's Digest: Journal of Orthopedics* 1.1 (2025): 115-133.
Larsen, J.L., Sinding, J. Sinding-Johansson and Adolescent Osseous Related Disease. *Ann Fam Physician*. 2014 Dec; 10(6):244-252.

† AAFP **OSD - Tx Prolotherapy?**

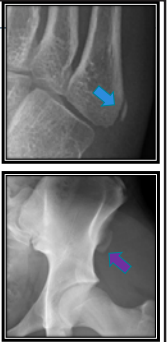
- 65 knees, girls 9-15 & boys 10-17 y/o
- RCT conservative tx vs. double-blind injection 1% lidocaine w/ or w/o 12.5% dextrose monthly inj x 3, then prn
- More asymptomatic in dextrose vs lidocaine only (14 of 21 vs. 5 of 22) or usual-care-treated (14 of 21 vs. 3 of 22)
- After 1 year, dextrose asymptomatic vs. lidocaine (32 of 38 vs. 6 of 13; P=.024) or only usual care (2 of 14).
- 2022 study confirmed benefit over saline at 3, 6, 12 mo.
- 20% dextrose not helpful



Papad GA, Padellaro LA, Reeves KD, Royo MF, Fullerton BD, Yoh HW. Hypermolar dextrose injection for recalcitrant Osgood-Schlatter disease. *Pediatrics*. 2011 Nov;128(5):e1121-8. doi: 10.1542/peds.2010-1931. Epub 2011 Oct 3.
Wu, Zha, Xiaonian Tu, and Zhiyuan Tu. "Hypermolar dextrose injection for Osgood-Schlatter disease: a double-blind, randomized controlled trial." *Archives of Orthopaedic and Trauma Surgery* 142(9) (2022): 2278-2285.
Nakano, Junaka, et al. "No superiority of dextrose injections over placebo injections for Osgood-Schlatter disease: a prospective randomized double-blind study." *Archives of Orthopaedic and Trauma Surgery* 140(2) (2020): 187-202.
Bakula, Dina, et al. "Efficacy of Hypermolar Dextrose Injection for Osgood-Schlatter Disease: A Systematic Review with Meta-Analysis." *Diagnostics* 15(10) (2025): 1285.

† AAFP **Traction Apophysitis**

- Overuse, NOT acute avulsion
- 5th metatarsal - Iselin's Disease
- Sever's disease
- Osgood-Schlatter disease
- Sinding-Larsen-Johansson disease
- Little league elbow (medial epicondyle)
- Hip and Pelvis-Most common apophyseal fractures

† AAFP

Shoulder Pain

† AAFP **15 y/o Male Shoulder Pain**



- Progressively worsening pain for 2-3 months
- Increased after more intense throwing
- Decreased throwing velocity
- Pain lateral shoulder

† AAFP **Little League Shoulder (proximal humeral epiphysiolysis)**

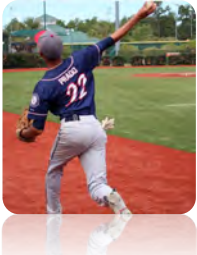
- Overuse/stress injury of prox. humeral physis
- In overhead athletes with open growth plates
- Baseball is most common, also:
 - Swimming
 - Gymnastics
 - Volleyball
 - Tennis



Bednar ED, Kay J, Memon M, Simunovic N, Purcell L, Ayeni OR. Diagnosis and Management of Little League Shoulder: A Systematic Review. *Orthopaedic Journal of Sports Medicine*. July 2021. doi:10.1177/232596712110317563

† AAFP **Little League Shoulder - Risk Factors**

- Improper throwing mechanics
- High volume pitches
- Inadequate throwing rest
- Breaking pitches (curveball, sliders) - NOT proven



Tizano BK, Estes AR. Overuse Injuries of the Pediatric and Adolescent Throwing Athlete. *Med Sci Sports Exerc*. 2016 Oct;48(10):1898-905. doi: 10.1249/MSS.0000000000000998.
Bednar ED, Kay J, Memon M, Simunovic N, Purcell L, Ayeni OR. Diagnosis and Management of Little League Shoulder: A Systematic Review. *Orthopaedic Journal of Sports Medicine*. July 2021. doi:10.1177/232596712110317563

Little League Shoulder: X-ray



- AP, Lat/Ext rot., lat. Y-view,
- **COMPARISON** to unaffected side
- Widened proximal humerus physis±:
 - physeal fragmentation
 - sclerosis
 - demineralization
 - periosteal reaction

Bednar ED, Kay L, Menon M, Simunovic N, Purcell L, Ayeni OR. Diagnosis and Management of Little League Shoulder: A Systematic Review. Orthopaedic Journal of Sports Medicine. July 2021. doi:10.1177/2325967121101564

Little League Shoulder - Tx

- Throwing relative rest 1-3 mo (SOR=C)
- Severe - No throwing 4-8 wks
- Ice, Pain meds
- Strengthening, stretching, core stab
- Restart throwing when pain free + FROM
- Focus on proper mechanics



Tisano BK, Estes AR. Overuse Injuries of the Pediatric and Adolescent Throwing Athlete. Med Sci Sports Exerc. 2016 Oct;48(10):1898-905. doi: 10.1249/MSS.0000000000000996. Achar, S, Yamanka, J., Apophysis and Osteochondritis: Common Causes of Pain in Growing Bones Am Fam Physician. 2019 May 15;99(10):610-618. Bednar ED, Kay L, Menon M, Simunovic N, Purcell L, Ayeni OR. Diagnosis and Management of Little League Shoulder: A Systematic Review. Orthopaedic Journal of Sports Medicine. July 2021. doi:10.1177/2325967121101564. Rakesh, Rakesh Dr. "Sports-Related Injuries in Adolescents: Prevention, Treatment, and Long-Term Outcomes." Scholar's Digest: Journal of Orthopedics 1.1 (2025): 115-133. Lintner LJ, Swisher J, Simon ZE. Childhood and Adolescent Sports-Related Overuse Injuries. Am Fam Physician. 2023 Dec;108(6):544-553.

Elbow Pain

Little League Elbow

- Overuse/stress injury of medial elbow in growing
- 9-12 y/o
- Throwing: tension on medial elbow ± compression lateral elbow
- Valgus stress
- Signs:
 - ↓ ROM
 - Tender medial epicondyle
 - Edema
- X-ray/MRI depending on severity



Little League Elbow - Tx

- Absolute throwing rest 4-6 weeks
- Ice, Pain meds
- Strengthening, stretching, core stab
- Restart throwing when pain free + FROM
- Focus on proper mechanics



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Little League Elbow/Shoulder Prevention

- Rest when fatigue
- No throwing overhead for >2-3 mo per year. No pitching for >4 mo/year
- Limit pitch counts & include rest days (SOR: B)
- Avoid radar guns
- Play other sports

Little League Baseball. Protecting young pitching arms. http://www.littleleague.org/assets/old_assets/media/pitch_count_publication_2008.pdf. American Academy of Pediatrics. Policy statement: baseball and softball. Pediatrics. 2012;129:e842-e856. Arnold A, et al. Overuse Physical Injuries in Youth Athletes. Sports Health Vol 3, Issue 2, pp. 129 - 147 First published date: February-06-2017 DOI: 10.1177/1941728117309847. Rakesh, Rakesh Dr. "Sports-Related Injuries in Adolescents: Prevention, Treatment, and Long-Term Outcomes." Scholar's Digest: Journal of Orthopedics 1.1 (2025): 115-133. Lintner LJ, Swisher J, Simon ZE. Childhood and Adolescent Sports-Related Overuse Injuries. Am Fam Physician. 2023 Dec;108(6):544-553.

Pitch Limits

Age	Pitches per day	Age	Pitches/ day	Rest Days
17-18	105	<14 y/o	>66	4
13-16	95		51-65	3
11-12	85		36-50	2
9-10	75		21-35	1
7-8	50		<20	0
		15-18 y/o	>76	4
			61-75	3
			46-60	2
			31-45	1
			1-30	0

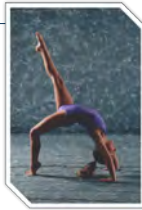
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Back Pain

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13 y/o Gymnast Back Pain

- Gradually worsening low back pain x 2 months
- Increased pain 2 mo.
- Ibuprofen some help
- ↓ Bending
- Stiffness
- PE
- ↓ flex/ext
- Pain with ext
- + stork
- - SLR
- Neuro intact



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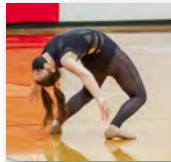
13 y/o gymnast back pain diagnosis

- Lumbar strain
- Spondylolysis
- Spondylolisthesis
- Spondylosis
- Scoliosis

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Spondylolysis

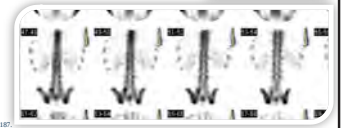
- Repetitive hyperextension = stress injury/fx
- Gymnastics, football, soccer, weightlifting, volleyball, ballet, dance
- Defect of pars interarticularis



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Spondylolysis - Dx

- History - Repetitive extension
- Stork test +
- ↓ ROM, Lumbar hyperlordosis
- Local tenderness
- X-ray: AP/Lat (SOR: B)
 - Oblique: "Scottie dog" - Neg early
- Bone scan w/ SPECT vs MRI?

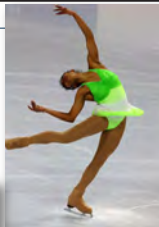


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Spondylolysis - Tx

- Relative Rest (SOR: C)
- Analgesics (SOR: C)
- P.T. (SOR: C)
- Bracing +/- (night pain)
- Advance activity as tol
- Approx 5-6 months
- Up to 9-12 month healing



Randall, R. et al. Review of Pediatric Spondylolysis and Spondylolisthesis. Sports Med Arthrosc. 2016 Dec;24(4):184-187.
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Overuse Prevention

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Overuse Injury Prevention

- Limit repetitive movements (eg, jumping, running, throwing) (SOR: B)
- Regular rest time (SOR: B)
- Sleep (SOR: C)
- Individualized training adjustments (especially during growth spurts) (SOR: B)
- Preseason conditioning/gradual progression (SOR: B)
- Proper fitting equipment (SOR: C)

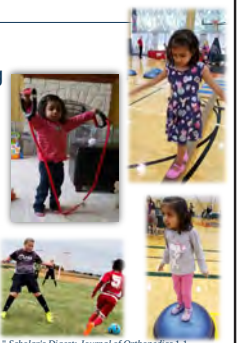


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Overuse Injury Prevention

- Prevent burnout - skills focus vs competing (SOR: C)
- Multisport/cross training vs specialization (SOR: C)
- Resistance & functional movement training (SOR: B)
- Neuromuscular training (SOR: B)
 - Ankle sprain reduced 29-73% (SOR: B)



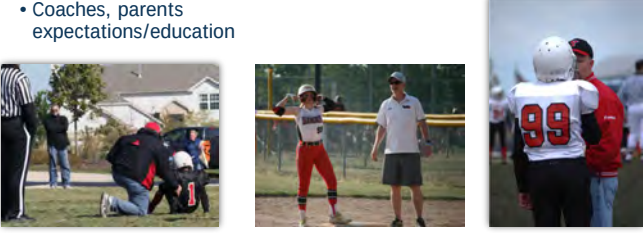
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Barriers

Barriers to Practice

- Multiple teams, single sport (sports specialization)
- Coaches, parents expectations/education



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Summary

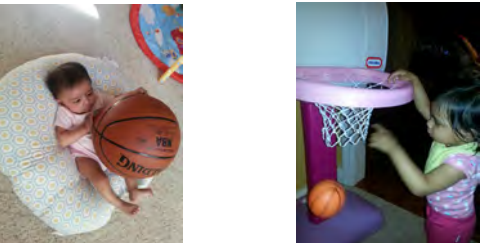
- Consider apophysitis when evaluating overuse injuries in Peds (SOR: B)
- Treat apophysitis with activity modification, stretching and rehab (SOR: B)
- Consider cross training and non-continuous sports season to prevent overuse injuries (SOR: C)
- Consider non casting options and avoiding repeat x-rays for distal radius buckle fractures (SOR: B)

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Resources

- STOP (Sports Trauma and Overuse Prevention) Sports Injuries: <https://www.stopsportsinjuries.org/>
- NATA position statements: <https://www.nata.org/news-publications/pressroom/statements/position>
- Little league Pitch counts <https://www.littleleague.org/playing-rules/pitch-count/>
- Pitch Smart guideline: <https://www.mlb.com/pitch-smart/pitching-guidelines>

† AAFP



† AAFP



Thanks!

Questions???

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SELF EVALUATION

Understanding Pediatric Overuse Injuries

1. The greatest risk for pediatric overuse injuries is?
 - a. Excessive exercise
 - b. Playing multiple sports
 - c. Too much video gaming
 - d. Year-round single sport participation
2. The most common overuse injury in growing children is apophysitis?
3. The most likely diagnosis of an 11 y/o runner with atraumatic lateral foot pain is ?
 - a. Stress fracture
 - b. Metatarsal apophysitis
 - c. Peroneus longus tendonitis
 - d. Avulsion fracture
4. The most likely diagnosis for a 16 y/o football playing with atraumatic posterior heel pain is?
 - a. Achilles tendonitis
 - b. Calcaneus apophysitis (Sever's dis.)
 - c. Calcaneus stress fracture
 - d. Plantar fasciitis
5. The most likely diagnosis for a 14 y/o volleyball player with tenderness at the inferior pole of the patella is?
 - a. Patellar tendonitis
 - b. Osgood-Schlatter Disease
 - c. Sinding-Larsen-Johansson Disease
 - d. Tibial stress fracture
 - e. Patellofemoral syndrome
6. The most likely diagnosis for a 15 y/o gymnast with extension aggravating back pain is?
 - a. Lumbar strain
 - b. Spondylolysis
 - c. Spondylolisthesis
 - d. Spondylosis
 - e. Scoliosis
7. T/F - The most helpful test to evaluate for a spondylolysis is a lumbar series that includes oblique views?

Answer Key: 1. D, 2. T, 3. B, 4. B, 5. C, 6. B, 7. F

FACULTY

Joel Kravitz, MD, FACEP, FRCPSC

Joel Kravitz, MD, FACEP, FRCPSC, is an emergency medicine physician based in Philadelphia, Pennsylvania, affiliated with Thomas Jefferson University Hospitals—Jefferson Health and Capital Health Medical Center—Hopewell. He earned his medical degree from McGill University, where he also completed a five-year emergency medicine residency and served as chief resident. He is board certified in emergency medicine in both the United States and Canada. Over a career spanning more than 25 years, Dr. Kravitz has held a variety of academic and leadership roles, including Associate Program Director at Albert Einstein in Philadelphia and Assistant Director of Emergency Medicine at Capital Health. His scholarly work includes research on topics such as diabetic ketoacidosis and asthma management, with presentations at local, national, and international levels. He has authored multiple book chapters in leading emergency medicine texts, including Tintinalli and Rosen, and remains deeply committed to teaching practical, real-world clinical decision-making in the emergency department.

You may contact Dr. Kravitz with your questions or comments at joel_kravtiz@hotmail.com.

Medical Mythbusters

Joel Kravitz, MD, FACEP, FRCPSC

Medical Mythbusters

Joel Kravitz MD FACEP
Associate Residency Director
Rutgers-CMC EM Residency Program, Toms River, NJ

We Know this to be true....



Just ask yourself....

- How many things were you taught in medical school...
 - That you took as 'gospel'?
- That you assumed to be true because everyone said it was and never bothered to look into it?
- That you still do to this day despite some evidence out there to the contrary...
 - ...that you know about but ignore because 'you're sure you are right'
 - ...that you just don't know

EM asks and answers

- Lidocaine with Epinephrine on fingers, nose, toes...
- Denkler, *Plastic Recon Surgery*, 2001
- Lalonde, *Jour Hand Surg Am*, 2005
- Thompson, *Plastic Recon Surg*, 2007
- EM studies as well
- But I still don't do it....

Here is a sample

- "we only use 10% of our brains"
 - Despite neuroscience saying otherwise for over a century
 - Possibly originated from Harvard psychologist William James (1907)
 - MRI/PET- entire brain active, even during simple tasks
- 'drink 8 glasses of water per day'
 - Based on a 1945 recommendation for a 'suitable allowance of water'
 - Even then, they said the majority comes from prepared foods
- 'eating turkey makes you drowsy'
 - NO – eating like a pig at Thanksgiving makes you drowsy....
 - More tryptophan per gram in pork and cheese than turkey

A classic example: Episiotomy

- Now only used in certain situations, but for a time was considered 'standard practice' or 'better for the mother'
 - 70's – 2/3 of women had them
 - 2004 – 25%
- Where did that start? With science?
- Original rec traced back to 1742
 - Dr. Fielding Ould. "A Treatise of midwifery in three parts"
- Took over 250 years to truly question it....

Inquiring minds want to know...



You can't trust anyone these days....

- John Carlisle ; *Anaesthesia*; Oct 2020
- "False individual patient data and zombie RCT's submitted to anaesthesia"
 - 526 submitted trials 2017-2020
 - 14% had false data, 8% were 'zombie' (fatally flawed)
 - Most from China, South Korea, India, Japan and Egypt
- Reviews of individual patient data showed false data in 44%
- Calls for all journals to review individual patient data prior to publication

Recommended reading

- JPA Ioannidis
- "Why most published research findings are false"
- PLOS Medicine 2005

Not to be jaded, but....

- I am not going to teach statistics now, but consider this....
- P-value < 0.05
 - 95% chance that the effect seen was NOT due to chance
 - It means that 5% of the time it IS due to chance
 - Thus, 1 out of every 20 articles you read is wrong!

What do you do?

- You can't go on someone else's say-so (much less mine...)
- It sounds like I'm telling you all the research you read is garbage
 - I'm not, but some of it is....



NTG in Inferior MI

- Origin: Ferguson 1989 Am J Cardiology
- Looked at patients with inferior MI with and w/out RV involvement
 - 20 hypotensive – 15/20 showed RV involvement
 - 20 normotensive – 2/20 showed RV involvement
- And thus the belief was born
 - Criteria for RV involvement?
 - ECG changes in precordial leads
 - Echo not included in study

NTG in inferior MI

- Yes: Inferior MI is preload dependent
- Yes: Inferior MI often affects the RV
- Yes: NTG does reduce your preload
- BUT: This study is by no means definitive
 - What about the benefits of vasodilation and improved coronary perfusion balanced against the BP
 - What about the fact that NTG sublingual last 1-4 minutes, so effect is transient

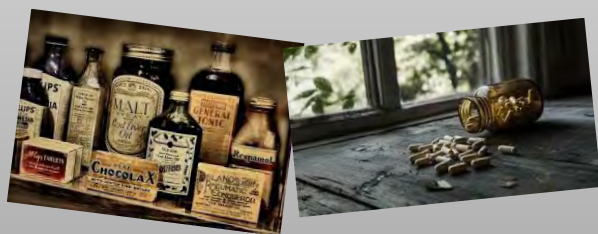
NTG in inferior MI

- Wilkinson-Stokes, Emerg Med J 2023
- Nitrate admin during RV MI: A SRMA
 - Not the best meta-analysis – only 5 studies
 - One was only an abstract (but they got the raw data...!)
 - Is giving nitrate to patients with RVMI associated with increased adverse events?
- Conc: “Low certainty evidence of no statistically significant difference in rates of adverse events”

Bottom line : at least partial myth

- Reasonable to give nitrate to inferior and RV MI
 - Assuming a reasonable blood pressure
- Be aware of possible hypotension
- Questionable in already hypotensive patients
 - No data on this, though

“I just took some of my old medications”



Shelf Life Extension program (SLEP)

- 1986 – joint FDA and DoD
- To reduce costs of maintaining military medical stockpiles
- Has saved almost \$1.5 billion dollars
 - DoD uses some meds far past their shelf life
- How did they do this?
 - Well, they had to study the drugs under certain storage conditions
 - Agencies pay a fee for FDA to study it
 - Data is not always freely available

But every once in a while....

- Lyon et al, Stability Profiles of drug products extended beyond labeled expiration dates
 - *J Pharm Sciences*; 2006 July; 95 (7); 1549-1560
- 122 different drug from over 3000 lots
- “SLEP data supports the assertion that many drug products, if properly stored, can be extended past the expiration date”
- “Due to lot variation, the stability and quality can only be assured by periodic testing”

OK, fine... but how long is long?

- Overall
 - 88% of lots were extended past 12 months
 - 47% were abated before failure at 70 months (~6 years!)
- Of the 412 lots that failed
 - NONE failed by 1 year

How long is long?

- | | | |
|--------------------|----------------|-------------------------|
| • Amoxicillin | 21/21 active | 22-23 months |
| • Doxycycline | 10/13 active | 50 months |
| • Ciprofloxacin | 205/242 active | 12-142 months (55 avg.) |
| • Cipro (susp) | 7/7 active | 32 months |
| • Potassium iodide | 12/12 active | 28-124 month (69 avg.) |
- Most were dormant but still retained some activity at 5 years!
 - So maybe that old Bactrim from the last UTI did something.....

Epi-pen

- Cantrell - Jun 2017 *Annals Int Med*
 - Arose from the spiking cost
- Asked community clinic to use/study expired Epi-pens
- The 40 pens studied – 80% or more potency at up to 50 months
 - Something is definitely better than nothing

The ultimate time release capsule...

- Nov 2012 *Arch Int Med*
- Sealed meds that expired 30 years earlier....
- 90% potency (or more) was retained)
 - I'm not saying you should keep them that long...
- The only exception?
 - Aspirin (1% potency)

Myth or fact?

- Probably a bit of both
- It is likely medications have far more potency past expiration than we give them credit for, BUT....
- It is contingent upon proper care and storage.

Why does this matter?

- Theoretically, partial treatment can mask diagnostic ability
 - UTI and urinalysis
- People may avoid treatment thinking they have the right med
 - Could see worsening disease that could have been easily treated

Do not take these together, right?



Metronidazole and alcohol

- Metronidazole blocks aldehyde dehydrogenase
- Thus, alcohol would convert to aldehyde and build up
- Cause a disulfiram-like reaction
 - Sweating, flushing, vomiting, tachy
 - Was actually pioneered as an alcohol Rx in 60's

Fact vs fiction

- This was all supported by biochem theory and a few case reports, UNTIL.....
- 2000 *Ann Pharmacother*
 - Reviewed six cases and questioned this
 - Of those cases – one death
 - The patient had no metronidazole Rx and none was found at the scene
- 2000 rat studies
 - Increases aldehyde in colon, but not blood
 - Rats had colonic bacteria that had Alcohol Dehydrogenase

If you cannot find humans, use medical students!

- Viasapaa et al; *Ann Pharmac*; 2002; 36; 971-974
 - 12 medical student 'volunteers', placebo controlled randomized
 - 5 days of flagyl and ethanol 0.4mg/kg
- No signs or symptoms in either group
- No disulfiram reactions

The verdict

- If you're on metronidazole, one drink is probably OK
- If you're a college student with trichomonas planning on partying on a Saturday, I would not recommend it.
- Truth is, we just don't know, but a small amount is likely OK

No IV on the side of breast cancer surgery

- Naranjo et al; *Anaesth Analg*; 2021 Sept; 133(3)
- Ipsilateral IV Catheter placement in breast cancer surgery patients
- Retrospective review of IV's after breast surgery (median – 1.5 yrs)
 - Contra : Cx 7.3 per 1000
 - Ipsi: Cx 3.9 per 1000
- This included patient who had lymph node dissection

Fair and balanced

- Clark and Sitzia; May 2005; *QJM*
 - 1 in 5 develop it, and hospital venipuncture is a risk factor
 - So was LN dissection and obesity, so not just IV's
- Winge, May 2010, *Clin Jour Nursing*
 - Questionnaire of 311 – only 4 developed lymphedema (88% had IV's placed there)

Bottom line - myth

- Limited evidence to support avoiding venipuncture with a history of breast cancer &/or lymphedema
- The advent of US may render some of this moot
- The edematous arm might occasionally be easier due to underuse.

Kayexalate for Hyperkalemia

- Known and used since the 1950's
 - i.e. before FDA requirement to show safety and efficacy
- Cation exchange resin
 - Exchanges Na for K (also Ca and Mg!)
- Potassium concentration higher in colon
 - Works better as a retention enema
- Risks- resin swells
 - Large doses can cause obstruction, necrosis and perforation

But does it really work?

- Kapral 1998 *J Am Soc Nephro*
- Only 6 patients with chronic renal failure
- Placebo versus single dose
- No reduced K levels
- This was the nephro literature – and they still recommend it!

Does it really work, part II

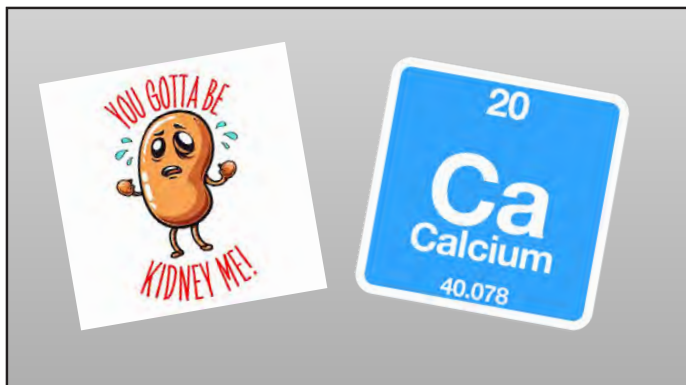
- Batterink et al 2015
 - Effectiveness of SPS for short term treatment of hyperkalemia
 - Retrospective observation of admitted patients
- Reduced serum K by 0.14 versus controls
- Was statistically significant, but clinically?

Why is this still a thing?

- LePage 2015 (a nephrologist!!!)
- Double blind, placebo RCT
- Some benefit from Kayexalate with sorbitol as a long- or intermediate-term treatment for hyperkalemia in CKD
- Patient still ended up with low calcium and magnesium

Bottom line...

- Likely a myth, but....
 - Literature from nephrology
 - Known to cause harm
 - Better a safer products out there (patiomer, Lokelma)
- Why are we still giving this?



Calcium : what you probably already know

- Only 1% of calcium circulates in the blood
 - 99% in bone
- 40% of that 1% is albumin bound
- Remaining circulates as free 'ionized' ca
 - This portion is responsible for metabolic functions
- Usually we correct for albumin
 - Theory: less albumin means less bound Ca so lower overall Ca
 - Payne's formula 1973
 - $(0.8 \times (\text{Alb} - \text{pt Alb})) + \text{serum Ca} = \text{corrected Ca}$
 - OR for every 1 g/dl decrease in albumin, Ca should go up by 0.8 mg/dl

But does it need correction?

- Payne's formula was based on 200 patients in a single lab
 - Larger retrospective data sets have not supported it

Sweden's rebuttal

- Ridefatt: *Scand J Clin Lab Invest*; 2017
- "Albumin adjustment of total calcium does not improve the estimation of calcium status"
- 20,000 hosp patients (100 times Payne!)
 - All 7 correction formula correlated poorly
- N.B.: Uncorrected calcium correctly identified the pt's iCa in 82%

Australia's rebuttal

- Smith et al; *Clin Chem*; 2018
- 5500 tertiary care patients
- Corrected calcium correlates in only 55-65%
- Formulae fail to correct in renal failure and at extremely low albumin levels (<3.0)
 - Performed better at near normal levels (which makes it unnecessary)

Norway's rebuttal

- Lian et al; *BMJ Open*; 2018
- 6500 hospital and clinic patients (so not just inpatient)
- Uncorrected more accurately determined clinically relevant free calcium
- Again, multiple formulas did not correlate well

Canada's rebuttal

- Steen et al; *Can J Gen Med*; 2016
- 678 patients, using Payne's method
- Corrected calcium was less reliable than uncorrected though the difference was small

What is the issue then

- iCa levels change with pH
 - Sample must be processed quickly and kept cool
 - Lower pH increases iCa and displaces calcium from albumin
- Also, using corrected Ca can cause an overestimation or a false 'normal', theoretically

bottom line: seems like a myth to me...

- Uncorrected total calcium seems to more accurately measure biologically active calcium
 - If unsure, you can get an iCa assay to determine
- Good news- it seems you have one less equation to remember!

I cannot get the flu vaccine because...



still made with egg products

- MMR
- MMRV
- Influenza
- ImmVue
- Yellow fever
- 1 type of rabies vaccine (RabAvert)
- All can have minute amounts of ovalbumin

Flu vaccine and egg allergy

- Greenhart et al 2018
 - Review of 28 studies
- Total of 4300 people with egg allergy
 - 650 with anaphylaxis
- No cases anaphylaxis after flu vaccine

Prospectively

- Gagnon 2010, *J Clin All Imm*
 - 830 with **confirmed** egg allergy
 - No anaphylaxis, 8 people took Benadryl
 - 3600 with **reported** egg allergy
 - No anaphylaxis
 - 2 'received epinephrine for symptoms consistent with allergy'
 - Not specified

Experts have spoken....

Canada and US advise that the flu vaccine can be administered in a routine fashion in individuals with egg allergy without special precautions

Bottom line - likely a bit of a myth



Propofol and egg allergies

- And soy and peanuts....
- Formulations do contain an emulsion that includes:
 - Egg lecithin
 - Soybean oil
- Early studies linked propofol reactions to eggs

However....

- Those early studies were limited and inconclusive
 - But enough to generate a widespread 'egg allergy' ban
- Most egg allergies are to proteins in the egg WHITE, not the lecithin
- The lecithin is denatured in the processing, so it is (possibly) safer
- Overall risk est 1:60,000

Br J Anaest, 2016

- Asserhøj et al 2016;116(7): 77-82
- Study A – 273 pts with suspicious peri-op reactions
 - 153 exposed to propofol – 4 Dx'ed with an allergy
 - None had allergic symptoms with eggs, soy or peanut
- Study B – retro of 520 patients with possible egg/soy/peanut allergy
 - No reactions in 171 anaesth charts
- OK... but this isn't conclusive either...

Propofol use in children with allergies

- Summerfield; Anaesth; 2019; 74(10); 1252-1259
- Retrospective – 300 kids with food allergies given propofol
 - 201 egg, 226 peanut, 28 soybean
- 10 reactions total, but in 9 – non-allergic explanations were found

Conclusion

- Amer Acad of Allergy Asthma and Immunology (AAAAI)
- "Though it is clear that propofol can cause anaphylactic reactions, the cause of these reactions is unclear and appears not to be related to soy or egg allergy"

Bottom line : maybe a myth ?

- Probably not as big a concern as we think, but evidence is still not yet 100% convincing
- Mild egg allergy – safe for propofol
- Anaphylaxis – MD discretion
- In the real world – just use something else....
 - Ketamine, versed, fentanyl.....

Antibiotics for aspiration pneumonia

- Given to prevent the development of aspiration pneumonia
- Exposes patients to unnecessary antibiotics risk and side effects
 - E.g. Clostridium difficile, etc....

Prophylactic antimicrobials for acute aspiration pneumonitis

- Clin Inf Dis 2018
- 200 patients
- No change in critical care
- More escalation of antibiotic therapy – seems obvious
- Fewer antibiotic free days – of course!

Myth? Maybe, but....

- No gold standard has truly been established
- No reliable way to predict who will go from pneumonitis (inflamm) to pneumonia (infection)
- CMS requirements being what they are...

Chocolate causing acne (OK this was just fun!)

- Suspected for decades until....
- Fulton et al JAMA 1969
 - 65 subjects with acne
 - Fed either a bar with chocolate or no chocolate for 1 month
 - No difference between the groups
- Teens of the world rejoice !!!!!

Chocolate and acne

- Subsequent articles said this requires revision as their calculations did not account for other dietary properties of chocolate
- Diets high in fat and carbohydrate stimulate sebaceous secretion and adversely affect acne vulgaris
 - After fat and carbs, what's left?
- Example: A 1974 study of Northern Inuits made no mention of acne until adopting a more 'modern' diet

Chocolate versus acne – no one really knows

- Netea et al, Cytokine 2013
 - Choc modulate cytokine production
 - Shown to release IL-1B and IL-10 when stimulated with *S. Aureus* and *P. Acne*
 - *In vitro* – never shown in humans
- Von Graviopap 2014 Int J Dermatology
 - 25 'acne-prone' males (never defined)
 - 25g of 99% dark chocolate daily
 - No acne at 4 weeks
 - ?Protective

Lets do this right

- Capierton et al 2014, J Clin Aesth Derm
 - Double blind RCT, but only 14 men
 - Capsule with either coca, gelatin powder, or both
 - Positive correlation between amount of chocolate and amount of lesions
- Delost et al 2016, J Am Acad Derm
 - Impact of choc consumption: a randomized crossover study
 - 54 college students
 - 1 Hershey bar or 15 Jelly Belly jellybeans (same glycemic load)
 - Chocolate group had more acne (4.8 vs. 0.7 lesions)

Bottom line - probably true?

- Was believed true
 - became a myth
 - the myth was disproved
 - but we are still not sure
- Evidence does quietly point to chocolate being associated with more acne.
- Many dietary and derm experts believe other ingredients (added sugar, etc...) are the real culprits

Renal colic and IV contrast



We've all been there

- Is it a stone?
- Do I need contrast?
- With no contrast, will I miss something else?



Dym Radiology 2014

- Retrospective study
 - 97 – with and without contrast
 - Read by 3 radiologists
- Sensitivity
 - All stones 81%
 - >2mm 88%
 - >3mm 95%
 - >4mm 99%
 - >5mm 98%

Contrast or no?

- Lei, Am J Eme med, Sept 21
- Can obstructive urolithiasis be safely excluded on contrast CT
- Retrospective cohort
- All CT's for a complaint of flank pain

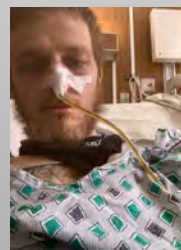
Contrast or no?

- Prevalence
 - No contrast 44% 351/797
 - Contrast 18.7% 86/459
- Why was prevalence different????
- Negative predictive value
 - No contrast 99.5% 1/200
 - Contrast 100%

Bottom line – this may soon become a myth

- Preliminary data says large stones can easily be seen
- IV contrast may aid in diagnosis of other pathology
 - This is also debated somewhat in literature
- Study may have suffered somewhat from a form of selection bias

Bowel obstruction and NG Tubes



“The NG tube was the worst part of 9 day stay in the hospital – worse than the colonoscopy”

Bowel obstruction and Ng tube

- No data to support routine use of Ng tubes
 - Especially with no emesis
- But surgeons still demand it...
- Ever had one up your nose?

He literally wrote the book!

- Owen Wangenstein
 - Chair, Dept of Surg, Univ Minn 1930-68
- “The therapeutic problem in obstruction: a physiological and clinical consideration”
 - 1957

How did we get here?

- Animal studies where mid-ileum was ligated
- Swallowed air was culprit causing distension
- Bonus: studies also showed no benefit in placing tube beyond the stomach

That is pretty much it!

- Animal studies
- NG tubes in all obstructions
- Almost 75 years!

Irony, thy name is....

“There exists a feeling among physicians and students that anything over 10 years old has no pertinence”

Owen Wangenstein

NGT may not be better after all

- Fonseca, Am J Surg 2013
- Shinohara, Am J Surg 2013
- Berman, Am J Emer Med, 2017
- Total of 750 patients retrospectively

What NG tubes in SBO actually do....

- Longer time to resolution
- Longer length of stay
- More pneumonia and resp failure
- No effect on operative rates
- No effect on mortality rates

Likely a myth for routine use

- There may be a sub-group from whom it is beneficial
 - Significant distension, high grade...
- If the benefit is so clear – prove it
 - Why has that research not been published? Does it exist?
- Until then – I am not putting these in routinely

Corneal anesthetics for home use



To drop or not to drop....

- ACEP Consensus cited article from some of the hottest journals...
 - Cornea 2020
 - Surv Ophthal 2013
 - OphthalSurg Lasers 2016 – Oprah's Book list!
 - J Refract Surg 2000
- Point: Ophtho has been doing this for a while...
 - Maybe in the right patient....

To drop or not to drop....

- Green et al. Annals May 2024
 - Consensus ACEP Guidelines for topical anesthetic with simple corneal abrasions
 - "For only simple corneal abrasions, it appears safe to prescribe/provide a commercial topical anesthetic for the first 24 hours, as long as no more than 1.5- 2 mL used in 24 hours. And remainder is discarded after 24 hours."
 - So IF, and IF, and IF... then OK

Sterile gloves for laceration repair

- 2004 Perelman et al, Annals
 - 816 patients, randomized prospective trial
- Infection rate
 - Non-sterile gloves 4.4%
 - Sterile 6.1%



Sterile versus non-sterile gloves

- 2024 Lobo et al, Annals EM
 - 6 RCT's, 6182 patients total
 - ED patient 2482
- Surgical site & ED infections were similar with either gloves
 - ?Included operative wound repair !?!

Sterile versus non-sterile... dressing too?

- 2022 Zwaans et al Emer med J
- Multi-center single blinded RCT
- Non-inferiority trial
- ~740 per group
- Did not reach planned sample size, BUT
 - Non-sterile 5.7% infection rate
 - Sterile 6.8% infection rate



Bottom line: likely a myth

- NOTE: this would likely apply only to simple routine lacerations we see in the ED
- NOTE: This does not mean you abandon all sterile technique
- Cannot explain in either study why non-sterile had a lower infection rate

Why is ginger ale in every hospital?



Ginger ale and nausea

- Used for over 200 years
 - Ayurvedic and Chinese medicine, and medieval Europe
 - Called 'the great cure' in India
 - Described in Greek texts as an 'Arabian import'
 - In the 14th century, was price equivalent to sheep
 - I assume per pound...

Benefits of ginger

- Digestive aid
- Nausea treatment
- Colds, sore throats, congestion
- Aphrodisiac
- Arthritis, gout
- Improve circulation

Ginger ale and nausea

- Gingerol-natural component of ginger
 - Encourages the stomach to empty more quickly
- Gingerol and shogaols
 - Affect neurotransmitters that trigger the vomit reflex in the CTZ

But does ginger actually work?

- ACOG – 1st line choice along with Vit B6
 - 250mg capsule qid
 - Ginger candies, lollipops, etc...
- Cochrane review 2011
 - 9 RCT's, B level evidence

Ginger and nausea

- Morning sickness – clear evidence of effect
- Chemotherapy- induced – evidence of effect
- Peri-operative – questionable
 - Brit J Anaesth 2000
 - Non-significant difference of ginger over placebo
 - Negligible therapeutic effects

So, it works, but here is the issue...

Ginger ale contains almost NO ginger
What you see is almost entirely placebo effect



Fletcher v. Canada dry

- July 2018
- Ms. Fletcher was giving it to her kids to settle their stomach because it had ginger
- Sued when it wasn't working and she found out it contain almost no ginger
 - Won a lawsuit for deceptive marketing
- Fun fact – Canada Dry was also sued for not being "made in Canada"

Bottom line - not a myth... but

- Ginger itself definitely has anti-nausea effect in certain scenarios
- BUT – the ginger ale in your hospital fridge has minimal ginger extract and does not contain the chemicals need for that effect
 - It's all placebo
- Safe daily dose is about 1000mg
 - Look for capsule, juices and teas
 - Check the ginger content and for the amount of gingerol

Question!... And Questions?



Question 1

You have a patient with symptoms of a urinary tract infection who used several days of an old Bactrim prescription from over a year ago. Which of the following statements is true about the old medication?

- A. The medication is unlikely to be of any use
- B. The medication is probably at full effect, even a year later
- C. There is a theoretical risk of partial treatment and thus masking a true UTI
- D. The medication has a higher likelihood of inducing an allergic reaction

Question 1

You have a patient with symptoms of a urinary tract infection who used several days of an old Bactrim prescription from over a year ago. Which of the following statements is true about the old medication

- A. The medication is unlikely to be of any use
 - B. The medication is probably at full effect, even a year later
 - C. **There is a theoretical risk of partial treatment and thus masking a true UTI**
 - D. The medication has a higher likelihood of inducing an allergic reaction
- With partial effectiveness, the old antibiotic could theoretically partially treat the UTI and hinder test results

Question 2

- You have a patient you are sending home with metronidazole for bacterial vaginosis. She says she is attending a wedding that weekend and wants to know if it is OK to drink alcohol, despite the drug warning. Based on available evidence, what is your recommendation?

- A. Rules are rules – no alcohol should be consumed
- B. A complete myth – drink as much as you like
- C. Switch to a different antibiotic so the patient can celebrate
- D. Evidence suggests that small amounts of alcohol are without toxic effects, so maybe one drink

Question 2

- You have a patient you are sending home with metronidazole for bacterial vaginosis. She says she is attending a wedding that weekend and wants to know if it is OK to drink alcohol, despite the drug warning. Based on available evidence, what is your recommendation?

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- C. Switch to a different antibiotic so the patient can celebrate
- D. **Evidence suggests that small amounts of alcohol are without toxic effects, so maybe one drink**

- Studies have shown no adverse effects with small amounts of alcohol, though the risk of a reaction still exists

Question 3

- The use of nasogastric tubes in most studies of bowel obstructions have been associated with:

- A. A decreased mortality rate
- B. Shorter length of hospital stay
- C. Increased incidence of pneumonia
- D. Shorter time to resolution of obstruction

Question 3

- The use of nasogastric tubes in most studies of bowel obstructions have been associated with:

- A. A decreased mortality rate
- B. Shorter length of hospital stay
- C. **Increased incidence of pneumonia**
- D. Shorter time to resolution of obstruction

- For the rest, the opposite has been shown (i.e. increased mortality, longer hospital stay, and longer resolution time)

Question 4

- People with egg allergies can be given the flu vaccine with the following proviso:

- A. They can be given the vaccine without premedication
- B. They should never be given the vaccine under any circumstance
- C. Pretreatment with diphenhydramine
- D. Pretreatment with dexamethasone

Question 4

- People with egg allergies can be given the flu vaccine with the following proviso:

- A. **They can be given the vaccine without premedication**
- B. They should never be given the vaccine under any circumstance
- C. Pretreatment with diphenhydramine
- D. Pretreatment with dexamethasone

- Several national groups (US and Canada) have said the flu vaccine can safely be given to individuals with egg allergies

Question 5

- Which of the following is true about correcting calcium levels for low albumin?

- A. The original formula was derived from a large multinational study
- B. Corrected calcium correlates well with true ionized calcium levels
- C. Uncorrected calcium seems to more accurately reflect true ionized calcium
- D. Correcting calcium can underestimate true levels

Question 5

- Which of the following is true about correcting calcium levels for low albumin?
 - A. The original formula was derived from a large multinational study
 - B. Corrected calcium correlates well with true ionized calcium levels
 - C. **Uncorrected calcium seems to more accurately reflect true ionized calcium**
 - D. Correcting calcium can underestimate true levels
- Also, corrected calcium can theoretically OVER estimate true levels

SELF EVALUATION

Medical Mythbusters

1. Which of the following is true regarding expired medications based on available data?
 - a. They lose all potency immediately after expiration
 - b. Most medications are ineffective after 6 months
 - c. Many medications retain potency well beyond expiration dates
 - d. Expired medications are universally unsafe to use
2. T/F - Metronidazole and alcohol consistently produce a disulfiram-like reaction in humans.
3. Which of the following has been associated with nasogastric tube use in bowel obstruction?
 - a. Decreased mortality
 - b. Shorter hospital stay
 - c. Increased pneumonia risk
 - d. Faster resolution of obstruction
4. Which statement is most accurate regarding calcium correction for albumin?
 - a. Corrected calcium is more accurate than uncorrected calcium
 - b. Corrected calcium is required in all patients
 - c. Uncorrected calcium better reflects biologically active calcium
 - d. Correction formulas are highly reliable across populations
5. T/F - Patients with egg allergies require special precautions before receiving the influenza vaccine.

Answer Key: 1. C, 2. F, 3. C, 4. C, 5. F

FACULTY

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Leslie S. Zun, MD, MBA, FACEP, FAAEM, is a Professor of Emergency Medicine, with a secondary appointment in Psychiatry, at Rosalind Franklin University of Medicine and Science in North Chicago, Illinois. He also serves as Chief Medical Officer for Hamdard Health Alliance and practices at Northwestern Medicine. Dr. Zun earned his medical degree from Rush Medical College and an MBA from Northwestern University's School of Management. He is an internationally recognized expert in emergency medicine and behavioral emergencies, with extensive experience lecturing and presenting research around the world. A past President of the American Association for Emergency Psychiatry, he has also served in leadership roles with the American Academy of Emergency Medicine and the Coalition for Psychiatric Emergencies. He is the chief editor of *Behavioral Emergencies for Healthcare Providers* and has directed the National Update on Behavioral Emergencies conference for over 17 years.

You may contact Dr. Zun with your comments or questions at leszun@gmail.com.

Violence in Healthcare Settings

Leslie S. Zun, MD, MBA, FACEP, FAAEM

Violence in Healthcare Settings

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Objectives

- ▶ To review violence in healthcare setting
- ▶ To exam the process to evaluate patients for risk of violence
- ▶ To reduce incidence of violence in healthcare institutions

Workplace Violence Definition

<https://www.cdc.gov/niosh/docs/2002-101/default.html#What%20is%20workplace%20violence?>

- ▶ NIOSH defines workplace violence as violent acts (including physical assaults and threats of assaults) directed toward persons at work or on duty
 - ▶ Workplace violence ranges from offensive or threatening language to homicide
 - ▶ Threats
 - ▶ Physical assaults
 - ▶ Muggings
- ▶ May involve patients, family, visitors, doctors, students, residents, contractors who were injured due from another person
- ▶ Acts of terrorism on hospital property

Incidence of Workplace Injuries

<https://www.bls.gov/iif/factsheets/workplace-violence-healthcare-2018.htm#:~:text=In%202018%2C%20the%20private%20ownership,viole%20injury%20that%20work%20overall>

Incidence rate of nonfatal intentional injury 2018

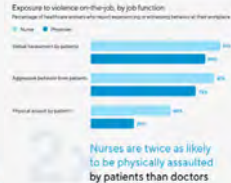
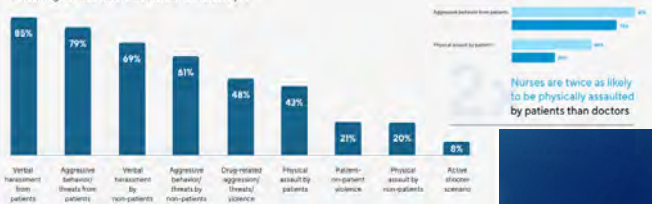
Private Industry	Incidence rate of nonfatal intentional injury by other person, per 10,000 full-time workers
All Industry	2.1
Health care and social assistance	10.4
Ambulatory health care services	3.1
Hospitals	12.8
Psychiatric and substance abuse hospitals	124.9
Nursing and residential care facilities	21.1
Social Assistance	12.4
Child day care services	7.8

The State of Healthcare Worker Safety

O'Grady, S. New Research Reveals Almost Half of Healthcare Workers Are Considering Leaving Their Jobs Due to Workplace Safety Concerns. Industry Insights Jul 23, 2025 <https://www.veikada.com/blog/healthcare-safetyresearch>

Incidents healthcare workers say they have experienced at their workplace

Percentage of healthcare workers who indicate yes



Nurses are twice as likely to be physically assaulted by patients than doctors

The State of Healthcare Worker Safety

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- ▶ 1,027 U.S. healthcare workers between April 21-May 7, 2025
 - ▶ Verbal harassment and aggressive behavior/ threats from patients (81% and 77%)
 - ▶ Non-patients (62% and 59%)
 - ▶ 79% of healthcare workers have experienced or witnessed aggressive behavior from patients
- ▶ 59% healthcare workers report they worry about safety in the workplace
- ▶ Women consistently report higher violence exposure of all types
- ▶ Employers lag on basic security measures
 - ▶ 41% of healthcare workers say their workplace has minimal security
 - ▶ 77% say that their company hasn't changed the level of security measures in the last 12 months
 - ▶ Visitor ID checks are only required at 40% of hospitals

Risk Factors

<https://www.cdc.gov/niosh/docs/2002-101/default.html#WhatH20%20workplace%20violence?>

- ▶ Inadequate security
- ▶ Lack of staff training
- ▶ Lack of policies for preventing and managing violence
- ▶ Lack of security camera
- ▶ Working when understaffed
- ▶ Transporting patients
- ▶ Long waits for service
- ▶ Overcrowded, uncomfortable waiting rooms
- ▶ Working alone
- ▶ Poor environmental design

Factors Related to the High Incidence in Healthcare Settings

- ▶ Availability of drugs, money and other valuable items at hospitals, clinics and pharmacies
- ▶ Low staffing levels in hospitals and clinics
- ▶ Unrestricted access to the public
- ▶ Increased prevalence of gang members, drug abusers, distraught family and friends
- ▶ Solo work with remote access, limited security
- ▶ Limited lighting in many setting including parking garages, surrounding public areas and walkways
- ▶ Physically separate buildings

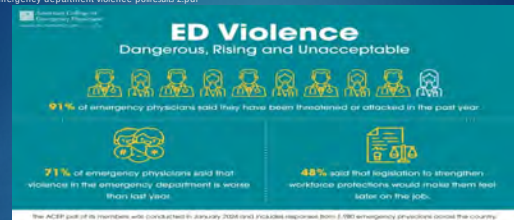
Workplace Place Violence Factors

Gillespie GL, Gates DM, Miller M, Howard PK. Workplace violence in healthcare settings: risk factors and protective strategies. Rehabil Nurs. 2010 Sep-Oct;35(5):177-84.

- ▶ Perpetrator
 - ▶ Mental health disorders
 - ▶ Being under the influence of drugs or alcohol
 - ▶ Ineffectively dealing with situational crises
 - ▶ Possessing weapons
 - ▶ Being a victim of violence
- ▶ Worker risk factors
 - ▶ Gender
 - ▶ Age
 - ▶ Years of experience
 - ▶ Hours worked
 - ▶ Marital status
 - ▶ Previous workplace violence training

Violence in the ED

Marketing General Inc. ACEP Emergency Department Violence Poll Research Results. American College of Emergency Physicians. September 2018. Accessed January 30, 2024. <https://www.emergencyphysicians.org/files/assets/files/pdf/2018acep-emergency-department-violence-pollresults-2.pdf>



- ▶ 2016 survey of 119 emergency medicine residents indicated that 66% had been physically assaulted by patients
- ▶ Only 16.8% had received prior training in violence prevention

Incidence of Violence in the ED

Workplace violence in the emergency department: A systematic review and meta-analysis. Published in: Emergency Medicine Australia, Jun2021.

- ▶ A systematic review of the workplace violence within EDs found the reports of patient or visitor perpetrated violence range between 1 to 172 per 10 000 presentations.
- ▶ The pooled incidence of workplace violence events indicated 36 of every 10 000 patients may be violent in the ED.
- ▶ The pooled proportion of drug and alcohol associated cases among the violent population was 45 of every 100.

Violence in an Urban Community ED

Bushman, AK, et al. A Deeper Dive into the Antecedents and Circumstances of Violent Behaviors. The Journal of Emergency Medicine, Vol. 77, No. C, pp. 1-13, 2025.

- ▶ 58 unique ED encounters resulting in 121 distinct assault incidents
- ▶ Most patients had psychiatric comorbidities
 - ▶ 50% schizophrenia
 - ▶ 70% on involuntary psychiatric hold
- ▶ Boarding for psychiatric placement was a major risk factor with 78% of assaults
- ▶ Most incidents were triggered by behavioral redirection or agitation tx
- ▶ Nurses (46%) and security officers (42%) were the most frequent victims
- ▶ Need for systemic interventions
 - ▶ Improved psychiatric bed access
 - ▶ Structured agitation management strategies
 - ▶ Staff training in de-escalation

What Type of Persons Become Violent?

Nestor, PG. Mental disorders and violence: Personality dimensions and clinical features. Am J Psych 2002;159: 1973-1978.

- ▶ Normal Person Under Stress
- ▶ Substance or Alcohol Intoxication
- ▶ Psychiatric
 - ▶ Psychotic
 - ▶ Breakdown in regulation of anger, hostility and irritability and loss of impulse control
 - ▶ Personality disorders
 - ▶ Borderline, paranoid, narcissistic, psychopaths and passive aggressive personality disorders

Violence and Psychiatric Disorders

Comigan PW, Watson AC. Findings from the National Comorbidity Survey on the frequency of violent behavior in individuals with psychiatric disorders. Psychiatry Res. 2005 Sep 15;136(2-3):353-62.

- ▶ Anxiety disorders, dysthymia and major depression were 2.4X more likely to be violent compared to those with no disorders.
- ▶ Bipolar disorder or drug and alcohol abuse were 8X
- ▶ Co-occurring substance use disorders were more likely to report violence than those without
- ▶ Borderline personality disorder displayed the highest aggression rate, reaching up to 73%.
- ▶ Schizophrenia experienced agitation ranging from 10% to 45% during hospitalization.

Identification of Violent Patients

- ▶ Prior history of violence
- ▶ Young male
- ▶ Poor impulse control or anger control
- ▶ Medical conditions-head injury, hypoxia, dementia, metabolic disorders, seizures

Tool to Identify Violent Patients

Luck, D. Jackson & K Usher: STAMP: components of observable behaviour that indicates potential for patient violence in emergency departments. J Advanced Nursing (2007), Volume 59, Issue1, pages 11-19.

- ▶ Five interconnected components
- ▶ STAMP
 - ▶ Staring and eye contact
 - ▶ Tone and Volume
 - ▶ Anxiety
 - ▶ Mumbling
 - ▶ Pacing

NIOSH Violence Risk Assessment Tools

https://www.cdc.gov/NIOSH/NIOSH-Course/SlideUnit08_0

Bresnet

The Bresnet Violence Checklist (BVC) - quick instructions:

Item	Score	Description
1	+10	The risk of violence is high. Immediate measures should be taken.
2	+5	The risk of violence is moderate. Preventive measures should be taken.
3	+1	The risk of violence is low. Preventive measures should be taken.
4	-1	The risk of violence is low. Preventive measures should be taken.
5	-5	The risk of violence is low. Preventive measures should be taken.
6	-10	The risk of violence is low. Preventive measures should be taken.

AHDA

ASSAULT & HOMICIDAL DANGER ASSESSMENT TOOL	
Key to Danger	Typical Indicators
1	No predictable risk of assault or homicide
2	Low risk of assault or homicide
3	Moderate risk of assault or homicide
4	High risk of homicide
5	Very high risk of homicide

Solutions Healthcare Institutions

- ▶ Healthcare institutions
 - ▶ A written program for job safety and security
 - ▶ Prevention programs should:
 - ▶ Create and disseminate a clear policy of zero tolerance for workplace violence, verbal and physical threats and related actions.
 - ▶ Document and trend all incidents

Solutions Workplace Place Violence Factors

Gilstrap GL, Gatt DM, Miller M, Howard PK. Workplace violence in healthcare settings: risk factors and protective strategies. Rehabil Nurs. 2010 Sep-Oct(35(5)):177-84.

- ▶ Protective strategies
 - ▶ Carrying a telephone
 - ▶ Self-defense
 - ▶ Instructing perpetrators to stop their violence
 - ▶ Self and social support
 - ▶ Limiting interactions with potential or known perpetrator

Solutions

<https://www.cdc.gov/niosh/docs/2002-101/default.html#What%20is%20workplace%20violence?>

- ▶ Administrative Controls
 - ▶ Design staffing patterns to prevent personnel from working alone and to minimize patient waiting time
 - ▶ Restrict the movement of the public in hospitals by card-controlled access
 - ▶ Develop a system for alerting security personnel when violence is threatened
- ▶ Behavior Modifications
 - ▶ Provide all workers with training in recognizing and managing assaults, resolving conflicts, and maintaining hazard awareness

Solutions

<https://www.cdc.gov/niosh/docs/2002-101/default.html#What%20is%20workplace%20violence?>

- ▶ Environmental Designs
 - ▶ Develop emergency signaling, alarms, and monitoring systems
 - ▶ Install security devices such as metal detectors to prevent armed persons from entering the hospital
 - ▶ Install other security devices such as cameras and good lighting in hallways
 - ▶ Provide security escorts to the parking lots at night
 - ▶ Design waiting areas to accommodate and assist visitors and patients who may have a delay in service

Legislation to Address HCW Violence

Taylor, M. Efforts to address workplace violence gain renewed attention. Becker's Hospital Review, March, 2025.

- ▶ Eight states are considering or passing legislation around workplace violence
 - ▶ Alaska, Indiana, Massachusetts, New York, Ohio, Oregon, Virginia and Washington
 - ▶ Increased protections for victims of violence, expand criminal penalties and require hospitals to create and enact stronger violence prevention plans.
- ▶ The Joint Commission said its new and revised workplace violence prevention requirements
 - ▶ All accredited assisted living communities, nursing care centers and office-based surgery practices
 - ▶ Address safety concerns for patients, staff and visitors
- ▶ Occupational Safety and Health Administration to issue proposed rules
 - ▶ The request for information closed in 2023, but the rule has not yet been finalized

Solutions

O'Grady, S. New Research Reveals Almost Half of Healthcare Workers Are Considering Leaving Their Jobs Due to Workplace Safety Concerns. Industry Insights Jul 23, 2025 <https://www.verkada.com/blog/healthcare-safetyresearch>

Two in five (41%) healthcare workers feel they have minimal security at their workplace. Among those that feel they have moderate to high security, on average, attributed this sense of safety to eight security measures:

 Enhanced access control (85%)	 On-site security guards/staff (77%)
 Training on how to de-escalate heightened situations (80%)	 Proactive security alerts or mass notifications technology (71%)
 Video security monitoring (79%)	 Parking lot surveillance (66%)
 Alarm systems (78%)	 Controlled entry into the facility (65%)

Identification and Control Phases of Violent Behavior

- ▶ Phase I - Anxiety
 - ▶ Action - Pacing, hand wringing, tension, fidgety, loud
 - ▶ Response - Listen, address concern, offer support
- ▶ Phase II - Defensive behavior
 - ▶ Action-Verbal abuse, complaints, repeated approach to staff
 - ▶ Response-Limits, explanations, consequences, enforce limits
- ▶ Phase III - Physically aggressive
 - ▶ Action-Violent acts
 - ▶ Response-Seclusion, restraint, medication

Training Stop Violence Escalation

- ▶ CPI and other training
- ▶ Verbal de-escalation training
- ▶ Use of security

Definition of Agitation

Pompli M, Ducci G, Galluzzo A, Rosso G, Palumbo C, De Berardis D. The Management of Psychomotor Agitation Associated with Schizophrenia or Bipolar Disorder: A Brief Review. *Int J Environ Res Public Health*. 2021 Apr 23;18(9).
Martinez-RJ et al. 1st International Experts' Meeting on Agitation: Conclusions Regarding the Current and Ideal Management Paradigm of Agitation. *Front Psychiatry*. 2018;9:54.

- ▶ DSM 5 TR
 - ▶ Inability to sit still, pacing, handwringing; or pulling or rubbing of the skin, clothing, or other objects and disruptive motor or vocal activity
- ▶ The International Experts' Meeting on Agitation
 - ▶ Internal features such as hyperresponsiveness, racing thoughts, and emotional tension
 - ▶ External ones, mainly motor and verbal hyperactivity, and communication impairment

Case #1 36 year old male with schizophrenia was brought in by the family because he stopped taking his medication and is getting violent at home. He became aggressive in the clinic/ED.

Quick Evaluation of Agitation

- ▶ Glucose
- ▶ Pulse ox
- ▶ Evidence of identifiable source such as head trauma, substance use or withdrawal, delirium, pain, seizure, or psychiatric illness.
- ▶ Ensure patient and staff safety

Differential Diagnosis of Agitation

Sharma, NP and Huecker, MR: Agitation. NCB Bookshelf. A service of the National Library of Medicine, National Institutes of Health StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.

Constitutional - insomnia, pain, hypothermia, hyperthermia, and terminal illness

Neurological - TBI, neurocognitive disorders, intracranial hemorrhage, stroke, TIA, encephalopathy, epilepsy, autoimmune encephalitis, and seizure

Infectious - meningitis, sepsis, UTI, pneumonia, cellulitis

Cardiopulmonary - Myocardial infarction, heart failure, arrhythmia, PE, respiratory failure, hypoxia, and hypoxemia

Metabolic and endocrine - DKA, electrolyte disturbances, chronic malnutrition, hypoglycemia, hyperthyroidism, myxedema, and hyperparathyroidism

Differential Diagnosis of Agitation

Sharma, NP and Huecker, MR: Agitation. NCB Bookshelf. A service of the National Library of Medicine, National Institutes of Health StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-.

Gastrointestinal - Ileus, inflammatory bowel disease, gastrointestinal obstruction

Toxicological - toxins and medication-related adverse effects, akathisia, cholinergic toxicity, neuroleptic malignant syndrome, serotonin syndrome

Hematologic and Oncologic - anemia, leukemia, multiple myeloma, primary brain tumors, brain metastases, and paraneoplastic syndrome

Renal - acute and chronic kidney disease, end-stage renal disease, uremia

Substance - substance intoxication or withdrawal, Wernicke-Korsakoff syndrome

Prevalence and Etiology of Agitation

Miner, JR, et al: The characteristics and prevalence of agitation in an urban county emergency department. Ann Emerg Med 2016; 72:361-370.

- ▶ Etiology
 - ▶ Psychiatric 20%
 - ▶ Medical 11%
 - ▶ Alcohol 83%
 - ▶ Other drugs 12%
- ▶ Restrained 84%
- ▶ Medicated 72%
 - ▶ Olanzapine 39%
 - ▶ Droperidol 20%
 - ▶ Haloperidol 20%

Prevalence and Etiology of Agitation

Miner, JR, et al: The characteristics and prevalence of agitation in an urban county emergency department. Ann Emerg Med 2016; 72:361-370.

- ▶ Medical history
 - ▶ Mental health problem 23%
 - ▶ Alcohol abuse 26%
 - ▶ Drug abuse 43%
 - ▶ Seizure disorder 6%
- ▶ Disposition
 - ▶ Home 69%
 - ▶ Inpatient psych 14%
 - ▶ Inpatient medicine 6%
 - ▶ Detox or ICU 5%

Agitation Assessment How is Agitation Assessed and Graded?

- ▶ "I know it when I see it"
- ▶ Tools
 - ▶ Agitated Behavior Scale
 - ▶ 14 item observation of behavior from absent to present to an extreme degree
 - ▶ Overt Aggression Scale
 - ▶ Assesses verbal aggression, physical aggression against objects, self, other people and interventions
 - ▶ Richardson Agitation Sedation Scale
 - ▶ Scored from combative to unarousable based on observation
 - ▶ PANSS (Positive and Negative Syndrome Scale)
 - ▶ Hostility, uncooperative, impulsivity, tension & excitable
 - ▶ Used in clinical trials

BARS Agitation Scale

Nordstrom K, Zun LS, Wilson MP, Steibel V, Ng AT, Bregman B, Anderson EL: Medical evaluation and triage of the agitated patient: consensus statement of the American Association for emergency psychiatry project beta medical evaluation workgroup. West J Emerg Med. 2012 Feb;13(1):5-10.

- ▶ The American Association for Emergency Psychiatry does not consider one agitation rating scale to be better than another
- ▶ Behavioral Activity Rating Scale (BARS)
- ▶ BARS is easy to use reliably, even for one not trained in psychiatry or emergency medicine.
- ▶ Simple to use and does not require the participant/patient to answer questions.

1	= Difficult or unable to rouse
2	= Awake but responds normally to verbal or physical contact
3	= Obedient, appears subdued
4	= Quiet and awake (normal level of activity)
5	= Signs of overt (physical or verbal) activity, seems down with instructions
6	= Extremely or continuously active, not responding to instructions
7	= Violent, requires restraints

Pilot Study of Self Reported Level of Psychic Pain and Agitation

Objectives	Methods	Results	Discussion
The objective of this study was to determine the prevalence of self-reported psychic pain and agitation in an urban county emergency department.	A convenience sample of 200 patients presenting to the ED for psychiatric evaluation was surveyed. The survey included questions about self-reported psychic pain and agitation, and demographic information.	A total of 100 patients were surveyed. The survey revealed that 10% of patients reported self-reported psychic pain and agitation. The prevalence of self-reported psychic pain and agitation was higher in patients with a history of psychiatric illness.	This is the first study of its kind to survey self-reported psychic pain and agitation in an urban county emergency department. The results of this study suggest that self-reported psychic pain and agitation are common in patients with a history of psychiatric illness.
None	None	Self-Reported Agitation	
		None 17%	
		Mild 10%	
		Moderate 17%	
		Marked 28%	
		Severe 27%	

Reason to Treat Agitated Patients

- ▶ Patient distress
- ▶ Prevent progression and violence
- ▶ Better able to assess the patient
 - ▶ 17 of 20 medical directors stated that the patients are so agitated that it is difficult to get vital signs.
 - ▶ 14 of 20 said the protocol was to physically restrain patients and medicate them prior to a medical work-up
- ▶ Begin therapeutic process
 - ▶ Fishkind, AB: Agitation II: De-escalation of the aggressive patient and avoiding coercion. Emergency Psychiatry, 2008.
 - ▶ Collaborative interactions
 - ▶ Elicit information
 - ▶ Patients say all they want
 - ▶ Include patients in planning & empathize

Agitation Treatment

- ▶ Determine and treat underlying etiology
- ▶ Verbal de-escalation
- ▶ Behavioral interventions
- ▶ Medicate based on most likely etiology
- ▶ Physical restraints

10 Domains of De-Escalation

AAEP: Verbal De-escalation of the Agitated Patient: Consensus Statement of the American Association for Emergency Psychiatry BETA De-escalation Work Group. West J Emerg Med 2012;13:17-25.

- ▶ Respect personal space
- ▶ Do not be provocative
- ▶ Establish verbal contact
- ▶ Be concise
- ▶ Identify wants and feelings
- ▶ Listen closely to what the patient is saying
- ▶ Agree or agree to disagree
- ▶ Lay down the law and set clear limitations
- ▶ Other choices and optimism

Behavioral Interventions

Mulvey MA, Munro CL. Calming the Agitated Patient: Providing Strategies to Support Clinicians. Medsurg Nurs. 2021 Jan-Feb;30(1):9-13.

Stressor	Intervention
Unmet needs	Promote rest and sleep at night. Address fear, hunger, toileting needs.
Acute medical condition	Consider possibility of pain, urinary tract infection, medication interactions/side effects.
Sensory deficits	Encourage use of visual and hearing aids. Provide simple activity (e.g., folding washcloths, using busy vests/drapes with buttons and zippers).

Behavioral Interventions

Mulvey MA, Munro CL. Calming the Agitated Patient: Providing Strategies to Support Clinicians. Medsurg Nurs. 2021 Jan-Feb;30(1):9-13.

Stressor	Intervention
Communication	Keep it simple; do not over-explain or discuss what will happen in the future. Use calm voice. Avoid open-ended questions. Limit number of options or choices. Don't argue or disagree; simply change the subject or focus of conversation.
Over/Under-stimulating environment	Limit number of people in the area. Reduce noise by turning off the TV, adjusting alarms. Remove unused or unneeded equipment. Bring patient in chair to nurses' station or hallway for visibility.

Medication Choices

- First generation antipsychotics – Haloperidol, Droperidol
- Second generation antipsychotics – risperidone, ziprasidone, olanzapine
- Benzodiazepine – lorazepam
- Antihistamines – Benadryl
- Ketamine
- Combination

Treatment Guidelines

Seafels Quick, Herbst, ED, Kalapatapu, RK. Which emergency medication should I give? Repeated use of emergent medications to treat acute agitation. Frontiers in Psychiatry. 2021;12:1-7.

- American Association for Emergency Psychiatry (AAEP)
 - Etiology dependent - known psych disorder, depressant intoxic, stimulant intoxic, agitation with delirium
- British Association for Psychopharm and the National Association of Psychiatric Intensive Care
 - Options - PO/inhalational/Buccal, IM mono, IM combination
- World Federation of Societies of Biological Psych Agitation Consensus.
 - Not possible to make specific recommendations
- Brazilian Guidelines for the management of Psychopharm Agitation
 - Etiology dependent - depressant intoxic, stimulant intoxic or withdrawal, psych disorder, delirium, elderly, pregnant
- ACEP
 - Limited recommendations

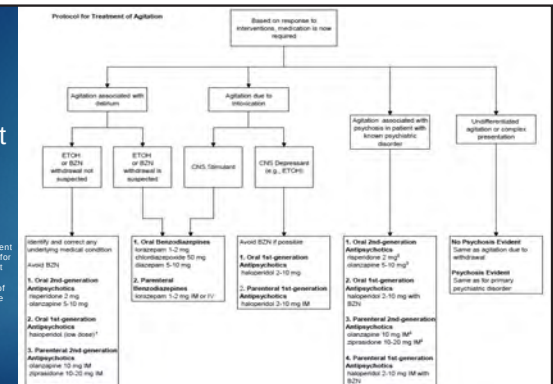
ACEP Agitation Guidelines

Thase, ME et al: Clinical Policy. Critical Issues in the Evaluation and Management of Adult Out-of-Hospital or Emergency Department Patients Presenting With Severe Agitation. Ann Emerg Med 2004; 43: 81-93.

- Is there a superior parenteral medication or combination of medications for patients with severe agitation?
- Use a combination of droperidol and midazolam or an atypical antipsychotic in combination with midazolam.
- If a single agent must be administered, use droperidol or an atypical antipsychotic
- Consider ketamine (intravenous or intramuscular)
- No recommendations for or against the use of specific agents in the out-of-hospital setting
- No recommendation for or against the use of specific agents in patients above the age of 65 years

Protocol for Treatment of Agitation

Wilson, M et al: he Psychopharmacology of Agitation, Consensus Statement of the American Association for Emergency Psychiatry Project BEA Psychopharmacology Workgroup Western Journal of Emergency Medicine Volume XII, 26 NO. 1, February 2012



Pediatric Agitation

denon, R et al: Best Practices for Evaluation and Treatment of Agitated Children and Adolescents (BETA) in the Emergency Department. Consensus Statement of the American Association for Emergency Psychiatry. West J Emer Med 2019.



Other Agents

Ketamine Use in Agitated Patients

Evenson, JE, Abernathy, MK: Ketamine for prehospital use: new look at an old drug. Am J Emerg Med 2007;25: 377-380

- Given to 40 agitated patients
- Recommend use even in head trauma patients
- 1-5 mg/kg IV or IM with no adverse events

Adasuve

- Inhaled loxapine
- Contraindicated for those with asthma & COPD
- Rapid absorption



QT Prolongation

Glassman, AH, Sigger. Antipsychotic drugs: prolonged QTc interval, torsade de pointes, and sudden death. Am J Psych 2001;158:1774-1782.

Prolongation of QT (msec)

- ▶ Ziprasidone 20.3 Quetiapine 14.5 Droperidol 15-59
- ▶ Risperidone 11.6 Olanzapine 6.8
- ▶ Thioridazine 35.6 Haloperidol 4.6

Findings

- ▶ Thioridazine is most marked associated with Torsade
- ▶ Haloperidol can cause Torsade and sudden death
- ▶ Olanzapine, Risperidone and Quetiapine does not cause Torsade

Concerns

- ▶ Young patients who have family history of prolonged QT
- ▶ Older patients with known heart disease or drugs that prolong QT need a pretreatment EKG
- ▶ Hypokalemia may predispose to QT prolongation

Use of Benzos

Gilles, D et al: Benzodiazepines alone or in combination with antipsychotic drugs for acute psychosis. Cochrane Database Syst Rev 2005;19

- ▶ Reviewed 11 studies of 648 patients
- ▶ Comparison of benzos alone
 - ▶ Sedation equally prevalent
 - ▶ Fewer people remained excited after 24 hours with benzos
 - ▶ Similar incidence of adverse events
- ▶ Comparison of benzos to antipsychotics
 - ▶ Higher incidence of extrapyramidal symptoms in antipsychotic group
- ▶ Combination treatment thought to have higher incidence of over sedation

Use of Antihistamines

- ▶ Questionable use as solo agent
- ▶ For use with typical anti-psychotics
- ▶ To prevent acute dystonic reactions
 - ▶ Studies done on daily use on adverse events
 - ▶ More frequent in initiation of treatment
 - ▶ More frequent in young males
- ▶ Increases sedation
- ▶ Can cause paradoxical agitation
- ▶ No good evidence for its routine use

Increased Violent Behavior

Herrera, JN, Sramek, JJ, Costa, JF et al: High potency neuroleptics and violence in schizophrenics. J Nervous Mental Dis 1988; 176:558-561.

- ▶ 16 male schizophrenic patients resistant to previous neuroleptic treatment
- ▶ Comparison of Haloperidol to Clozapine or Chlorpromazine
- ▶ Significantly more violent episodes occurred with haloperidol than other meds or placebo
- ▶ Could this be from akathisia or drug-induced behavioral toxicity

Which Med to Repeat?

Searies Quick, Herbst, ED, Kalapatapu, RK: Which emergency medication should I give? Repeated use of emergent medications to treat acute agitation. Frontiers in Psychiatry. 2021;12:1-7.

- ▶ Avoid meds that prolong QT, EPS side effects (Haloperidol)
- ▶ Higher risk if given <60 minutes, alcohol intox and >65 yrs old
- ▶ Scenario #1 – Oral/Inhalational
 - ▶ More antipsychotics or switch antipsychotic
 - ▶ Benzo repeat with caution
 - ▶ Use know outpatient med
- ▶ Scenario #2 – IM
 - ▶ More antipsychotic or switch antipsychotic
 - ▶ Benzo with caution
 - ▶ Use outpatient med
- ▶ Scenario #3 – Oral/Inhalational and IM
 - ▶ Max on initial med

Special populations

Huybrechts, KP, et al: Antipsychotic use in pregnancy and the risk for congenital malformations. JAMA Psychiatry 2019;17: 939-946.
Baldacara L, Diaz AP, Leite V, Pereira LA, Dos Santos RM, Gomes Junior VP, Caifali ELB, Ismael F, Périco CAM, Porto DM, Zacharias CDK, Cordero Q, da Silva AG, Tung TC: Brazilian guidelines for the management of psychomotor agitation. Part 2: Pharmacological approach. Braz J Psychiatry. 2019 38-Aug;41(4):324-335.

Pregnant

- ▶ Antipsychotics (lack of known teratogenicity)
 - ▶ PO risperidone
 - ▶ IM haloperidol
- ▶ Pregnancy Class C

Special Population – Autism

Sharma NP, Huecker MR. Agitation. [Updated 2024 Jul 30]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK493153/>

- ▶ For autism spectrum disorder, risperidone and aripiprazole are the only FDA-approved medications.
- ▶ Risperidone approved for 5-12 years old
 - ▶ Reduces aggression, self-injury, temper tantrums, and mood swings
- ▶ Aripiprazole approved for aged 6 to 17
 - ▶ Treating irritability

Approved Treatment for Elderly

Lee, D, et al: Brexpiprazole for the Treatment of Agitation in Alzheimer Dementia A Randomized Clinical Trial. JAMA Neurology 2021

- ▶ 345 pts studied for treatment of agitation associated with dementia due to Alzheimer's disease
- ▶ Rexulti (brexiprazole) oral tablets 2-3 mg/day for 12 weeks
- ▶ Statistical improvement in reduced agitation
- ▶ Few adverse events/discontinuation
- ▶ First FDA-approved treatment option for this indication
- ▶ Not indicated for prn use

American Psychiatric Association Guidelines for Treatment of Agitated Patients with Dementia

Reus V, Fochtmann LJ, Eyler AE, Hilly DM, Horvitz-Lennon M, Johnson MD, Lopez OL, Mahoney J, Papp M, Tan ZS, Wils CC, Rhoads R, Yager J. The American Psychiatric Association Practice Guideline on the Use of Antipsychotics to Treat Agitation or Psychosis in Patients With Dementia. *Am J Psychiatry*. 2016 May 1;173(5):543-6.

- ▶ Access for pain
- ▶ Use non-pharmacologic means
- ▶ Indicated for severe symptoms, dangerous, significant distress
- ▶ Lowest dose for shortest time period

Physical Restraint

Chen, T et al. Evaluation and Management of Children and Adolescents With Acute Mental Health or Behavioral Problems. Part 1: Common Clinical Challenges of Patients With Mental Health and/or Behavioral Emergencies. *PEDIATRICS* Volume 138 , number 3 , September 2016 .e 2016157

- ▶ Physical restraint - use of mechanical restrictive devices to limit physical activity
- ▶ Seclusion - placement of an individual in isolation in an enclosed space
- ▶ Both to be avoided
- ▶ "Therapeutic holding" - hold the individual to contain the agitated behavior
 - ▶ Used in patients of younger ages as a method to help patients regain control of their behavior

How to Apply Restraints Safely?

- ▶ Restraints are ONLY used when all other methods have failed to keep the patient from harming himself or others.
- ▶ Restraints used should be least restrictive to the patient.
- ▶ Make sure that the restraints are correct size for the patient's build and weight.
- ▶ Have enough personnel to safely apply restraints
- ▶ Explain the need for restraint to the patient.



Reducing Restraint Use – Code De-Escalation

Im, dd, et al. Code De-Escalation: decreasing restraint use during agitation in a community hospital emergency department. *Am J Emerg Med* 2024; 76, 193-196.

- ▶ Use of a team-based approach for management and treatment of threatening behavior
- ▶ Standardized de-escalation algorithm
- ▶ Pre post study
- ▶ 434 pre and 535 post
- ▶ Decreased restraint use from 7.4% to 3.7%

Case #1 36 year old male with schizophrenia was brought in by the family because he stopped taking his medication and is getting violent at home.

- ▶ **He now becomes more agitated**
- ▶ What is the treatment of choice?
 - ▶ De-Escalation was unsuccessful
 - ▶ BARS score of +3
 - ▶ Patient given Haloperidol and Lorazepam
- ▶ Agitation re-evaluated in one hour
 - ▶ Patient had score of 0

Take Home Points

- ▶ Assess violence risk in your work setting
- ▶ Determine treatment based on underlying condition and level of agitation
- ▶ Use verbal de-escalation, if possible
- ▶ Identify violence risk early in process of patient care

Contact Information

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SELF EVALUATION

Violence in Healthcare Settings

1. T/F - Does the ACEP's 2024 agitation guidelines recommend ketamine for severe agitation?
2. Which healthcare setting has the highest incidence rate of nonfatal intentional injury?
 - a. General hospitals
 - b. Substance use hospitals
 - c. Orthopedic
 - d. Stroke
3. What is not one of the five components of the STAMP tool for identifying potentially violent patients?
 - a. Stuttering
 - b. Anxiety
 - c. Mumbling
 - d. Tone
4. What factors do not contribute to high rates of violence in healthcare settings?
 - a. Low staffing
 - b. Clinic location
 - c. Unrestricted access
 - d. Crowded waiting rooms
5. What percentage of ED residents in the 2016 survey reported being physically assaulted?
 - a. 50-60%
 - b. 60-70%
 - c. 70-80%
 - d. 80-90%
6. What is a recommended response for phase 1 violent behavior?
 - a. Support
 - b. Set limits
 - c. Call security
 - d. Restrain

Answer Key: 1. T, 2. B, 3. A, 4. B, 5. B, 6. A

Cranial Nerve Syndromes: From Isolated Palsies to Cavernous Sinus Syndromes

Jonathan A. Edlow, MD

Cranial Nerve Syndromes: From Isolated Palsies to Cavernous Sinus Syndromes

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Summary Slide

- Understand presentations of the more common isolated cranial neuropathies - 2, 3, 6, 7 & 8
- Know the more common multiple (anatomically grouped) cranial nerve syndromes, especially cavernous sinus syndrome
- Be aware of confusing “fake-outs” (INO, myasthenia gravis & small brainstem lesions)



3 types of problems

- Isolated cranial neuropathy
- Anatomically-grouped cranial neuropathies
- Cranial neuropathy WITH other neurological findings

Isolated cranial neuropathy

- 3rd nerve palsy
- 6th nerve palsy
- 7th nerve “Bell’s” palsy
- 8th nerve palsy

Multiple cranial neuropathy

- Anatomically grouped
 - Cavernous sinus syndrome
 - Cerebello-pontine angle syndrome
 - Jugular foramen syndrome
- Non-anatomically grouped
 - Myasthenia
 - Basilar meningitis (Lyme, cryptococcal, TB, carcinomatous, syphilis)

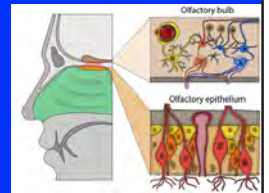
Cranial neuropathy WITH other neurological findings

- Brainstem lesions including posterior circulation stroke and INO (internuclear ophthalmoplegia)
- Supra-tentorial (UMN) lesions with UMN cranial nerve pathology
- Myasthenia gravis

Olfactory nerve

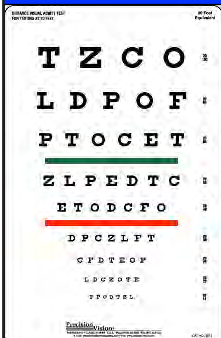
The “rediscovered” forgotten nerve

- Prior to Covid-19, rarely a problem other than occasional inferior frontal lobe meningioma/mass
- Fairly common early symptom with Covid-19
- Likely due to non-neurologic tissue inflammation



Optic Nerve

Always measure visual acuity if any visual symptoms are present



“How many fingers am I holding up?”

Acute Visual Loss

Ocular

- Corneal pathology (abrasion, ulcer, keratitis)
- Anterior chamber (hyphema, ANAG)
- Posterior chamber (endophthalmitis, vitreous bleed)
- Retinal detachment
- Optic neuritis

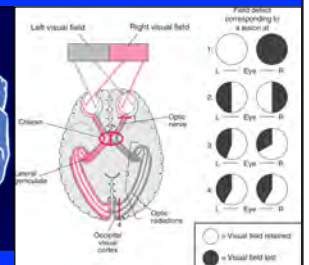
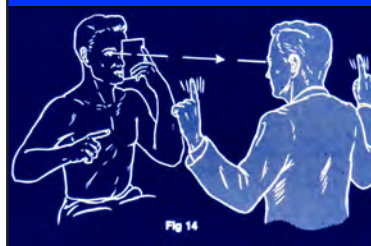
Neurologic

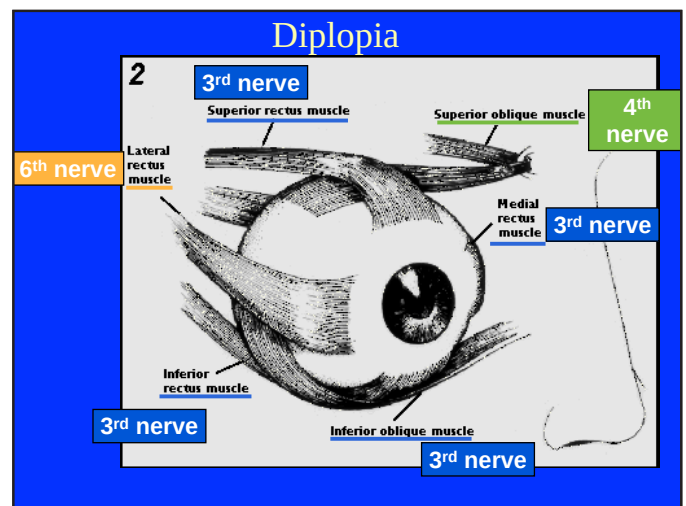
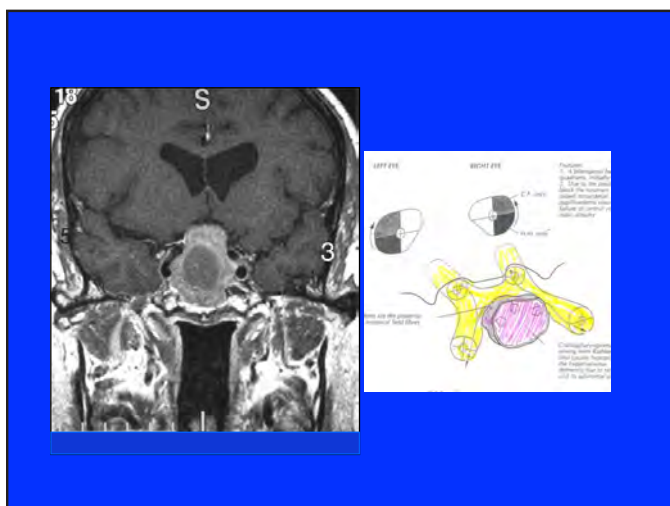
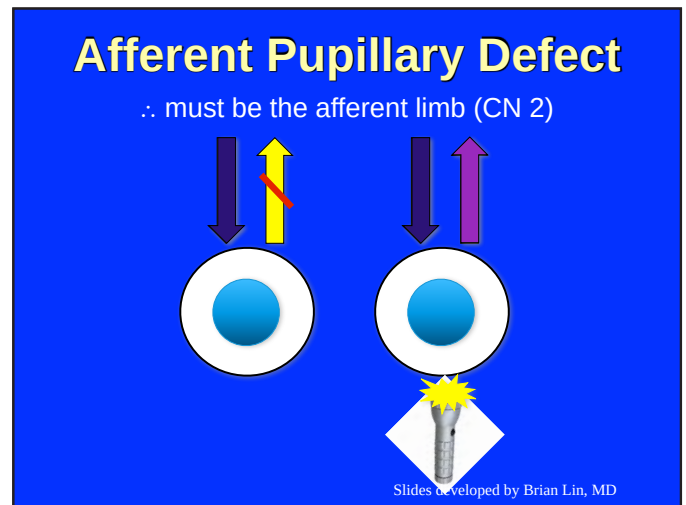
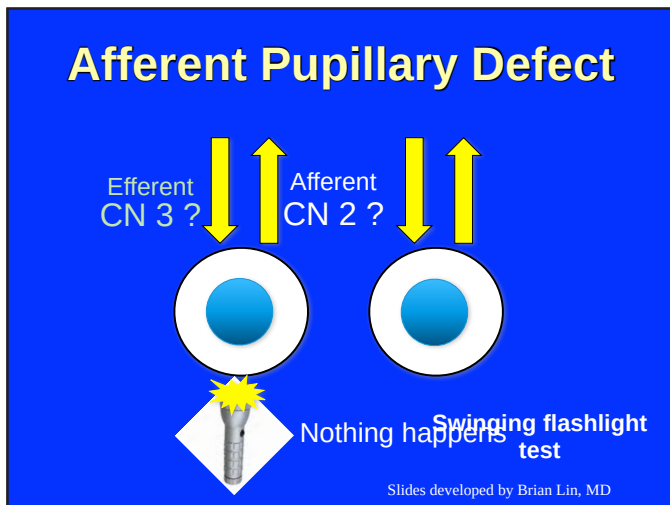
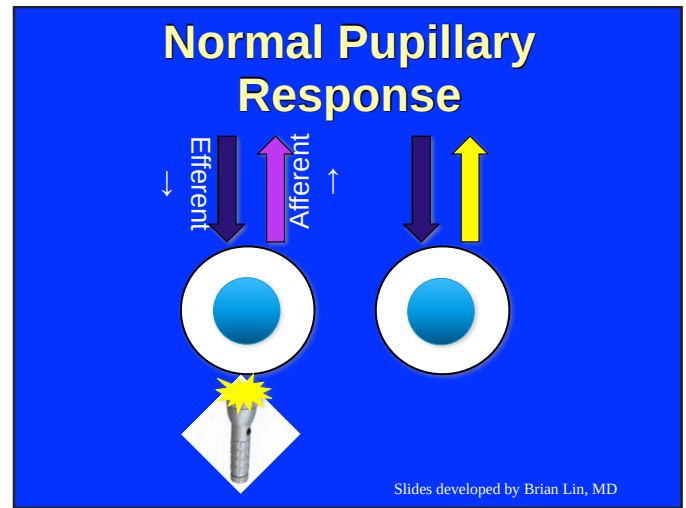
- Vascular causes
 - Acute retinal vein/artery (or branch) occlusions
 - Giant cell arteritis
- Ocular migraine

Acute Visual Loss History

- Is there eye pain?
- Is it one eye or both eyes?
- Is it transient or permanent?
- Is the onset sudden or gradual?

Visual Fields - use 1, 2 or 5 fingers





Evaluation of Patients
with Diplopia

Evaluation of Patients
with Diplopia

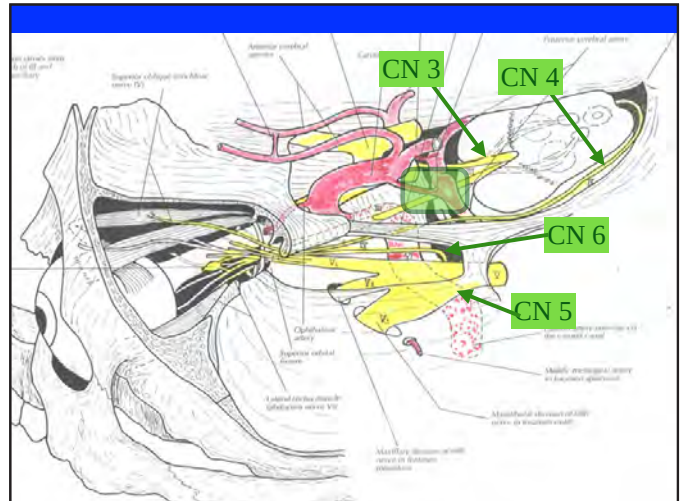
Evaluation of Patients
with Diplopia

**CAUTION: mild diplopia
is perceived as blurred
vision**

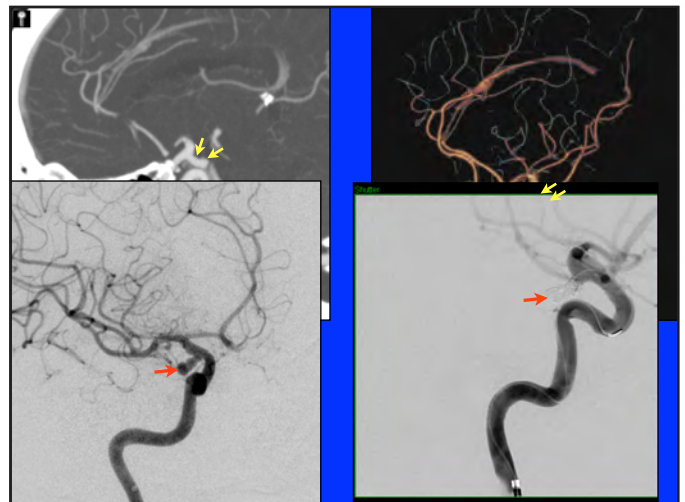
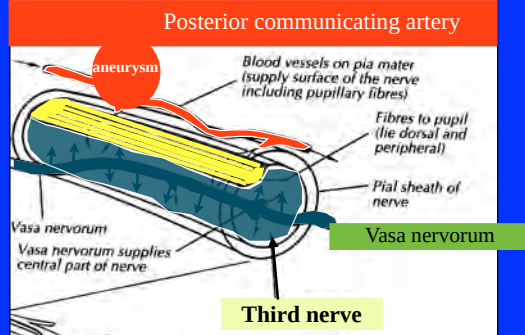
Evaluation of Patients
with Diplopia

Third Nerve Palsy

	“Diabetic” 3 rd nerve	“Surgical” 3 rd nerve
Etiology	Microvascular nerve infarction	External compression, often by PCom aneurysm
Time course	Evolves over days	Evolves over days
Pain present	Ocular pain/pressure	Ocular pain/pressure or SAH HA pain
Pupil involvement	Rare	Almost always, but not always initially or completely
Outcome	Benign, resolves over months without treatment	Untreated, generally worsens, with rupture if aneurysmal



Section of 3rd nerve showing relation to PCom artery and superficially located pupillary constrictor fibers

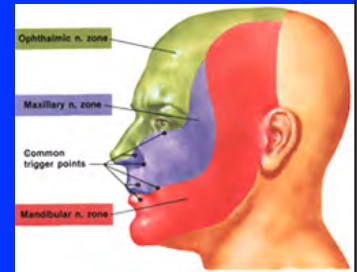


Fourth Nerve Palsy



Trigeminal nerve

- Nucleus is a long, widespread tract
- Sensory component
 - Ophthalmic (V1) - supplies cornea, forehead & upper face
 - Maxillary (V2) - mid-face
 - Mandibular (V3) - lower face
- Motor component
 - Pontine nucleus - muscles of mastication



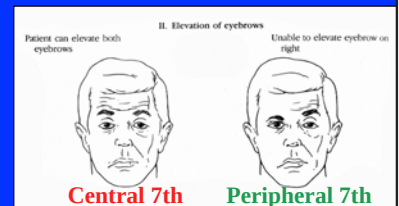
Corneal reflex

- CN-5 in and CN-7 out
- Using a wisp of cotton, touch the cornea, slowly approaching from the lateral (temporal) side
- The corneal reflex is **ALWAYS** normal in trigeminal neuralgia



Facial nerve

- Nucleus in pons, then fibers loop around the 6th nerve nucleus then exits brainstem via the internal auditory canal (along with 8th nerve)
- Forehead - bilateral projections
- Lower face - projects only contra-laterally



Central 7th
Usually can raise forehead

Peripheral 7th
Usually cannot raise forehead

Differential diagnosis of facial nerve palsy

- Idiopathic (HSV) Bell's palsy
- Ramsay-Hunt syndrome (HZV)
- Lyme (epidemiological context)
- Others
 - Guillain-Barré
 - Sarcoid
 - Post-traumatic
 - Any small lateral pontine lesion

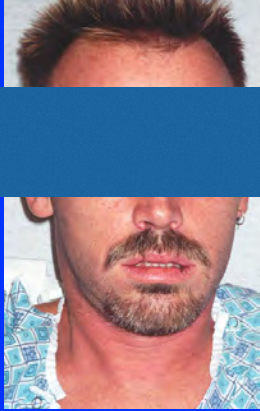


Ramsay-Hunt syndrome



Facial nerve (Bell's) palsy

Bilateral facial palsy



- Lyme (often sequentially bilateral)
- Guillain-Barré
- Rarely idiopathic Bell's palsy

Treatment of Bell's palsy

- Steroids - 7-10d course of prednisone
- Anti-virals - data are less compelling data, valacyclovir 1gm TID
- Consider empiric Lyme treatment
- Eye protection
 - Saline drops frequently during the day
 - Lacrilube ointment at night
 - ? Tape eye shut at night
- Follow-up with PCP or neurologist

8th nerve palsy

- Vestibular neuritis (vestibular nerve) or acute sensorineural hearing loss (cochlear nerve) or labyrinthitis (both nerves)
- Distinguish from posterior circulation stroke using HINTS examination
- Treat like Bell's palsy (though the data for steroids' effectiveness is far less convincing)

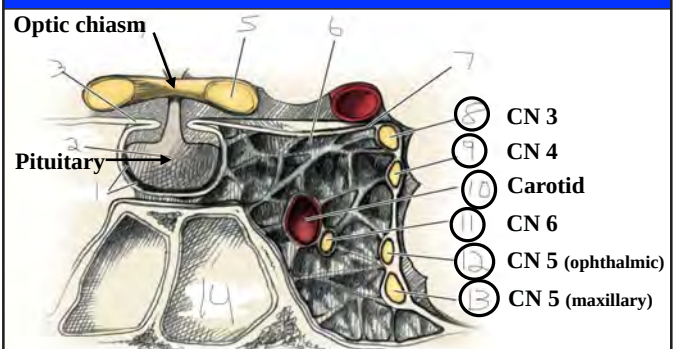
8th nerve palsy Labyrinthitis vs AICA stroke

- New onset of both hearing and balance loss
- ~ 25-30% is due to AICA stroke
- HINTS + (hearing by finger rub) helps but gait assessment is necessary; severe gait disturbance is common in AICA stroke

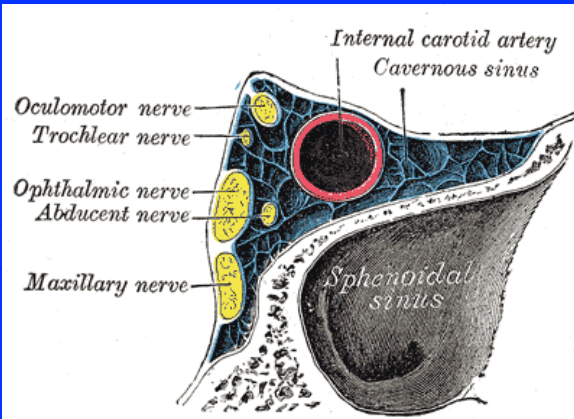
Anatomically grouped cranial neuropathies

- Cavernous sinus thrombosis (3, 4, V1, V2 & 6)
- Cerebello-pontine angle (7 & 8)
- Jugular foramen (Vernet's) syndrome (9, 10 & 11)

Cavernous Sinus



Cavernous Sinus

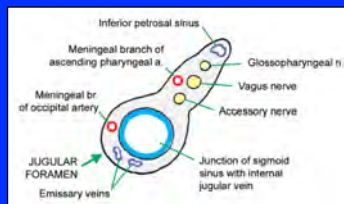


Cavernous sinus syndrome etiology (N=126)

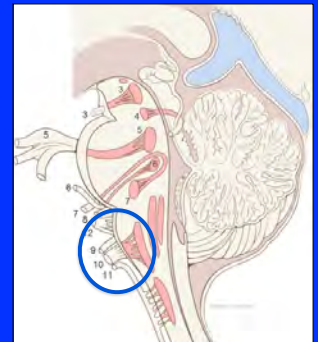
Category	Specific cause	No (%)
Tumor		80 (63)
	Pituitary	29
	Meningioma	25
	Other (8 types)	26
Vascular		25 (20)
	Aneurysm	16
	Carotid-cavernous fistula	9
Inflammatory	Tolosa-Hunt syndrome	16 (13)
Other		5 (4)

Jugular foramen (Vernet's) syndrome

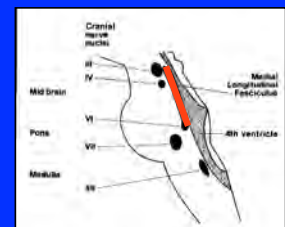
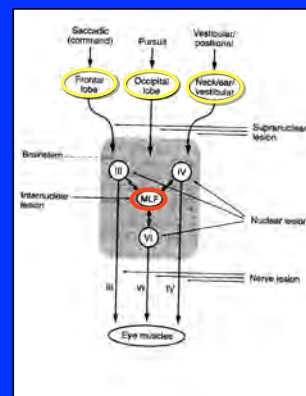
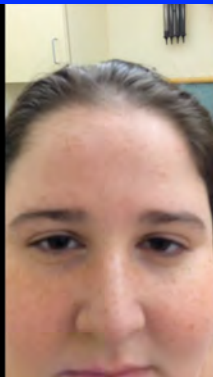
- Hoarseness
- Dysphagia & cough (loss of gag)
- Ipsilateral ear pain
- Headache



Lower cranial nerves



Caution: INO may mimic a neuropathy



Brainstem lesions

- Patients with small brainstem lesions may not have severe deficits and have prominent cranial nerve findings
- CT is usually negative due to small lesion size and bony artifact in the posterior fossa
- Awareness of these 2 facts can help avoid misdiagnosis, even if you don't remember the specific anatomic details
- The classic "crossed lesion" (ipsilateral nuclear cranial nerve deficit with contralateral long-tract findings) is relatively uncommon

Ice test



Tensilon test: + LR 15, - LR 0.11

Ice test: + LR 26, - LR 0.16

Myasthenia Pearls

- Symptoms and signs are intermittent, or wax and wane, shifting with time of day and use of specific muscles
- Patients often go undiagnosed for months or years
- The pupils are always normal in myasthenia
- Painless ptosis or diplopia

Summary Slide

- Understand presentations of the more common isolated cranial neuropathies - 2, 3, 6, 7 & 8
- Know the more common multiple (anatomically grouped) cranial nerve syndromes, especially cavernous sinus syndrome
- Be aware of confusing "fake-outs" (INO, myasthenia gravis & small brainstem lesions)

SELF EVALUATION

Cranial Nerve Syndromes: From Isolated Palsies to Cavernous Sinus Syndromes

True/False

1. The afferent pupillary defect, diagnosed by using the swinging flashlight test, can help to diagnose optic neuritis.
2. Third nerve palsies that are caused by posterior communicating aneurysms usually cause pupillary dilation.
3. The corneal reflex is always normal in trigeminal neuralgia.
4. The most important reason to examine a well-appearing patient with a Bell's (peripheral seventh nerve) palsy is to exclude meningococcal meningitis.
5. A patient who presents with various combinations of cranial nerve 3, 4, 5 and 6 probably has a cavernous sinus thrombosis.

Answer Key: 1. T, 2. T, 3. T, 4. F, 5. T

FACULTY

Brian Fuehrlein, MD, PhD

Brian Fuehrlein, MD, PhD, of New Haven, Connecticut, graduated from the M.D. Ph.D. program at the University of Florida in 2008, adult psychiatry residency program at the University of Texas Southwestern Medical Center in 2012 and addiction psychiatry fellowship at Yale University in 2013. He is currently an Associate Professor and the director of the psychiatric emergency room at the VA Connecticut. Dr. Fuehrlein has a strong interest in medical student and resident education, particularly surrounding addiction psychiatry and serves on multiple local and national committees in this role. In 2017 he was awarded the Irma Bland award for excellency in psychiatry resident education through the APA. In 2018 he was awarded the Clerkship Faculty Teaching Award for Outstanding Medical Student Educator and Role Model. He is also passionate about emergency psychiatry and substance use disorders and has presented and published his work surrounding opioid use disorder in the emergency room setting. In 2019 he was inducted into the American College of Psychiatrists, an organization that recognizes excellence in clinical practice, research, academic leadership, or teaching.

You may contact Dr. Fuehrlein with your comments or questions at brian.fuehrlein@yale.edu.

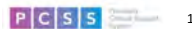
Alcohol Use and Screening in the Emergency Department

Brian S. Fuehrlein, MD, PhD



Alcohol Use and Screening in the Emergency Department

Brian Fuehrlein, MD PhD
Director, Psychiatric Emergency Room, VA Connecticut
Associate Professor of Psychiatry, Yale University



1

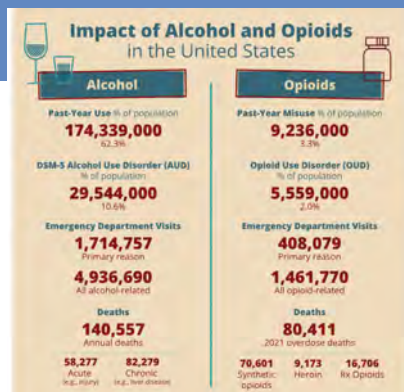
What is alcohol use disorder?

- AUD is a chronic medical condition characterized by an impaired control of alcohol use leading to adverse health, social, psychological and life consequences occupational, or health consequences
- Can be mild, moderate, or severe
- Risk factors for AUD
 - Binge drinking/ heavy drinking over time
 - Drinking at an early age
 - Genetics/ family history of challenges with alcohol
 - Mental health conditions

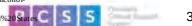
National Institute on Alcohol Abuse and Alcoholism (NIAAA). Understanding alcohol use disorder. Accessed May 22, 2024. <https://www.niaaa.nih.gov/publications/brochures-and-fact-sheets/understanding-alcohol-use-disorder>



2



National Institute on Alcohol Abuse and Alcoholism (NIAAA). Alcohol-related emergencies and deaths in the United States. Accessed June 4, 2024. <https://www.niaaa.nih.gov/alcohol-effects/health/alcohol-topics/alcohol-facts-and-statistics/alcohol-related-emergencies-and-deaths-united-states>



3



4

Clinical Presentation

- Sun presents to the ED chest pain
- She is cleared medically
- She reports drinking "1-2 drinks" before bed, a few nights each week
- Her husband reports that she drinks nearly a fifth of alcohol every night

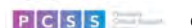


5

Standard Drinks

- 12 oz regular beer (5% alcohol)
 - Light beer contains slightly less alcohol (4.2%)
 - Malt beverages contain approximately 7% alcohol
- 5 oz of table wine (12% alcohol)
- 1.5 oz of 80 proof spirits (40% alcohol)
- 14 grams of alcohol

Remember 60 as an easy way to figure out drink size and percent



6

Common Terms

- Nip = common airplane bottle = 50 ml = 1.7 oz = slightly more than 1 standard drink
- Pint = less than a real pint = 375 ml = 12.7 oz = 8.5 standard drinks
- Fifth = fifth of a gallon = 750 ml = 25.4 oz = 17 standard drinks
- Handle = approximately half gallon = 1.75 L = 59 oz = 39 standard drinks

Standard drink of alcohol



National Institute on Alcohol Abuse and Alcoholism (NIAAA). What's a standard drink measurement? Rethinking Drinking | NIAAA. Accessed June 4, 2024. <https://rethinkingdrinking.niaaa.nih.gov/how-much-too-much/whats-standard-drink>

Alcohol limit recommendations

	Drinks per week	Drinks per day
Men	14	4
Women	7	3
Age >65	7	3
Pregnancy	0	0

Binge Drinking
Men – one time use of 5+ drinks
Women – one time use of 4+ drinks

Heavy Alcohol Use
Binge Drinking on
5+ days in the past month

National Institute on Alcohol Abuse and Alcoholism (NIAAA). Drinking levels defined: Alcohol's effects on health. Published 2023. Accessed June 4, 2024. <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking>

Screening

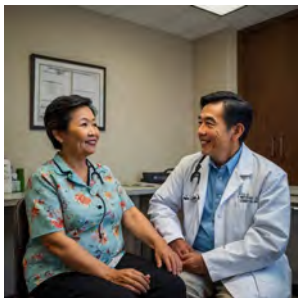
- NIAAA Single Screener
 - o How many times in the past year have you had 5 or more drinks in a day (male) or 4 or more drinks in a day (female)?
 - o ≥ 1 = at-risk drinking (note: >0 is considered a positive screen)
 - o Sensitivity = 82%
 - o Specificity = 79%
- AUDIT-C
 - o Contains 3 questions on drinking frequency and quantity
 - o The higher the score the more likely alcohol is affecting health and safety
 - o Sensitivity = 88%
 - o Specificity = 72%

1. Alcohol Use Disorders Identification Test (AUDIT-C) - Viral Hepatitis and Liver Disease. Accessed August 9, 2021. <https://www.hepatitis.va.gov/alcohol/treatment/audit-c.asp>

2. Miller W, West J, Mih H. Screening Tools for Unhealthy Alcohol Use. *alp*. 2017;96(1):online-online.

SBIRT

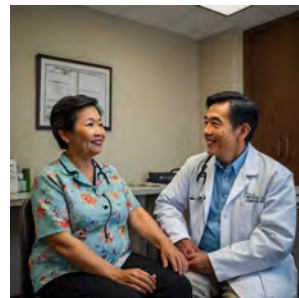
"Hi doc, you had asked me about my drinking earlier and I told you that I drink 1-2 drinks at most."



"I would like to get back to that since many people define drinks differently. Do you drink liquor, and do you know the size bottle that you buy?"

SBIRT

"Yes, I drink vodka. I usually buy the normal size bottle...it is 750ml. I finish a bottle every two days or so."



"OK, that makes sense. I am not sure if you are aware but there are 17 drinks in each of those 750ml bottles. That means you are drinking 17 drinks every 2 days."

SBIRT

"That's absurd. There are 2 drinks in that bottle. I can only fill my glass up twice before the bottle runs out."

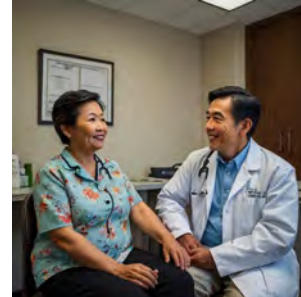


"That's why I wanted to get into more detail. Each drink of alcohol is 1.5 ounces, which is actually a very small amount."

PCSS 13

SBIRT

"That is not very much at all!"



"The guidelines for what we consider to be risky drinking is more than 3 drinks in a day for a woman. The level you are drinking puts you at risk of consequences and for the development of an AUD. Are you willing to try to cut back to 3 drinks or less per day?."

PCSS 14

SBIRT

"Sure doc. I did not realize how much I was drinking and how it could put me at risk."

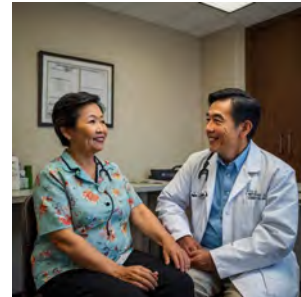


"Sounds good. See if you are able to cut back and I will see you back in a month and we can discuss further."

PCSS 15

One Month Later (Scenario 1)

"Hi doc, just wanted you to know I have not had much to drink at all since our visit last month. I guess you talked sense into me. I am sleeping better and plan to minimize my drinking in the future."



"That is great to hear. Remember, maintain healthy drinking levels and let me know if you experience any problems."

PCSS 16

One Month Later (Scenario 2)

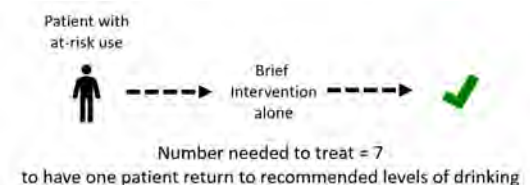
"Hi doc, well I tried to cut back, and it was going fine for a few days but then I went right back to drinking my normal amount. In fact, the past week I have had nearly a bottle each night."



"OK, I appreciate you being so candid with me. I would like to have a further discussion about your use and various options to help you."

PCSS 17

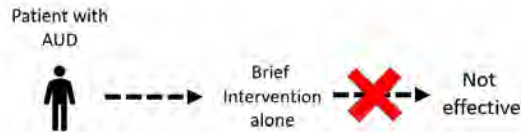
Connection to ongoing AUD treatment



Slide credit: Dr. Paul Joudrey

PCSS 18

Connection to ongoing AUD treatment



Slide credit: Dr. Paul Joudrey

PCSSS

19

Connection to ongoing AUD treatment



Slide credit: Dr. Paul Joudrey

PCSSS

20

Connection to ongoing AUD treatment



Medical Management:

Relapse Prevention Planning

Planning for change

Even when you have committed to change, you still may have mixed feelings at times. Making a written "change plan" will help you to solidify your goals, why you want to reach them, and how you plan to do it. A sample form is provided below. After filling it in, you can print it or email it to yourself.

A sample form is provided below. After filling it in, you can print it or email it to yourself.

Goal (select one)

☐ I want to drink no more than drinks on any day and no more than drinks per week (see U.S. dietary guidelines).

☐ I want to stop drinking.

Timing: I will start on this date:

Reasons: My most important reasons to make these changes are:

Strategies: I will use these strategies:

People: The people who can help me are (names and how they can help):

National Institute on Alcohol Abuse and Alcoholism. Planning for change - rethinking drinking Accessed June 4, 2024. <https://rethinkingdrinking.niaaa.nih.gov/thinking-about-change/planning-change>

PCSSS

23

Setting goal to reduce alcohol use

- Keep track of use
- Count and measure
- Set goals
- Find alternatives
- Avoid triggers
- Plan to handle urges
- Know your "no"

4-week tracker

GOAL: No more than drinks on any day and per week.

How (starting)	Sa	M	T	W	Th	F	Sa	Total
/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/
/	/	/	/	/	/	/	/	/

Drinking analyzer

Date	Situation (people, place) or trigger (mood, feelings)	Type of drink(s)	Amount	Consequences (what happened)
/	/	/	/	/
/	/	/	/	/
/	/	/	/	/
/	/	/	/	/
/	/	/	/	/

Medications for alcohol use disorder

Medication treatment effects	Acamprosate	Disulfiram	Naltrexone
Reduces heavy drinking	X		X
Manages cravings	X		X
Supports abstinence	X	X	X
Blocks breakdown of alcohol, causes unpleasant symptoms		X	

1. Patel AK, Balasravan AA. Treatment of Alcohol Use Disorder. JAMA. 2021;325(6):5596. doi:10.1001/jama.2020.20112

PCSSS

24

Approaches to AUD treatment

- Goal setting
- Abstinence vs reduction in use
- Reducing harm
- Creating individualized treatment plans
- Addressing underlying reasons for drinking
- Connect to resources

PCSSS

23

Medications for alcohol use disorder

Medication	Outcome	NNT (95% CI)
Acamprosate	Return to any drinking	11 (1-32)
	Return to heavy drinking	NA
Naltrexone (50mg/day)	Return to any drinking	18 (4-32)
	Return to heavy drinking	11 (5-41)
Medication	Outcome	NNT
SSRI	Depression improvement	7-9
Statin	Prevention of non-fatal MI	104
DVT prophylaxis	Prevention of non-fatal PE	345

Jonas, D, Amick HR, Feltner C. Pharmacotherapy for adults with alcohol use disorders in outpatient settings: a systematic review and meta-analysis. JAMA. 2014;311(18):1889-1900. doi: 10.1001/jama.2014.3628.

PCSS 25

All-cause mortality benefit of MAUD

- In individuals with alcohol-associated cirrhosis (n=9131), MAUD use is associated with a 68% reduced hazard for all-cause mortality (HR 0.32, 95% CI 0.18-0.59, p <0.001)

Rahlee A, Nadim M, Caroline F, et al. Medications for alcohol use disorder improve survival in patients with hazardous drinking and alcohol-associated cirrhosis. Hepatology Communications. 2023;7(4):e0093. doi: 10.1097/HCS.0000000000000093.

PCSS 26

Alcoholics Anonymous

- The recovery program
 - Meetings (90 in 90)
 - Sponsorship
 - Step work
 - Commitments



PCSS 27

SELF EVALUATION

Alcohol Use and Screening in the Emergency Department

1. What will be the approximate blood alcohol level for a 180 pound man after consuming 2 standard drinks?
 - a. 0.01
 - b. 0.03
 - c. 0.08
 - d. 0.30
2. T/F - The symptoms of alcohol withdrawal typically begin approximately 48 hours after the last drink.
3. Which of the following is a risk factor for the development of complicated alcohol withdrawal?
 - a. A prior history of complicated alcohol withdrawal
 - b. Younger age
 - c. At least 2 weeks from the last drink of alcohol
 - d. Legal stressors
4. T/F - PAWSS is a clinical tool for screening for complicated alcohol withdrawal syndrome.
5. T/F - When alcohol withdrawal is managed appropriately there is no need to also manage the alcohol use disorder.

Answer Key: 1. B, 2. F, 3. A, 4. T, 5. F

Drug-Drug Interactions

Joel Kravitz, MD, FACEP, FRCPSC

Drug-Drug Interactions (DDIs)

Joel Kravitz, M.D., F.A.C.E.P., F.R.C.P.S.C.

Scope of the Problem

- Simple math
 - Enough drugs = probability of interaction
 - 2 drugs ~13% probability
- Aging population
 - 25% > 65 take 3 or more
 - Nursing home – average > 6
 - Probability of interaction ~82%!

Scope of the problem

- 2013-2014 surveillance data
- 58 Eds
 - 4 ADE's per 1000 visits
- Older: anticoag, hypoglycemics, opioids
- Children: antibiotics, antipsychotics

Beers criteria

- By geriatrician Mark Beers in 1991
- Guide to avoiding ADE's in elderly
- Updated 2015
- Good news – it's a great guide
- Bad news – it warns you against everything!
 - Includes recommendations against Benadryl, Insulin...
 - ?what's left?

Scope of the problem

- The emergency room
 - High volume, high speed
 - Incomplete information
 - Many meds often ignored or forgotten
- Modern medicine
 - Sub-sub-specialization
- Modern pharmacology
 - Medicine
 - Business - finance, marketing, \$\$\$

Audience Question Drug 'Classes'

Which macrolide is not metabolized by the liver?

- Clarithromycin
- Azithromycin
- Erythromycin
- All are significantly liver metabolized

N.B.: Answer a bit later on...



You ever heard of...

- Cardamyst PSVT
- Nereus Motion sickness
- Myqorzo HOCM
- Nuzolvence Urogenital gonorrhea
- That's only the FDA approvals you would likely see in the ED
- Only half of all the approvals in Dec. 2025 alone



Scope of the Problem

- FDA – 19,000 drugs approved
 - 340 per year (one-a-day!)
- Pressure for approval (FDA regulations)
 - 90% within 12 months or lose funding
- Near deadline = higher safety risks
 - 2-3 times more likely to be pulled
 - 2-7 times more likely to be 'black-boxed'
 - 2-7 times more likely to be withdrawn
 - E.G. Vioxx, Baycol, Rezulin



Did you even know?

- FDA website is a great resource
- A small example
- FDA 3/31/2021
 - Possible increased risk of dysrhythmias in patients with heart disease who are taking Lamotrigine (Lamictal)
 - Recommended in vitro studies
 - Do not recommend stoppage... yet



A big (expensive) problem

- Pirmohamed et al BMJ 2004
- 2 hospitals in Merseyside England
- >18000 patients over 6 months
 - 6.5% admission related to ADR's
 - Estimated cost to NHS
 - \$847 million



In the ED

- Grymonpre et al 1988
 - DDI = 2.8% of all ED-based admissions
 - Cost-of-illness model - \$1.5 billion/yr
- Einarson T et al 2002
 - Can. Study: 29,000 patients on HMG Co-A's
 - 25.9% took drugs that interacted
 - Increased rates of hospital admissions, MD visits
 - Increased health care costs



Is it really an ER problem?

- Yes and No
- No – a single dose in the ED is rarely a problem
 - Though it can be
- Yes
 - We deal with people who get new Rx
 - We send people home with a lot of new stuff

Audience Question

What class of drugs is consistently the most implicated in drug-drug interactions?

- a. NSAIDs
- b. Calcium channels blockers
- c. Penicillins
- d. Antacids

Audience Question

What class of drugs is consistently the most implicated in drug-drug interactions?

- a. NSAIDs
- b. Calcium channels blockers
- c. Penicillins
- d. Antacids

- 
- It is estimated that 175,000 ED visits in patients over 65 years of age are as a result of drug complications
 - Most are bleeding related
 - NSAIDs, Coumadin....

In the ED

- 
- Becker et al 2006
 - Meta-analysis of drug-drug interactions
 - 0.054% of ED visits
 - 0.57% of admission
 - 4.8% in the elderly (> 65 years)
 - Most common drug: NSAIDs and CV drugs

Recent Data

- 
- Tessler, JAMA 2008
 - 3000 pts 57-85
 - 4% risk of DDI
 - Most common
 - ASA and OTC – gingko especially
 - Good news – very few 'forbidden combos'
 - ? Safety systems are working

DDIs - the doctors

- 
- Glassman 2002
 - Clinicians noted just over ½ of DDIs
 - Only 54% of potentially fatal DDIs
 - Langdorf 2000
 - 'Computer versus physician study'
 - ED docs - only 21% of DDIs

DDIs - the pharmacists

- Cavuto 1996
 - Study of 50 pharmacies in DC
 - Erythromycin and Terfenadine Rx
 - 16/50 readily filled
 - 9/16 said they're safe to be taken together
 - 48/50 used computer programs to spot DDIs

Meet the new pharmacist...



The future is now...

- Jan 6, 2026
- Utah partnering with Doctronic
 - Give patients with chronic conditions a faster automated way to renew medications
- First state approved program allowing AI to participate in medical decision making for Rx renewals

Did you know....?

- Antacids reduce the bioavailability of Cipro in the intestine?
- Vitamin B6 can cause intestinal inactivation of levodopa?
- Garlic can potentiate the effects of hypoglycemic agents?

But these aren't *drugs* !!!

- Birth control pills
- Vitamins
- Herbal supplements
- OTC
 - Pain killers (Goody's powder – salicylates)
 - Cold medicines
- They flat out forget!

All drugs are poisons with beneficial side effects.



Case #1

- 26 y.o. male
- Sent from Psychiatry – ‘he’s not right’
- Paroxetine (Paxil) and Geodon for psychotic depression
 - Geodon for 2 months
- C/O muscle ‘tightness’, sweating
- Diarrhea today
- Recent rhinorrhea, dry cough
- No drug use, no alcohol



Case #1

- Temperature 100.6
- Pulse 123
- BP 135/80
- RR 14 per minute
- Sat 99% r/a



Case #1

- Pupils 4/4 and reactive, normal fundi
- Moist mucous membranes
- Chest and heart normal
- Abdomen benign
- Extremity muscle rigidity, ?cogwheeling
- Reflexes 3+, no clonus
- No rash
- Not responding to questions (not usual)



Case #1

- CBC – WBC 10.2
- Lytes – normal
- CK – 635
- CT head negative

Audience Question

What is your choice?

- Psychiatric exacerbation
- Serotonin syndrome
- Dystonic reaction
- Neuroleptic malignant syndrome
- Meningitis

Audience Question

What is your choice?

- Psychiatric exacerbation
- Serotonin syndrome
- Dystonic reaction
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Serotonin Syndrome

When questioned, patient has been taking OTC cold medication for his URI



Serotonin Syndrome

- From SSRI alone, syndrome is rare
- Combination
 - Inhibit 5HT breakdown (MAOIs, ayahuasca)
 - Block 5HT re-uptake (Cocaine, DM, Demerol)
 - Serotonin precursors (Li, Buspirone, LSD)
 - Enhance 5HT release (MDMA, Ecstasy)
- Case reports with antipsychotics (atypicals, too...)



Serotonin Syndrome

- Triad of:
 - Alteration in mental status (agitation)
 - Muscle hypertonicity
 - From tremor to myoclonus
 - Hyperreflexia
 - Autonomic dysregulation
 - Diarrhea
 - Hyperthermia, hypertension, tachycardia



Serotonin Syndrome

- SSRI overdose - wide safety margin
 - Symptomatic supportive care
 - Fluids, benzodiazepines, cooling
 - Removal of offending agent
- Case reports w/cyproheptadine (4 or 8 mg)
 - Also – methysergide, chlorpromazine
 - No definitive utility



Case #2

- 45 y.o. male
- Medications: None
- PMHx: None
- C/P while *in flagrante*
 - Tight retrosternal
- SOB, diaphoresis



Case #2

- ECG – Anterior MI
 - 15 lead - no right sided or inferior MI
- B-blocker, ASA
- NTG – BP to 65 systolic
 - No relief with fluids
 - Repeat ECG - No right/inferior extension
- What happened ?



Viagra



Sildenafil - do you really ask?

- Prevents cGMP breakdown
 - Penile vascular relaxation
- Synergistic effect with nitrates
 - cGMP stimulation via NO
- Levels increased w/some P450 inhibitors
 - Macrolides, antifungals, protease inhibitors



Case #3

- 30 y.o man with seizures, GERD
- Recurrent seizures and low Dilantin levels
 - “treat ‘em and street em”
- Wife says he takes his meds regularly
- On treatment for ‘stomach bacteria’
- Dilantin level 60!!!
- Persistent seizures



Case #3

- Called pharmacy
 - ‘Stomach bacteria treatment’ was omeprazole and clarithromycin
- Treatment stopped and switched
 - Dilantin normalized during admission



Case #4

- 55 y.o. woman
 - Sent in by MD for INR of 9 !!!
 - On Warfarin (Coumadin) for DVT
- VSS
- No complaints
- What was the one question needed???



Case #4 - Warfarin Overdose?

Q: Have any of your medications been recently changed?

A: No, but I just finished these antibiotics (erythromycin).

P450 system

- Oxidizes 'xenobiotics'
 - More reactive - easier to breakdown
- $RH + O_2 + 2H^+ + 2e^- \rightarrow ROH + H_2O$
- Demystifying toxicology
 - CYP1A2, CYP3A4, CYP2C9 and so on
 - CYP - cytochrome P450
 - Names refer to genetic subfamilies

Cytochrome P450 system

- Over 30 different subtypes
- 6 enzymes account for 90%
 - CYP3A4 - CCB's, cyclosporine, opioids, phenytoin, macrolides....
 - CYP2E1 - induced by EtOH, cigarette smoke
 - CYP2D6 - TCAs, SSRI, codeine

Cytochrome P450 system

- Not an exact science
- Goldfrank 7th edition
 - P. 213 – "CYP2C9....responsible for oxidative metabolism....of warfarin, and increased risk of bleeding"
 - P.635 – "Warfarin is metabolized by isoenzymes CYP1A2 and CYP3A4"

P450 system

- | Common inducers | Common Inhibitors |
|-------------------|------------------------|
| • Phenytoin | • N.B. longer list !!! |
| • Carbamazepine | • Antifungals |
| • Rifampin | • Macrolides |
| • Ethanol | • TCAs |
| • Omeprazole | • SSRIs |
| • Phenobarbital | • Diltiazem |
| • Cigarette smoke | • Haloperidol |
| | • Amiodarone |

Grapefruit juice???

- Naringenin
- Inhibits CYP3A4 – most abundant variant
 - Decreases clearance of:
 - Felodipine
 - Nifedipine
 - Cyclosporine
- Also implicated in QT prolongation
- Clinical implications unclear

The codeine 'myth'

- 8% (Cauc.) and 3% (Afr-Am) lack 2D6
- 2D6 - converts codeine to morphine
 - Absence:
 - Stomach pains
 - Nausea, vomiting
- Not an allergy



Warfarin – trouble at every turn

- Displaced from protein binding sites
 - Sulfonyleureas
- P450 inhibition
- Competes with other drugs for enzyme sites
 - Flagyl decreases warfarin metabolism



TMP-SMZ

- Long track record of safe use
- Glasheen et 2005
 - Watched INR while on antibiotics
 - INR increase
 - Azithromycin 0.1
 - Levofloxacin 0.8
 - TMP-SMX 1.8



TMP-SMX

- Ahmed et al 2008, *J Thr Thromb*
 - Reduced Coumadin dose while on TMP
 - Case-control study
 - TMP case 2/8 INR >4.0
 - TMP controls 8/9 INR >4.0
 - Suggest a 15-20% reduction Coumadin



More from TMP-SMX

- Hyperkalemia with ACE or ARB's
- Antoniou T et al *Arch Int Med* 2010
 - Case control study
 - Odds ratio for Hyperkalemia
 - 6.7 with TMP
 - 0.8 -1.1 with all other studied antibiotics
 - All patients over 65
 - All Abx for UTI (TMP-SMX, Amoxicillin, Cipro, Nitrofurantoin)



And yet more form TMP-SMX

- Juurlink et al, *JAMA*, 2003
 - Over 175,000 patient on glyburide
 - Exposure to TMP-SMX resulted in being 6.6 times more likely to be hospitalized for hypoglycemia
- Studies have been replicated
 - With glipizide
 - With other antibiotics
 - ?is it the infection being treated?



Another P450 example...

- Plavix and Omeprazole
 - Omeprazole inhibits CYP2C19
 - Can't convert Plavix to active metabolite
- FDA warning Nov 2009 about Plavix
 - Do not use with Nexium, Prilosec, Prozac, Diflucan and 5 others
 - Protonix considered as alternative
- N.B. ? 2-14% are poor metabolizers
 - NEJM 2010 controversy



A real world example

- Patient with renal colic
 - On Zofran... what pain meds?
- Hydrocodone or Oxycodone?
- Zofran inactivated by CYP2D6
 - Hydrocodone uses 2D6, so Zofran may be potentiated
- Oxycodone uses a different CYP



CMAJ Jan 2011 (Wright et al)

- Macrolides & Calcium Channel Blockers
- Population based case-crossover study
- 7100 pts over 65 on CCB's
 - Erythromycin – OR 5.8
 - Clarithromycin – OR 3.7
 - Azithromycin – OR 1.5 (Not significant)
- Macrolide inhibit CYP3A4 (not azithro)
 - CCB's use same enzyme & accumulate

Audience Question – answer from earlier

Which macrolide is not metabolized by the liver?

- Azithromycin
- “In vivo and in vitro studies not performed”
- “Biliary excretion, mainly as unchanged drug, is a major route of elimination”



Paxlovid

- AKA nirmatrelvir/ritonavir
- FDA approved for COVID with
 - Mild to moderate symptoms
 - Non-admitted
 - Higher risk for complications
 - Long list on Paxlovid website



Paxlovid criteria at our shop

- Age > 65 years
- Cancer (not immunocompromised)
- Chronic kidney Disease
- Chronic liver Disease
- Chronic lung Disease
- Dementia or other neurological condition
- Diabetes
- Down syndrome
- Heart condition
- HIV infection
- Mental health condition
- Overweight (BMI ≥ 25 kg/m²)



Paxlovid

- “Contraindicated with drugs that are highly dependent on CYP3A for clearance”
- “Drug listed in this section are a guide and not considered a comprehensive list”
- Contraindicated with drugs that are potent CYP3A inducers...with potential loss of virologic response”

So what's on the list

- Just from the FDA site (highlights):
 - Amiodarone
 - Flecainide
 - Propafenone
 - Quinidine
 - Lurasidone (Latuda)
 - Lovastatin, Simvastatin
 - Sildenafil (OK, I had to include it...)
 - Tegretol, phenytoin, primidone
- They don't even mention warfarin

Prescribe an alternative COVID-19 therapy		Consider withholding the medication, using an alternative concomitant medication or using an alternative COVID-19 therapy	
Amiodarone	Lurasidone	Alfuzosin	Procainamide
Apixant	Lurasidone	Alprazolam	Propoxyphene
Bosentan	Mexiletine	Alosetron	Rosuvastatin
Carbamazepine	Phenobarbital	Axitinib	Salmeterol
Clozapine	Phenytoin	Clozapine	Sildenafil for erectile dysfunction
Clopidogrel	Pimozide	Codine	Sildenafil
Cyclosporine	Propafenone	Cyclosporine	Simvastatin
Colchicine in patients with renal and/or hepatic impairment	Quinidine	Diazepam	Sildenafil
Doxycycline	Ranolazine	Everolimus	Sildenafil
Dofetilide	Rifampin	Fentanyl	Sildenafil
Dronedarsone	Rifapentine	Hydrocodone	Sildenafil
Eplerenone	Sildenafil for pulmonary hypertension	Lomitapide	Sildenafil
Ergot derivatives	St. John's wort	Meperidine (pethidine)	Sildenafil
Flecainide	Tadalafil for pulmonary hypertension	Midazolam (oral)	Sildenafil
Fibronectin	Ticagrelor	Oxycodone	Sildenafil
Glucagon	Vorapaxar		Sildenafil

Paxlovid

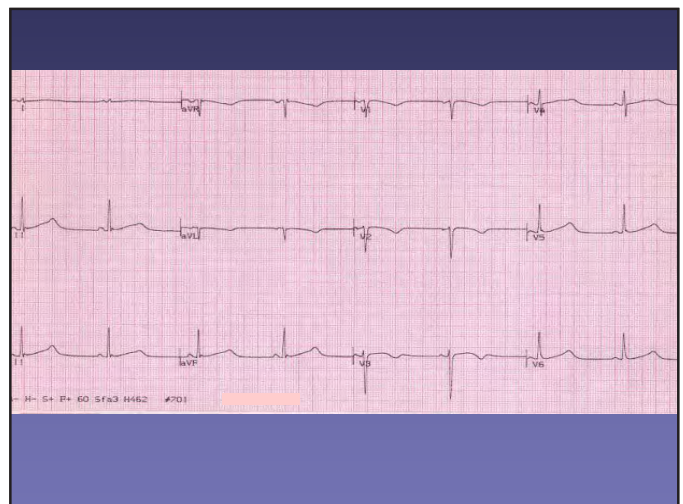
- Not a bad drug
- Interactions make the drug less available to those people who might most benefit from it.
- A modern world example of the problem.

GI Issues

- Drug binding in GI tract
 - E.G. Cations (Fe) may chelate Cipro
 - Take 2 hours apart at least
- GI pH
 - Alkalinization by omeprazole may decrease absorption of ketoconazole
 - Antacids reduce the bioavailability of Cipro in the intestine?
- GI flora
 - Decrease bacterial production of Vitamin K due to antibiotics can affect Coumadin

Case #5

- 25 y.o. male
- Passed out while playing basketball
- PMHx: Bipolar disorder
- Meds
 - Lithium, Ziprasidone
 - On erythromycin for sinusitis
- Afeb, Pulse 64, BP 120/85, RR 14
- Accu-Chek 124, 'lytes' normal
- Normal examination – Chest. Heart, neuro

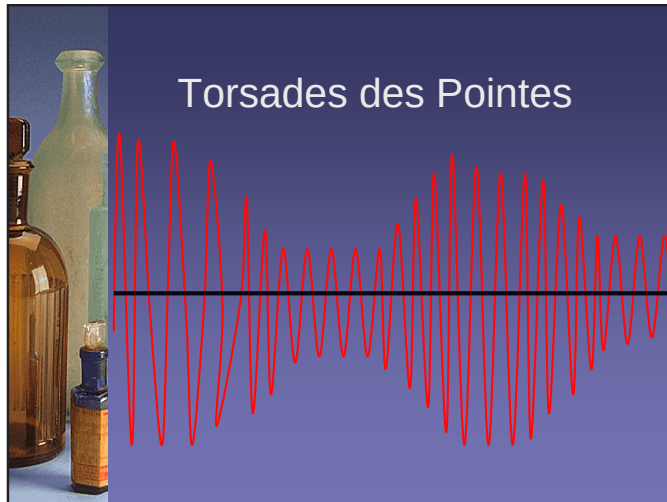


Audience Question

Case #5 – Plan:

- Discharge
- Admit telemetry
- Further testing – CT head, thyroid, 'lytes'
- I know the answer...it's...

Torsades des Pointes



Long QT syndrome

- Rare acquired trait (1/5000 births)
- QTc generally > 0.44 sec
- Multiple medications
 - Antiarrhythmics: Procainamide, Amiodarone
 - Antihistamines: Terfenadine, Benadryl
 - Antibiotics: Cipro, erythromycin, azithromycin
 - CCBs: Diltiazem, Verapamil
 - Psych meds: TCAs, Haldol, Droperidol, Li
 - Others: Methadone, Vasopressin

Long QT syndrome

- Need QTc > 600 msec to get torsades
- Treatment
 - Remove implicated agents
 - Long observation to see resolution
 - Admit and test if not improved
 - Screen family

Case #6

- 58 year old male
- Hx of CHF, MI
- Unresponsive
- Cardiac enzymes normal, K 9.8
- No history of renal disease



Audience Question

What do you do first?

- IV calcium
- IV bicarbonate
- IV furosemide
- IV insulin and glucose
- None of the above



Case #6

- IV calcium
 - Patient goes into asystole and dies
- What happened?
- DIGOXIN



Digoxin

- Blockage of Na-K ATPase pump
 - Result – increase use of Na-Ca pump
 - Result – acc. intracellular calcium
- IV calcium for hyperkalemia
 - Contra-indicated in this case
 - “Stone heart”



Digoxin and calcium

- Is the problem real?
 - Yes, but...
- Hack et al 2003
 - Animal study showed calcium did not affect mortality in digoxin poisoning
- Lots of case reports where tolerated



Case #7

- 45 y.o. woman
- Increased cough for 2 weeks
 - No sputum, No F/C, no dyspnea
- PMHx: HTN
- Meds: Lisinopril
 - ‘Sinus-Buster’ for headaches for 2 weeks
- VSS, exam unremarkable



Case #8

- 19 y.o. female
- N/V, suprapubic pain
- LMP 2 weeks ago
- Hx: depression (takes only St. John's Wort)
- HCG+
- “No way - I use birth control pills!!!”



Herbal drug interactions

- Case #7
 - Sinus-Buster – “The power of the pepper”
 - Active ingredient – capsaicin
 - Capsaicin – increase cough in people on ACEi
- Case #8
 - St. John's Wort – P450 inhibitor/inducer
 - Decreases effectiveness of many drugs
 - Including birth control pills



Herbal-drug interactions

- Multi-billion dollar industry
- Marketed only by their intended effect
- Not controlled by the FDA



Herbal – drug interactions

- Black licorice – resp., hepatitis, infections
 - Inc K⁺ loss with diuretics
- Yohimbine – erectile dysfunction
 - Decreased effect of clonidine
 - Enhanced autonomic effects of TCAs
- St. John's Wort – depression
 - P450 inhibitor
 - Increases levels of digoxin, indinavir, cyclosporine
 - Serotonin syndrome with SSRIs



Herbal/Foods

- Cinnamon
 - Helps with control of blood sugar
 - Annals Fam Med, Sept 2013
 - Most commercial cinnamon is 'cassia'
 - Contains coumarin
 - Affects CYP 2D6 and 3A4
 - Theoretical problem with people on warfarin



Herbal

- Theoretical bleeding risks w/meds
- Anti-platelet activity
 - Ginkgo, ginseng, turmeric
- Coumarin – like activity
 - Chamomile, horse chestnut, red clover
- Salicylate like activity
 - Wintergreen, willow, meadowsweet



Chocolate (no, not chocolate!)

- Contains theobromine
 - Stimulant that can interact with other stimulants e.g. Ritalin
- My opinion – chocolate and Ritalin... did you not expect this was a problem?
- Bottom line – everything can interact with something



How to avoid the problem

- Our responsibilities
 - Knowledge
 - FDA.gov – big but useful site
 - Check patient lists for potential interactions
 - Suggest alternatives if possible
 - Co-ordinate with PCP
 - DDI warnings that are patient specific
 - Information sharing with pharmacies

How to avoid the problem

- Patient's responsibilities
 - Single physician to co-ordinate meds
 - Encourage PCP to be 'point person'
 - Remind PCP of all new meds
 - Single pharmacy
 - Keep complete records
 - Up to date card in wallet...
 - Ask doctor, pharmacist... about DDIs

Summary

- Keep informed about DDIs
 - Know the common interactions of common medications
 - Electronic programs have a place here
- Look through your patient's med lists
 - Educate them and call the PCP's
 - Suggest eliminating non-essential medications

Questions from the Audience?

Question 1

- Which diet advice is correctly matched with the prescribed medication?
 - A. Green leafy vegetables (e.g. spinach, broccoli) can increase INR levels while on warfarin
 - B. Ingestion of large amount of the spice turmeric can cause mild hypertension
 - C. Avoid peanut butter while taking doxycycline
 - D. Grapefruit juice can potentially increase levels of nifedipine

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 - Potentially through the cytochrome p450 system

Question 2

- Which diet advice is correctly matched with the prescribed medication?
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Question 2

When prescribing medications, which piece of discharge advice is CORRECT?

- A. Do not take your Ciprofloxacin within 2 hours of taking antacids
- B. There are no dietary restrictions when taking Coumadin
- C. Keep an eye on your blood pressure, as the Rifampin you're starting can increase the effect of your Metoprolol
- D. Dilantin can increase the levels of your birth control pills and lead to increased side effects



Question 2

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 - C. Keep an eye on your blood pressure, as the Rifampin you're starting can increase the effect of your Metoprolol
 - D. Dilantin can increase the levels of your birth control pills and lead to increased side effects
- They can chelate in the GI tract



Question 3

Which drug-drug interaction is matched correctly with its pharmacologic effect?

- A. Sildenafil and nitrates - vasoconstriction
- B. Zoloft and Buspar – serotonin syndrome
- C. Bactrim and sulfonyleureas - hyperglycemia
- D. Paroxetine and dextromethorphan - Neuroleptic malignant syndrome



Question 3

Which drug-drug interaction is matched correctly with its pharmacologic effect?

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 - B. Zoloft and Buspar – serotonin syndrome
 - C. Bactrim and sulfonyleureas - hyperglycemia
 - D. Paroxetine and dextromethorphan - Neuroleptic malignant syndrome
- Serotonin syndrome is caused by the addition of a medication can increase serotonin (by release, inhibiting re-uptake, etc...)



Question 4

Why is warfarin so frequently involved in drug interaction that affect its potency?

- A. It is affecting by cytochrome P450 inhibitors
- B. It is displaced from protein binding sites by other drugs
- C. It competes for enzymatic bindings sites with other medications
- D. All of the above



Question 4

Why is warfarin so frequently involved in drug interaction that affect its potency?

- A. It is affecting by cytochrome P450 inhibitors
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- D. All of the above

Question 5

Which antibiotic does NOT potentially lengthen the QT interval?

- A. Augmentin
- B. Ciprofloxacin
- C. Azithromycin
- D. Erythromycin

Question 5

Which antibiotic does NOT potentially lengthen the QT interval?

- A. **Augmentin**
- B. Ciprofloxacin
- C. Azithromycin
- D. Erythromycin

• All the others have a risk of QT prolongation

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SELF EVALUATION

Drug-Drug Interactions

1. What is the approximate probability of a drug-drug interaction when a patient is taking six or more medications?
 - a. ~25%
 - b. ~50%
 - c. ~65%
 - d. ~82%
2. T/F - Most drug-drug interactions are correctly identified by physicians in clinical practice.
3. Which class of medications is most commonly implicated in drug-drug interactions leading to emergency department visits?
 - a. Penicillins
 - b. Antacids
 - c. NSAIDs
 - d. Antihistamines
4. Which of the following best explains the interaction between sildenafil and nitrates?
 - a. Increased vasoconstriction
 - b. Decreased nitric oxide production
 - c. Excessive vasodilation due to increased cGMP
 - d. Reduced cardiac output from beta-blockade
5. T/F - Antacids can reduce the absorption of certain antibiotics such as ciprofloxacin.

Answer Key: 1. D, 2. F, 3. C, 4. C, 5. T

Commonly Missed Orthopedic X-Rays in the ER and Urgent Care

Deepak S. Patel, MD, FAAFP, FACSM, CIC

AAFP CME

Commonly Missed Orthopedic X-Rays in the ER and Urgent Care

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Medical Director, Rush-Copley Sports Medicine, Aurora, IL
Family Medicine and Sports Medicine, Yorkville Primary Care, Yorkville, IL
Chair/Subject Matter Expert for AAFP Sports Medicine, Musculoskeletal Medicine, & ER/Urgent Care CME

AAFP CME

Learning Objectives

1. Identify musculoskeletal conditions often missed on routine radiographs.
2. Determine when specific x-ray images or views can prevent clinicians from missing important Orthopedic conditions.
3. Counsel patients on when additional imaging and follow up may be warranted for orthopedic injuries.

AAFP CME

Missed Orthopedic X-rays Overview



AAFP CME

Imaging basics

AAFP CME

Fracture Diagnosis-Imaging

- X-ray preferred
- 3 views preferred (AP, LAT oblique)
- Fracture lucency seen on >1 view
- Repeat xray in 10-14 days may demonstrate findings
- CT/MRI an option if uncertain
 - \$\$\$



47 y/o Ankle pain

Initial

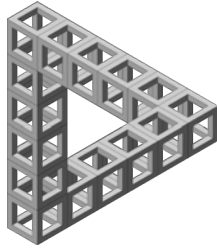


10 days after



AAFP CME

Look carefully



AAFP CME

Upper Extremity

AAFP CME

Scaphoid fracture

- Fall onto out-stretched hand (FOOSH) injury
- Tender snuffbox sensitive (87-100%), not specific (3-98%) (SOR: A)
- Thumb compression: sensitive (48-100%), specific (22-97%) (SOR: A)
- Scaphoid tubercle tenderness: sens (82-100%), spec (17-57%)(SOR: A)



Tait, Mark; Brace, John; Gaston, R. Acute Scaphoid Fractures: A Critical Analysis Review. JBJS Reviews. 4(9), September 27, 2016. DOI: 10.2106/JBJS.RVW.15.00073
Kraatzman, Patrick, et al. "Diagnostic accuracy of history taking, physical examination and imaging for phalangeal, metacarpal and carpal fractures: a systematic review update." BMC musculoskeletal disorders 21 (2020): 1-24.

AAFP CME

AES Question



AAFP CME

Question 1

If you suspect scaphoid fracture with a negative initial x-ray. The most sensitive advanced imaging is?

- A. Bone Scan
- B. CT
- C. MRI
- D. Ultrasound

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Scaphoid fracture- imaging

- 3 view + scaphoid (navicular view) (SOR: C)
- Imaging: x-ray often neg early (10-35%) (SOR: B);
- Any suspicion: thumb spica splint, repeat exam (tenderness), imaging in 10-14 days (SOR: C)
- Bone scan = MRI (less cost-effective) (SOR: A)
- ?immediate MRI/CT more cost effective (SOR:B)
- ? Bandage vs splint



Li, E., and Sanford, C. What is the best imaging test for patients with suspected scaphoid fractures and normal plain radiographs? Evidence-Based Practice Vol. 20,(7) July 2017
Khan MS, et al. Evidence-based practice: best imaging practice in musculoskeletal disorders. J Trauma Nurs. 2014 Jul-Aug;21(4):170-9; quiz 180-1. doi: 10.1097/JTN.0000000000000059.
Kraatzman, Patrick, et al. "Diagnostic accuracy of history taking, physical examination and imaging for phalangeal, metacarpal and carpal fractures: a systematic review update." BMC musculoskeletal disorders 21 (2020): 1-24.
Stirling, Paul HC, et al. "Diagnosis of suspected Scaphoid fractures." JBJS reviews 5.12 (2021): e20.
Cohen, A., Reijman, M., Kraan, G.A., et al. Can we avoid casting for suspected scaphoid fractures? A multicenter randomized controlled trial. J Orthop Traumatol 26(4) 2021. <https://doi.org/10.1186/s10195-025-00822-5>

AAFP CME

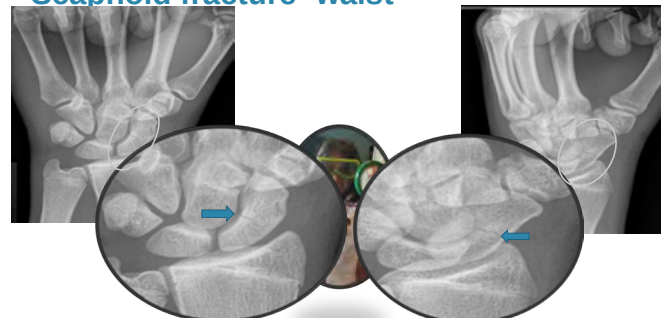
Scaphoid Fracture Imaging

Test	Sensitivity	Specificity
CT	72%	99%
MRI	88%	100%
Bone Scan	99%	86%

Malte WH, Wang J, Poolman RW, Koen P, Maas M, de Vet HCW, Doornberg JN. Computed tomography versus magnetic resonance imaging versus bone scintigraphy for clinically suspected scaphoid fractures in patients with negative plain radiographs. Cochrane Database of Systematic Reviews 2015, Issue 6. Art. No.: CD010023. DOI: 10.1002/14651858.CD010023.pub2.

AAFP CME

Scaphoid fracture- waist



AAFP CME

Scaphoid Fracture-MRI



AAFP CME

What do you see?



AAFP CME

Scaphoid fracture- Treatment

- Non displaced fx:
- Short arm cast w/ or w/o Thumb spica
 - Casting: 6-12 wks
 - Thumb spica stabilizes scaphoid
 - longer for proximal pole vs distal pole?
- Displaced fracture needs Ortho for ORIF



Kawanishi Y, Oka K, Tanaka H, Sugamoto K, Murase T. In Vivo Scaphoid Motion During Thumb and Forearm Motion in Casts for Scaphoid Fractures. J Hand Surg Am. 2017 Jun;42(6):475.e1-475.e7. doi: 10.1016/j.jhsa.2017.03.008. Epub 2017 Mar 30.
 Arsalan-Werner A, Sauerbier M, Mehling IM. Current concepts for the treatment of acute scaphoid fractures. Eur J Trauma Emerg Surg. 2016 Feb;42(1):3-10. doi: 10.1007/s00068-015-0587-8. Epub 2015 Nov 25.
 Shehadi R, Miralbell MH. Evaluation and diagnosis of wrist pain: a case-based approach. Am Fam Physician. 2013 Apr 15;87(8):568-73.
 Tait, Mark; Bracey, John; Gaston, R. Acute Scaphoid Fractures: A Critical Analysis Review. JBJS Reviews. 4(9), September 27, 2016. DOI: 10.2106/JBJS.RVW.15.00073

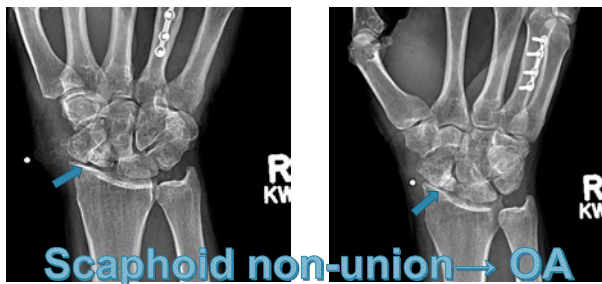
AAFP CME

What do you see?



AAFP CME

What do you see?



AAFP CME

Elbow

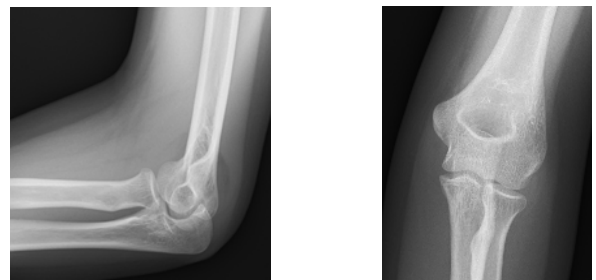
AAFP CME

13 y/o elbow pain

- Tripped fell onto L elbow
- Limited ROM
- Tenderness entire elbow

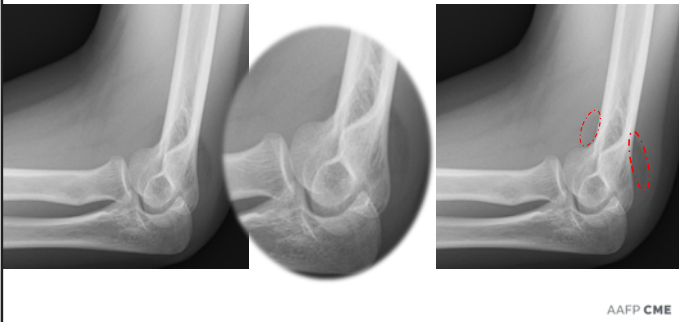
AAFP CME

What do you see?



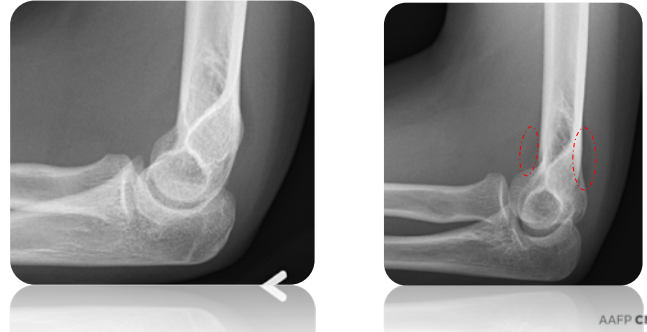
AAFP CME

Elbow Fat Pad



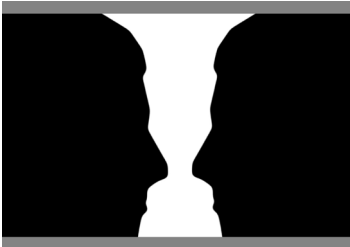
AAFP CME

10 days later



AAFP CME

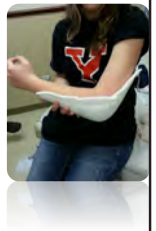
What do you see, Look carefully



AAFP CME

Isolated Fat Pad

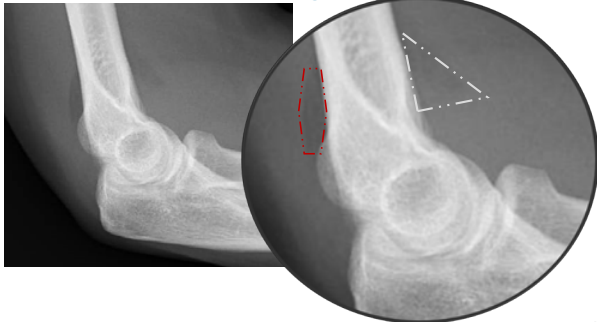
- Effusion w/o fracture
- Needs f/u <10-14 days, but not ortho (SOR: C)¹
- Splint (posterior mold), sling
- Posterior fat pad normally hidden (olecranon fossa)-more reliable sign of injury 2-3
 - Peds fracture: Sens: 62.2, Spec: 81.3
- Fracture 44.6%⁴
 - Suprachondylar 43%, proximal ulna (19%), proximal radius (17%), and lateral humeral condyle (14%).
- Inc fracture detection accuracy



1. Jie, Kim E.; van Dam, Lisette F.; Hammacher, Eric R. Isolated fat pad sign in acute elbow injury: is it clinically relevant? *Euro. J. Em. Med.* June 2016; Volume 23, Issue 3, p 228-231 doi: 10.1097/MEJ.0000000000000288
 2. Saki H, Aydin OF. Clinical accuracy of the posterior fat pad sign for detecting elbow fractures in children. *J Med Palliat Care.* 2025;6(3):271-275
 3. Atacan MA, Kiliç KK, Temiz A, Tayfur I, Doganay F. 2025. Diagnostic accuracy of fat pad sign, X-ray, and computed tomography in elbow trauma: implications for treatment choices—a retrospective study. *PeerJ* 13:e18922 <https://doi.org/10.7717/peerj.18922>
 4. Kandelberg, B., et al. "Elbow fractures in children with a positive posterior fat pad sign: a meta-analysis of 10 published studies." *JBJS reviews* 10, 10.

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Anterior Fat Pad Enlarged= Sail Sign



AAFP CME

What's next after fat pad?



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What's next after fat pad?



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1 wk later



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Imaging Results 1 Wk later

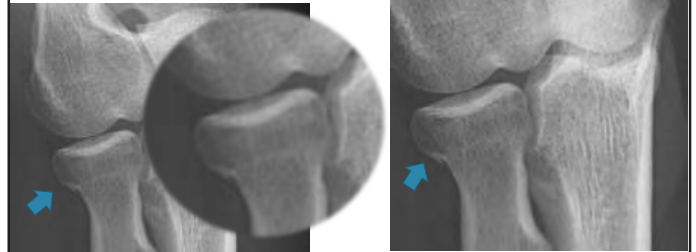


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Imaging Results

Initial

1 wk later



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Radial head fracture

- Often missed on initial x-ray
- 85-94% of sail sign or posterior fat pad
- Sling for 2-3 wks
- Rom exercise after 2-3 wks
- Gradual strengthening after 4 wks.
- Usual return to full activities 4-6 wks.



DynaMed [Internet]. Ipswich (MA): EBSCO Information Services; 1995 -. Record No. T903402. Proximal Radius Fracture - Emergency Management; [updated 2018 Nov 30; cited 12/23/19].
 Patel, Deepak S., Siddhan M. Statius, and Naashta Ahmed. "Common fractures of the radius and ulna." *American family physician* 103.6 (2021): 345-354.
 Zhao, Binzhi, et al. "Comparison of operatively and nonoperatively treated isolated mason type II radial head fractures: a systematic review and meta-analysis." *Journal of Orthopaedic Surgery and Research* 19.1 (2024): 540.

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Radial head fracture

- Focus on transition zone (middle 1/3 from neck & head)
- Sens: 86.04- 75.61%
- Spec: 87.80- 97.56 %
- NPV: 80-85.71 %
- PPV: 88.10-96.88%



Leschinger, T., Müller, L.P., Hackl, M. et al. *Arch Orthop Trauma Surg* (2016) 136: 1115. <https://doi.org/10.1007/s00402-016-2495-7>

AAFP CME

Radial head fracture- US?

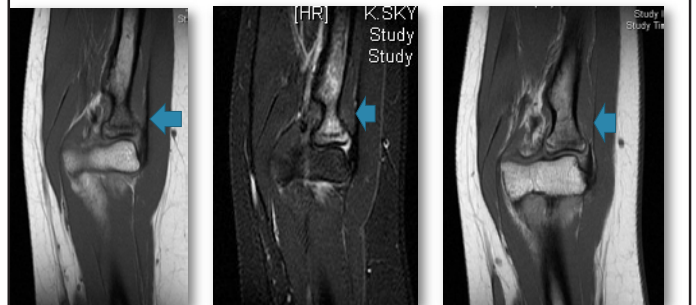
- Neg initial xray
- 15/23 seen on US & CT
- 3 seen on CT but NOT on US
- 2 seen on US but not confirmed by CT
- US sens: 83.3%, spec: 60%; Accuracy: 78.2 %
- Effusion in contact w/ radial neck most sensitive US sign (14/15)



Maliksis, Michael-Alexander et al. "Bedside Ultrasonography for Early Diagnosis of Occult Radial Head Fractures in Emergency Room: A CT-Comparative Diagnostic Study." *The archives of bone and joint surgery* vol. 6.6 (2018): 539-546.

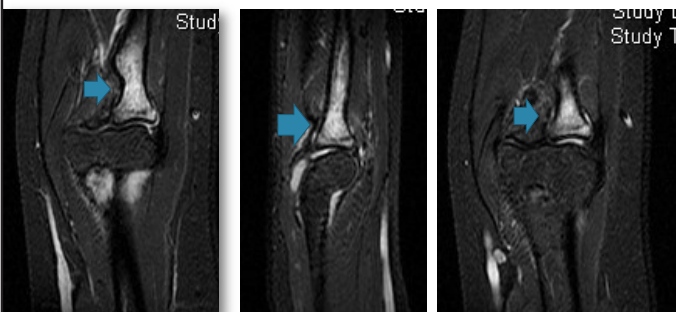
AAFP CME

MRI



AAFP CME

Stress Fractures



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Stress Fracture

- Rarely a faint lucency may be seen
 - late finding/ nonunion
- More commonly indirect findings:
 - periosteal thickening or sclerosis,
 - cortical changes with initial decreased density ("gray cortex") and
 - more commonly later callus formation
 - endosteal thickening and sclerosis



Patel, D., Roth, M., Kapil, N.; "Stress Fractures: Diagnosis, Treatment and Prevention" Am Fam Physician. 2011;83(1):39-46

AAFP CME

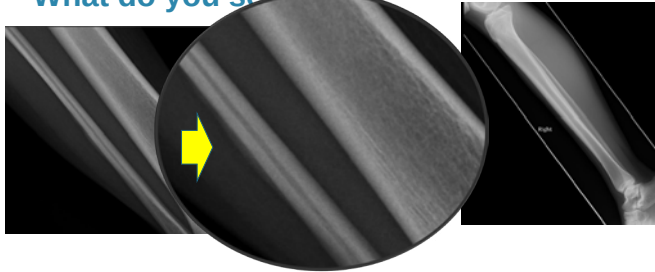
LE Stress fracture imaging

Modality	Sensitivity	Specificity
X-ray	12-56%	88%
Bone Scan	50-97%	33-98%
MRI	68-99%	4-97%
CT	32-38%	88-98%
Ultrasound	43-99%	13-79%

Wright, Alexis A. et al. "Diagnostic Accuracy Of Various Imaging Modalities For Suspected Lower Extremity Stress Fractures". The American Journal Of Sports Medicine, vol. 44, no. 1, 2015, pp. 255-263. SAGE Publications, doi:10.1177/0363546515574066. Accessed 1 Dec 2019.

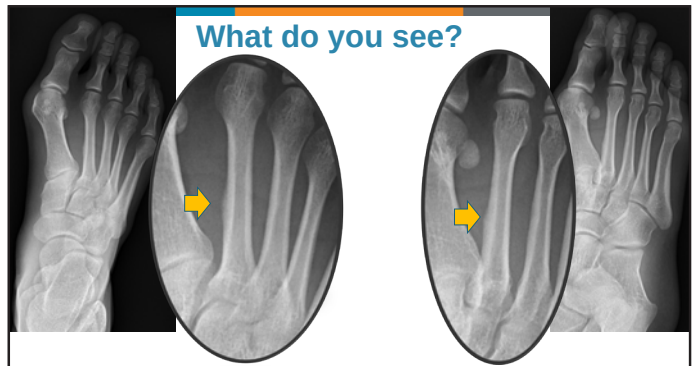
AAFP CME

Runner, lateral shin pain, What do you see?



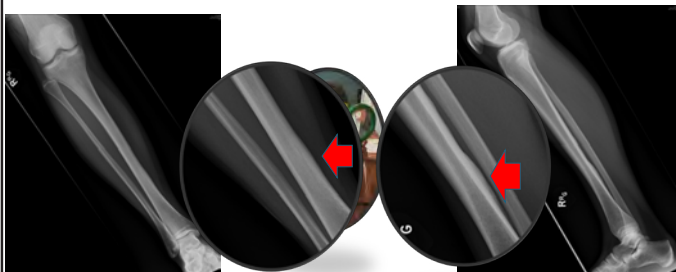
AAFP CME

What do you see?



AAFP CME

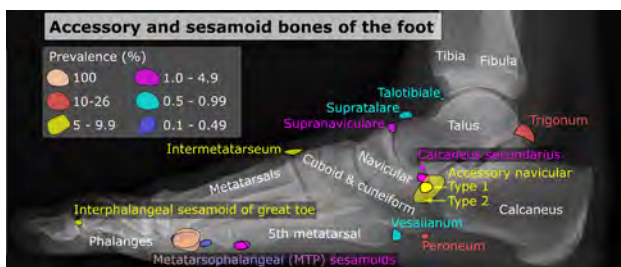
What do you see?



AAFP CME

Accessory Bones: "OS"

AAFP CME

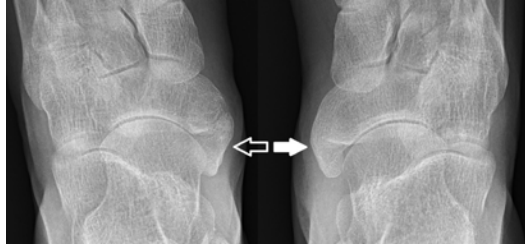


AAFP CME



AAFP CME

Os Naviculare



AAFP CME

Os Naviculare Variants



AAFP CME

Pediatric considerations

AAFP CME

Pediatric Fractures



AAFP CME

Salter Harris Fracture classification



AAFP CME

Peds Fractures

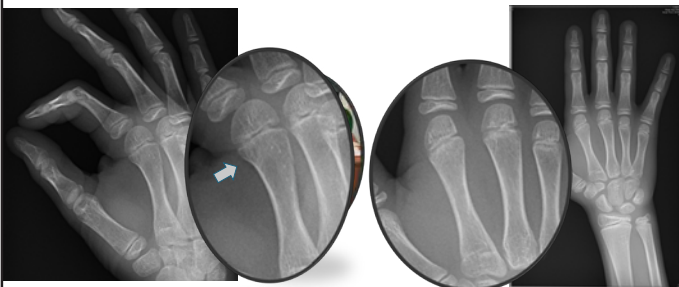
- Due to flexibility of bone, cortical stretching
- Cortical bends
- Physeal fractures
- Lucency without cortical disruption
- Apophyseal avulsions
- Clinical diagnosis?

George, M., & Bixby, S. (2019). Frequently Missed Fractures in Pediatric Trauma. *Radiologic Clinics Of North America*, 57(4), 843-855. doi: 10.1016/j.rcl.2019.02.009



AAFP CME

2nd MCP struck a shin

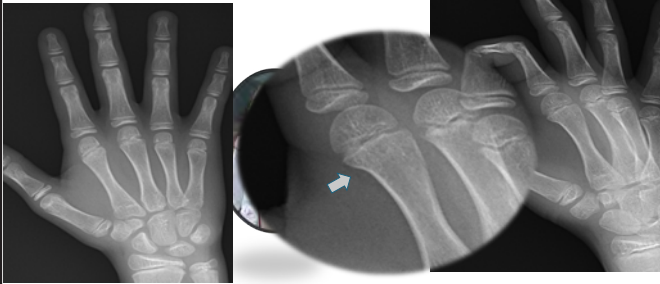


AAFP CME



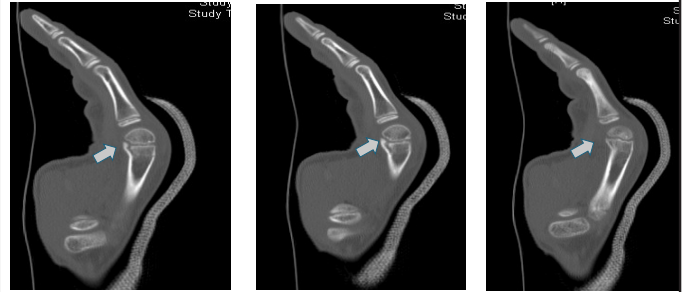
AAFP CME

1 wk later; Fracture?



AAFP CME

CT



AAFP CME

8 y/o buckle fracture



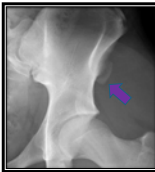
AAFP CME



AAFP CME

Traction Apophysitis

- Overuse, NOT acute avulsion
- 5th metatarsal - Iselin's Disease
- Sever's disease
- Osgood-Schlatter disease
- Sinding-Larsen-Johansson disease
- Little league elbow (medial epicondyle)
- Hip and Pelvis-Most common apophyseal fractures



AAFP CME

Lower Extremity

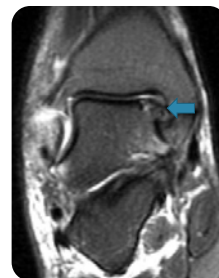
AAFP CME

What do you see?



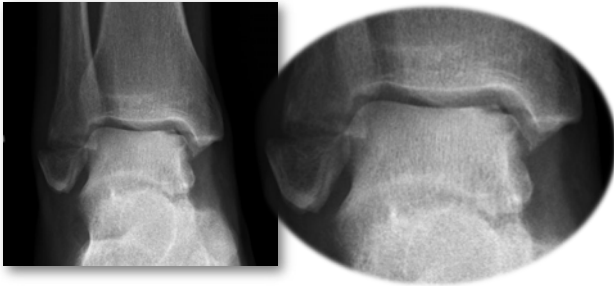
AAFP CME

OCD MRI



AAFP CME

4 wks later



AAFP CME

Talus Osteochondral Defect (OCD)

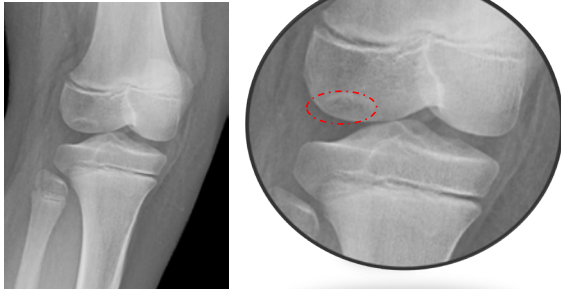
- 70% of ankle sprains/fractures
- 50% missed on xray
- MRI 96% Sens/Spec
 - Helpful for grading
- Increased risk of OA



Loose CA, et al. Evaluation and Management of Osteochondral Lesions of the Talus. *Cartilage*. 2017 Jan 01;19-30. Epub 2016 Sep 28.
 Giannakos AL, et al. Current management of talar osteochondral lesions. *World J Orthop* 2017; January 18; 8(1): 12-20.
 ISSN 2218-5836 (online)
 Dynalimed [Internet]. Ipswich (MA): EBSCO Information Services. 1995. - Record No. T114731. Osteochondritis Dissecans; [updated 2018 Nov 30; cited 12/1/19].
 Buck, Tristan MF, et al. "Nonoperative Treatment for Osteochondral Lesions of the Talus Provides Clinical Improvement in the Minority of the Patients at Short-term Follow-up." *Foot & ankle international* (2025): 10711007251330861.

AAFP CME

OCD



AAFP CME

Osteochondral Defect (OCD)

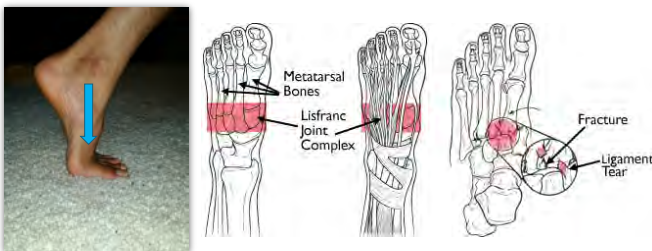
- Was Osteochondritis dissecans
- Distal femur, elbow, ankle (talus)
- Stable: Younger, attached, < 2 cm lesion, medial fem condyle.
- Often asymptomatic, occasional post traumatic
- MRI vs MRI arthrogram for dx & grading.

- Treatment:
 - Stable: non wt bearing,
 - Unstable: surgical treatment
 - Drilling, fixation, graft transplant, implant

DynaMed [Internet]. Ipswich (MA): EBSCO Information Services. 1995. - Record No. T114731. Osteochondritis Dissecans; [updated 2018 Nov 30; cited 12/1/19].
 Buck, Tristan MF, et al. "Nonoperative Treatment for Osteochondral Lesions of the Talus Provides Clinical Improvement in the Minority of the Patients at Short-term Follow-up." *Foot & ankle international* (2025): 10711007251330861.

AAFP CME

Lis Franc injury- mechanism



AAFP CME

Lis Franc X-ray

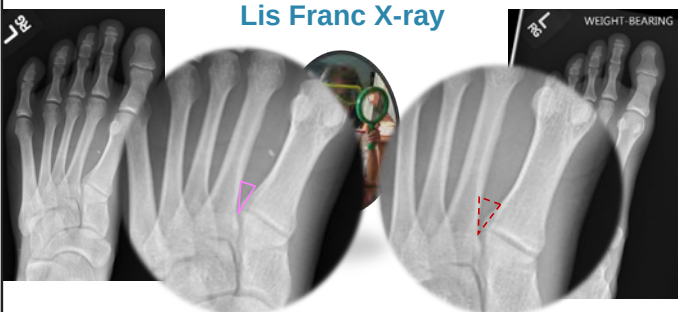


- 20-40% missed
- Non weight bearing may not demonstrate injury (arrow)
- Weight bearing x-ray should demonstrate widening if tear of lis franc ligament (arrowhead)

Wolcott T, Graham P, Denker J. "Treatment of Lis Franc Joint Injury." *Current Concepts J Am Med Assoc Orthop Surg* 2016;18: 719-728.
 Sripasich, Vantarat et al. "Imaging in Lis Franc injury: A Systematic Literature Review". *Skeletal Radiology*. 2019. Springer Science And Business Media LLC, doi:10.1007/s00276-019-03282-1.
 Chen, Cheng, et al. "Is the diagnostic validity of conventional radiography for Lis Franc injury acceptable?." *Journal of Foot and Ankle Research* 16.1 (2023): 1-9.
 Mohamed, Ahmed, et al. "From Missed Diagnosis to Optimal Outcomes: A Comprehensive Review of Lis Franc Injuries." *Cureus* 17.10 (2025)

AAFP CME

Lis Franc X-ray



AAFP CME

Barriers to Practice

- Reading experience
- Reading availability
- Clinical correlation: better with time/follow up
- Repeat or follow up imaging

AAFP CME

Summary

- In patients with a suspected scaphoid fracture and a negative initial negative x-ray, should be placed in a thumb spica splint, repeat exam (tenderness), imaging in 10-14 days (SOR: C)
- A patient with an elbow effusion or elevated fat pad on x-ray should be splinted and have repeat imaging to evaluate for missed fractures such as a radial head fracture (SOR: C)
- Obtain weight bearing and non-weight bearing AP foot x-ray for any suspicion for Lis Franc injury (SOR: B)

AAFP CME

Thanks!

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www.rush.edu/dpatel

AAFP CME

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AAFP CME

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- Mohamed, Ahmed, et al. "From Missed Diagnosis to Optimal Outcomes: A Comprehensive Review of Lisfranc Injuries." *Cureus* 17.10 (2025).
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- Baki H, Aydın ÖF. Clinical accuracy of the posterior fat pad sign for detecting elbow fractures in children. *J Med Palliat Care*. 2025;6(3):271-275
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- Buck, Tristan MF, et al. "Nonoperative Treatment for Osteochondral Lesions of the Talus Provides Clinical Improvement in the Minority of the Patients at Short-term Follow-up." *Foot & ankle international* (2025): 10711007251330881.

AAFP CME

SELF EVALUATION

Commonly Missed Orthopedic X-Rays in the ER and Urgent Care

True/False

1. A negative x-ray within 24hrs of the injury does not completely rule out a fracture?
2. A patient with a FOOSH injury with scaphoid tenderness and a negative x-ray should be splinted and repeat evaluation in 10 days?
3. An elevated elbow fat pad should be seen by orthopedic surgeon for follow up within 1 wk?
4. Reviewing the transition zone of aids detection of radial head fractures?
5. A cortical lucency is a common finding for a stress fracture on x-rays?
6. Lis Franc injuries are best seen with a comparison weight bearing and non weight bearing AP foot x-rays?

Answer Key: 1. T, 2. T, 3. F, 4. T, 5. F, 6. T