



Pediatric Neurologic Emergencies (Seizures +)

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03/05/2024
2024 NAEMS Pediatric Symposium

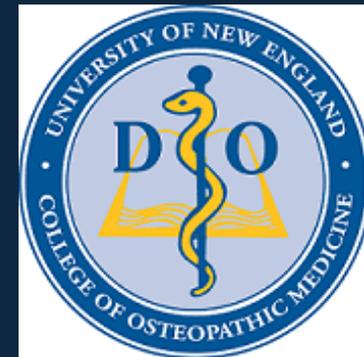


EMS
CONSORTIUM



Presenter Biography

- Medical school in Maine
- Residency in Phoenix, AZ (Maricopa County)
- EMS Fellow at University of New Mexico
- Interest - rural emergency care, medical education



High quality emergency medicine practice

Disclosures

Employed by UNM Hospital

No other financial disclosures

ER Physician, no focused training
in Pediatrics



Outline

- General Approach to Pediatric Assessment
 - Considerations in Pediatric Neurologic Exams
- Disease Review
 - Primary Seizures
 - Febrile Seizures
 - Neurologic Infections
 - Infantile Spasms
 - Intracranial masses and Hydrocephalus
- Take home Points

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Introduction

- Children are unique
- Factors in assessment
 - Physical/Anatomical variability
 - Language barrier
 - Developmentally variability
 - Caregiver coordination
- Occult presentations



Developmental milestones

MILESTONES MATTER: LET'S TALK ABOUT THEM!

MILESTONES AT 4 MONTHS

- Begins to babble
- Responds to affection



MILESTONES AT 6 MONTHS

- Likes to play with others
- Responds to own name



MILESTONES AT 9 MONTHS

- Has favorite toys
- Understands "no"



MILESTONES AT 1 YEAR

- Tries to say words you say
- Waves "bye-bye"



MILESTONES AT 2 YEARS

- Begins to run
- Begins to sort shapes, colors



MILESTONES AT 3 YEARS

- Knows name and age
- Climbs and runs well



Get free milestone checklists for these ages and more at www.cdc.gov/Milestones or by calling 800-CDC-INFO (800-232-4636).

Learn the Signs. Act Early.

Developed in partnership by the University of Missouri and the US Department of Health and Human Services, Centers for Disease Control and Prevention.



Adjust your approach



Toddlers – Engage from a distance



Pre-school -> receptive

Adjust your approach



Historical Considerations

Parent inference should be taken as fact



“The Doorway Exam”



Pediatric Assessment Triangle Findings

APPEARANCE	WORK OF BREATHING	CIRCULATION TO THE SKIN
Tone	Abnormal sounds—stridor, grunting, snoring, wheezing	Pallor
Irritable, interactive	Abnormal positioning—sniffing, tripodding, refusal to lie down	Delayed capillary refill time (>2 s) Mottling
Consolable	Retractions	Cyanosis
Look, gaze	Head bobbing	Petechiae
Speech, cry	Nasal flaring	

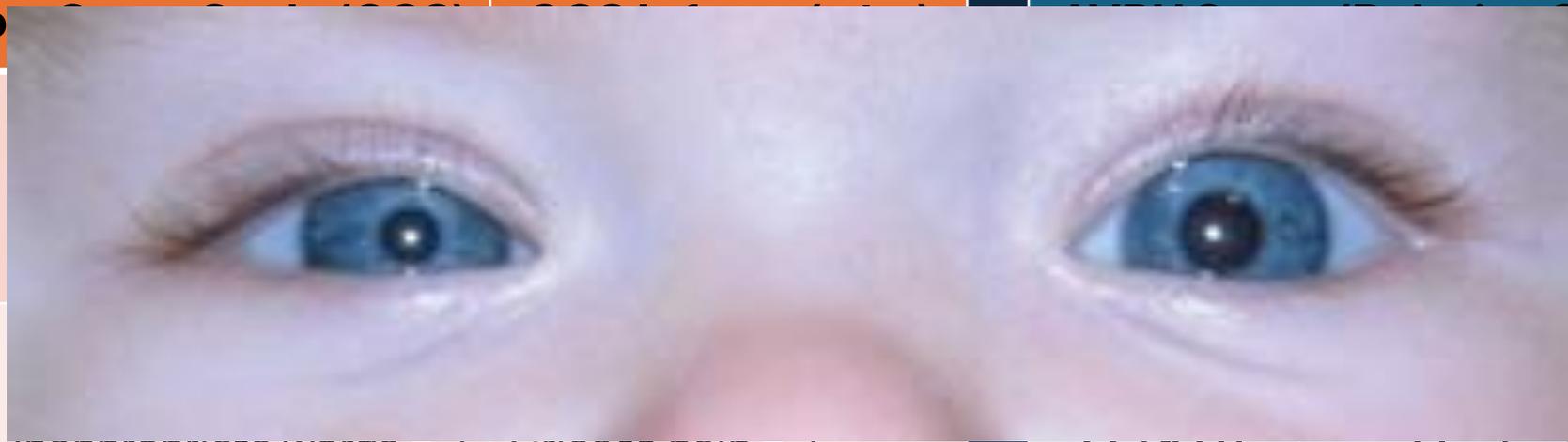
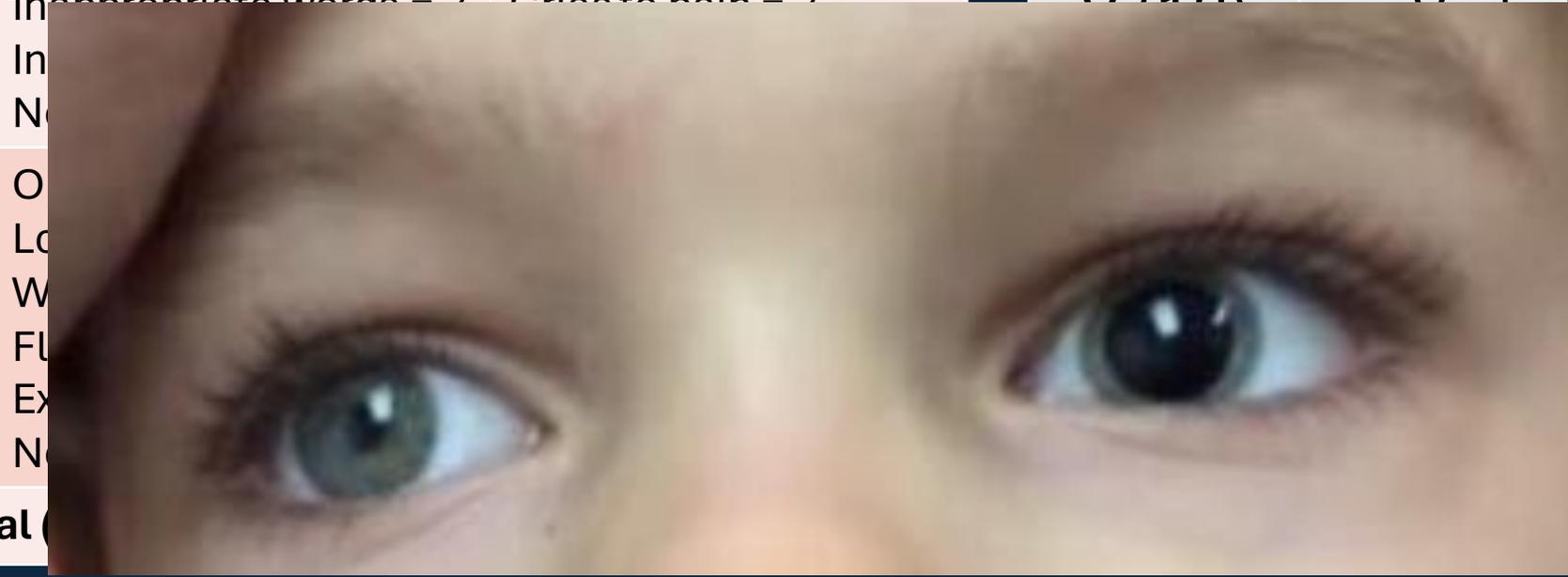
Circulation to skin

Be Observant



Pediatric Rapid Neuro Assessment

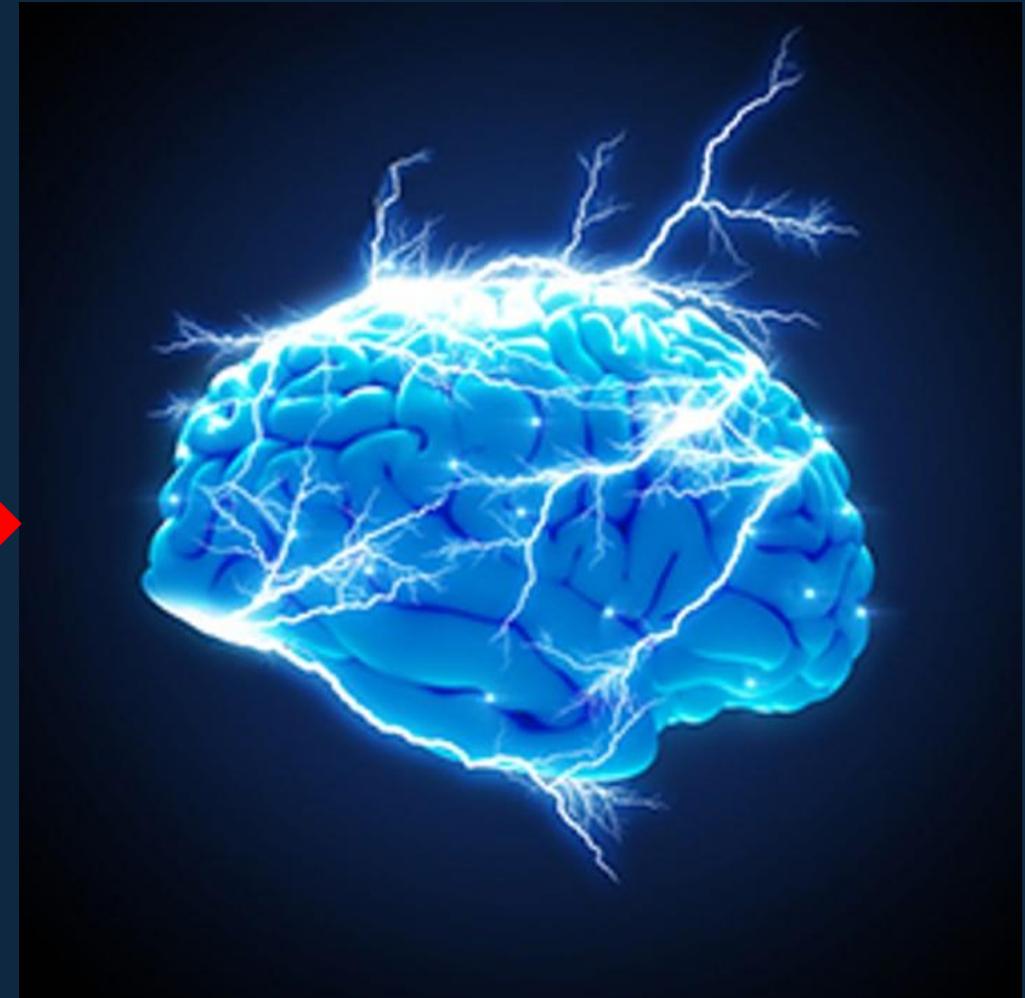
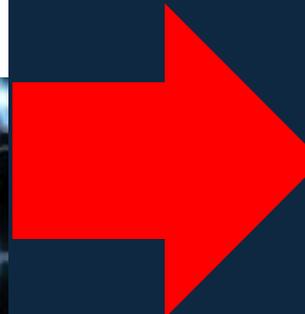
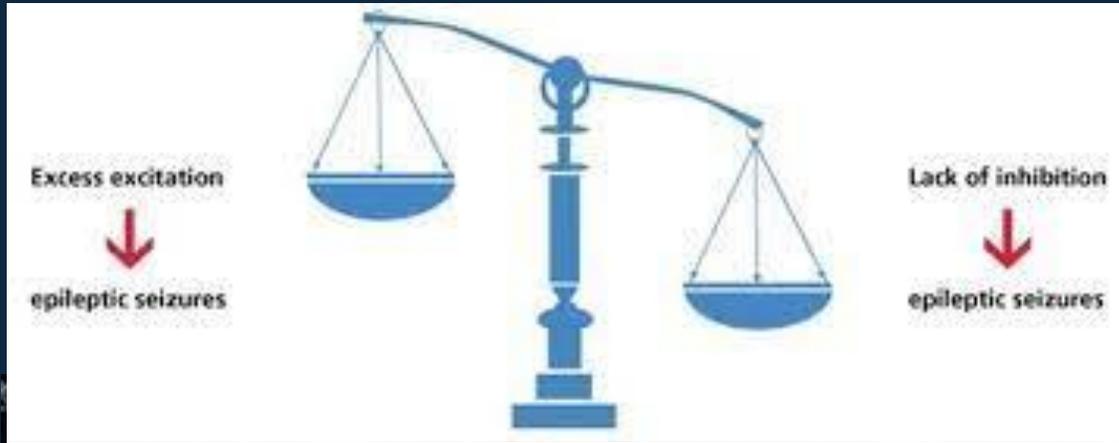


Glasgow		CS)	
			
			
			
Total (sive

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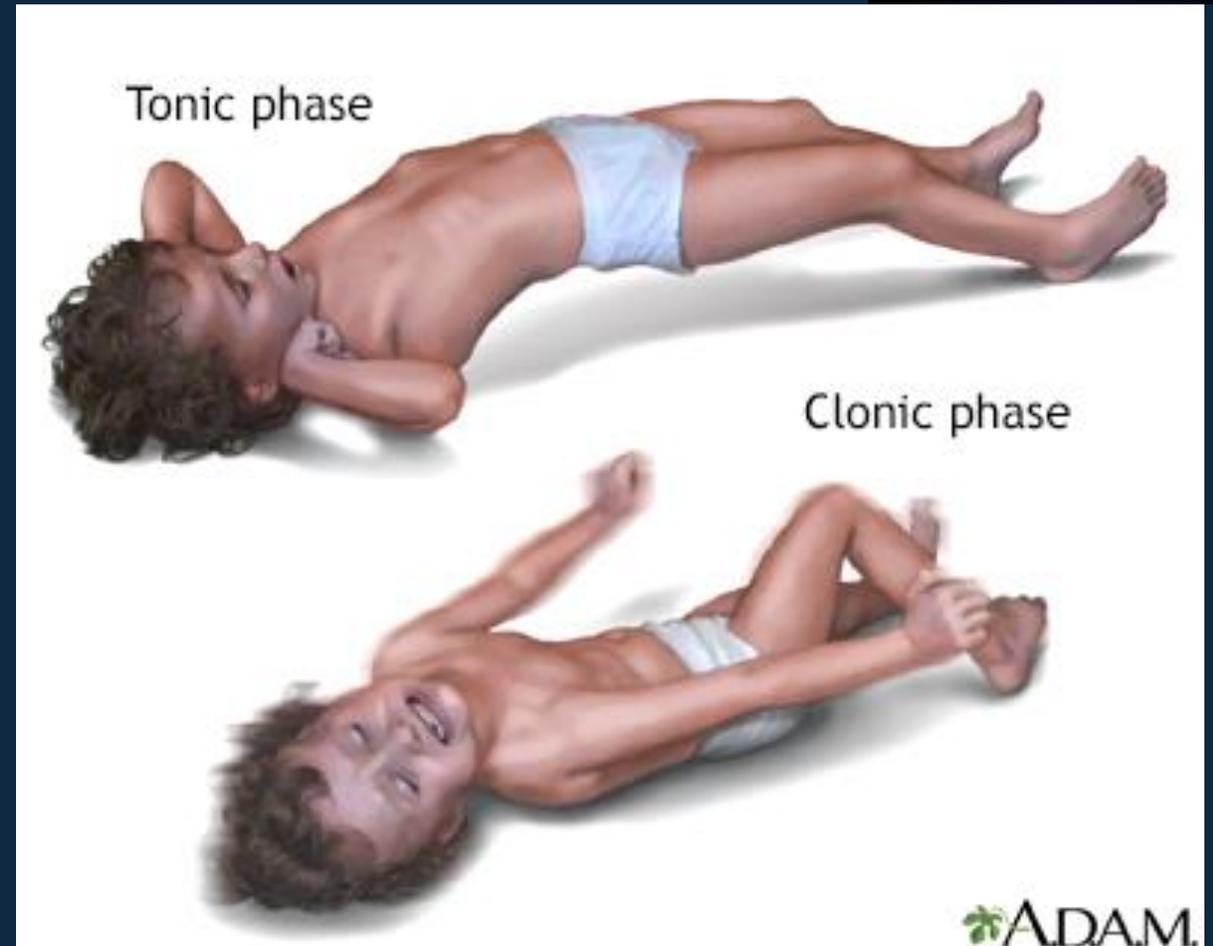
Unprovoked Seizures (Epilepsy)



Unprovoked Seizures (Epilepsy)



- Presents in the 2nd decade
 - Absence seizure 1st decade
- Generalized tonic-clonic
 - “Tonic” = stiffening
 - “Clonic” = repetitive jerking
- First rapid and rhythmic
 - Slows, becomes irregular



History is Crucial

Key questions to consider:

1. What was happening before the seizure?
2. How did it start?
3. Was it symmetrical?
4. How long did it go for?
5. What were the patient's eyes doing?
6. What was the recovery period like?



History is Crucial – Other considerations

Was there a particular trigger?

- Trauma
- Ingestion
- Electrolytes
- Inborn errors of metabolism
- Pregnancy



Was it a seizure?

- Fatal arrhythmias
 - Adolescence/early childhood
 - Metabolic disorders
- Most associated with seizures:
 1. Tongue biting (lateral)
 2. Drowsy post-ictal period
 3. During sleep
 - Upon waking
 4. Urinary incontinence?



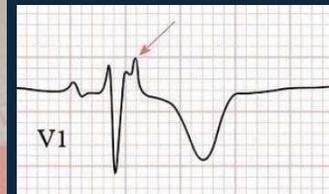
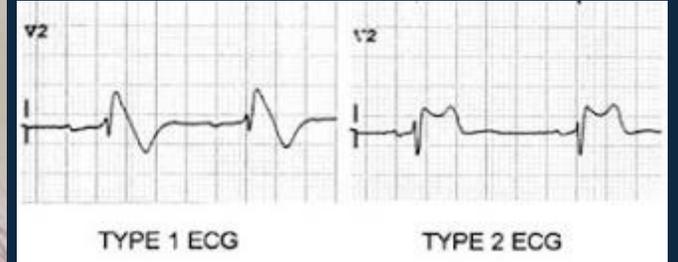
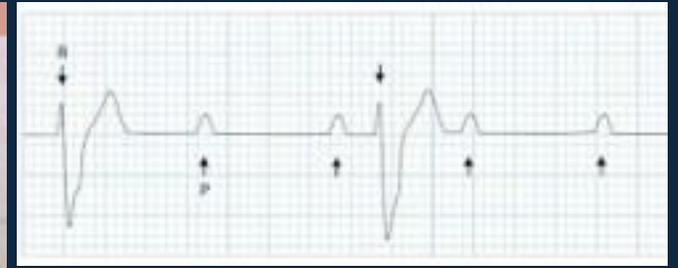
Was it syncope?

- Red flags for SYNCOPE
 1. During exercise
 - Or while supine
 2. Patient was surprised/startled
 3. Family history of arrhythmia
 - Sudden death
 - Unexplained drowning
 - Pacemakers early in life
 - Deafness

7 CAN'T MISS ECG FINDINGS IN SYNCOPE

- A** AV Block
- B** Brugada pattern
- C** QTc prolongation
- D** Delta waves (WPW)
- E** Epsilon waves (ARVC)
- Left ventricular hypertrophy
- Right ventricular strain

EMDocs.net website here
@kaynani32



With these features, consider ECG and Monitor Closely in transport

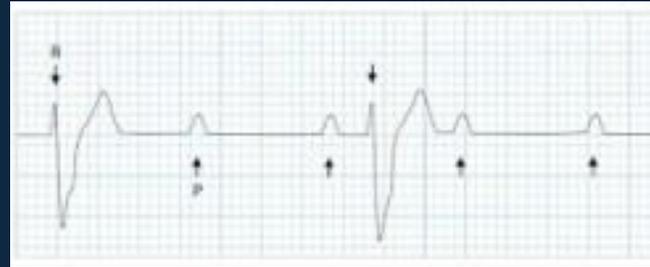
ECG for Syncope – “ABCDE Left/Right”

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A



B



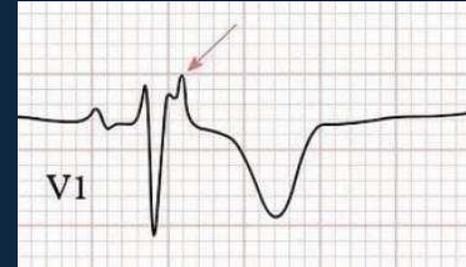
C



D



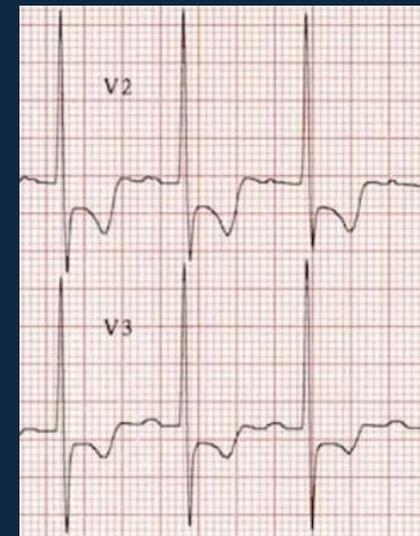
E



Left



Right



Modified Calgary/Canadian Syncope Score

> [Neurol Sci. 2017 Jan;38\(1\):143-149. doi: 10.1007/s10072-016-2740-5. Epub 2016 Oct 17.](#)

Calgary score and modified Calgary score in the differential diagnosis between neurally mediated syncope and epilepsy in children

Runmei Zou ¹, Shuo Wang ¹, Liping Zhu ¹, Lijia Wu ¹, Ping Lin ¹, Fang Li ¹, Zhenwu Xie ¹, Xiaohong Li ², Cheng Wang ³

	Question	Score (if yes)
Q1	Waking with cut tongue?	2
Q2	Prodromal deja vu or jamais vu?	1
Q3'	Loss of consciousness during sleeping?	1
Q4	Head turning to one side during loss of consciousness?	1
Q5	Abnormal behavior noted by bystanders, including witnessed unresponsive, unusual posturing or limb jerking? (score as yes for any positive response)	1
Q6	Postictal confusion?	1
Q7	Any presyncope, such as dizziness, palpitation or nausea?	-2
Q8	Diaphoresis before a spell?	-2
Q9	Loss of consciousness with prolonged sitting or standing?	-2

Score ≥ 1 is highly predictive of seizure vs syncope

Special Considerations – Seizing Neonates

- Not the typical pattern
- Consider these features
 - Starts focally and spreads
 - Focal rhythmic jerking
 - Extension of limbs
 - Myoclonic Seizures
 - Infantile spasms



Associated physical features of Seizure

- During episodes
 - Increased HR/BP
 - Pupillary dilation
 - Eye/head deviation
 - Rapid, shallow breathing
- How many jerks?
 - <10 jerks, less likely seizure
 - >20 jerks, more likely seizure



How would you describe this?

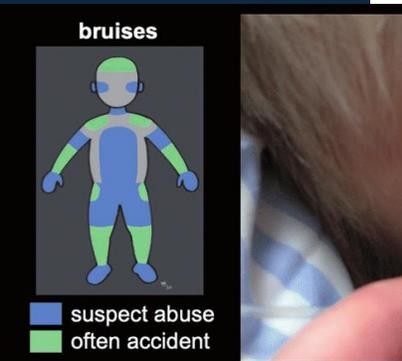
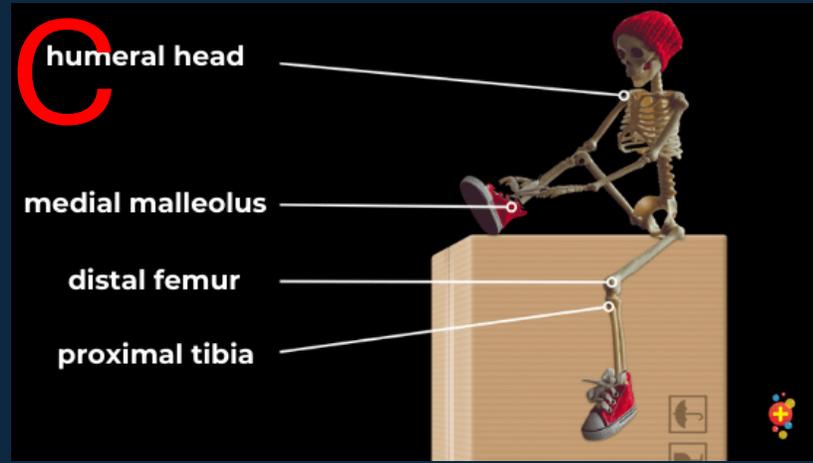


Status Epilepticus

- Incidence = ~20/100,000
- Seizure lasting >5 minutes without return to full consciousness
 - OR
- 2+ back-to-back seizures without return to baseline
- Non-convulsive -> prolonged post-ictal state

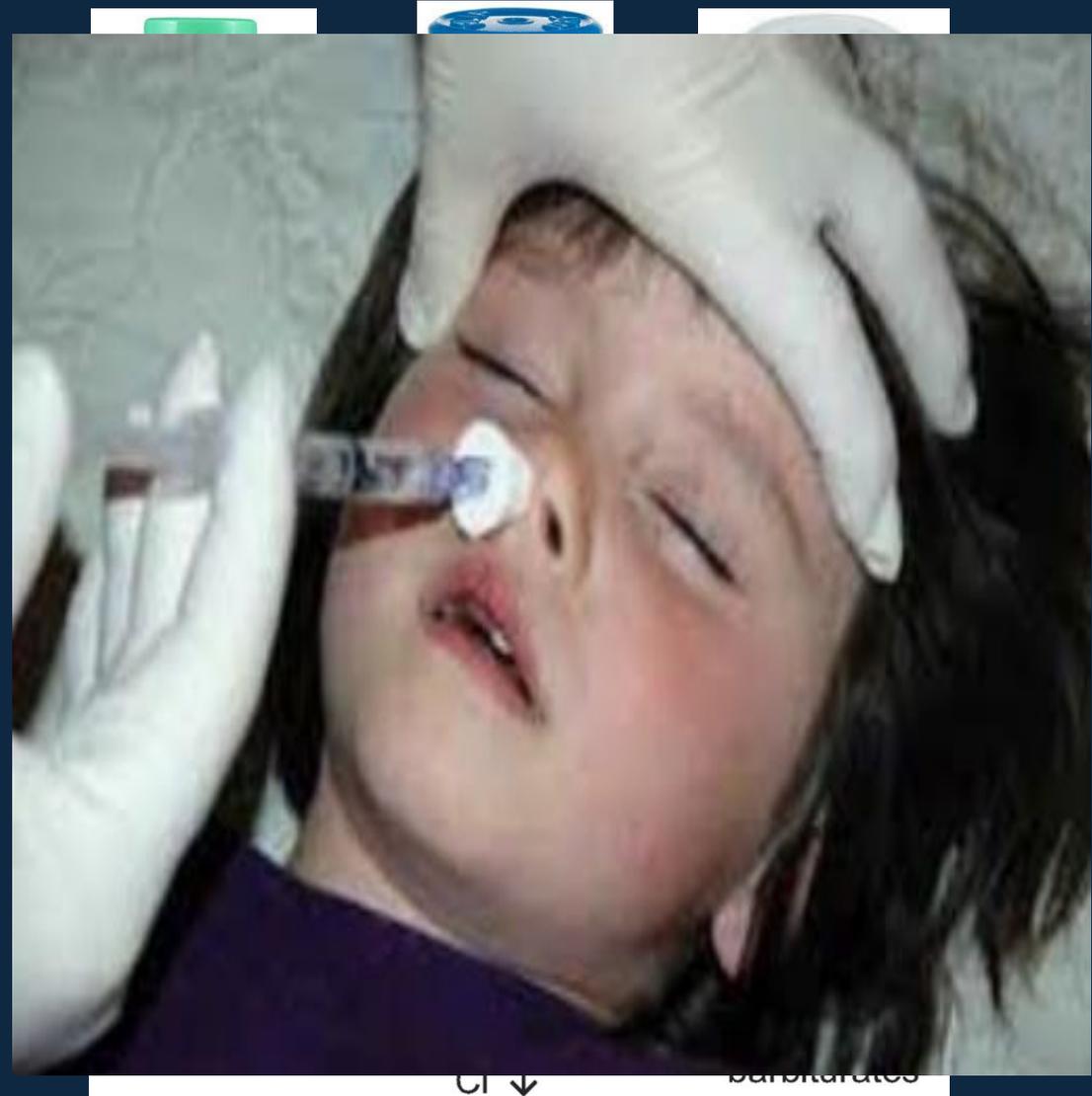
>30 minutes of seizure activity = neurologic injury

Pre-hospital treatment approach – Stabilization



Pre-hospital treatment: Benzodiazepines

- Midazolam
 - IV/IO/IN – 0.1-0.2 mg/kg (max 10mg)
 - IM – 0.2 mg/kg OR
 - 5 mg IM for 13-40 kg
 - 10 mg IM for >40 kg
- Lorazepam
 - IV/IO – 0.1 mg/kg (max 4 mg)
- Diazepam
 - IV/IO – 0.15 – 0.2 mg/kg (max 10mg)





Infantile Spasms

- Incidence ~25/100,000
- Usually between 4-7 months
 - Always <1 year old
- Occur in clusters
 - Usually after waking
- Symmetric movements (~2-10s)
 - Flexor (most common)
 - Extensor (less common)

STOP
Infantile Spasms
The Brain Can't Wait

Delaying treatment of Infantile Spasms can have serious impacts.
Lifelong Epilepsy Autism Intellectual Disability Death

Signs of Spasms
Raising of the Arms
Bending Neck Forward
Crunching of legs and midsection

Often Mistaken As
Startle Reflex
Reflux
Colic

1sec Length of Individual Spasms
15sec Repeats every 5 to 15 seconds
Minutes Over a span of several minutes

S See The Signs
T Take A Video
O Obtain Diagnosis
P Prioritize Treatment

Infantile Spasms are a severe form of epilepsy.
Starts between 4 - 8 months

Infantile spasms are diagnosed with an EEG to see if suspected spasms match with typical electric changes.

www.infantilespasms.org

The poster features a central illustration of a baby in a spasm, surrounded by text and icons. At the top right, three babies are shown. The background is white with red and blue accents.

Infantile Spasms



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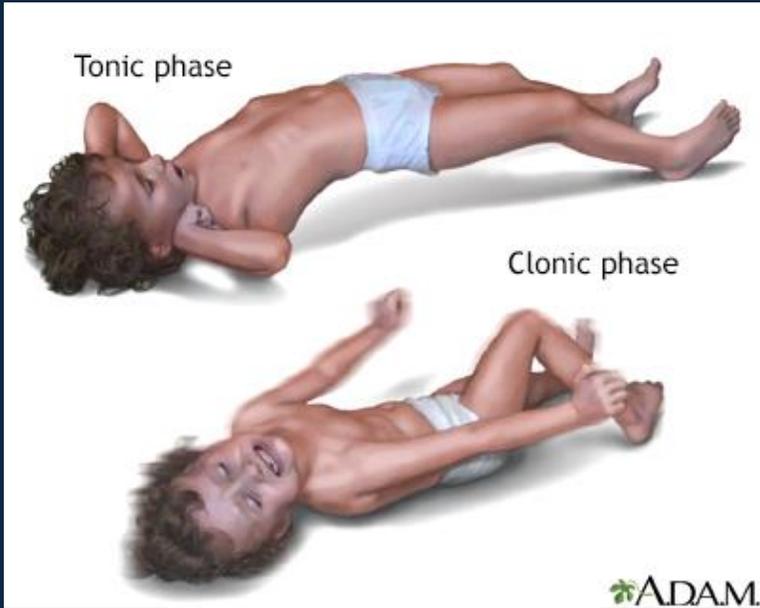
Febrile Seizures

- Onset 6mo – 6yrs
 - Approximately 4% of children
 - Familial pattern
 - ~1/3 will experience a 2nd
- Delineation
 - Simple
 - Complex

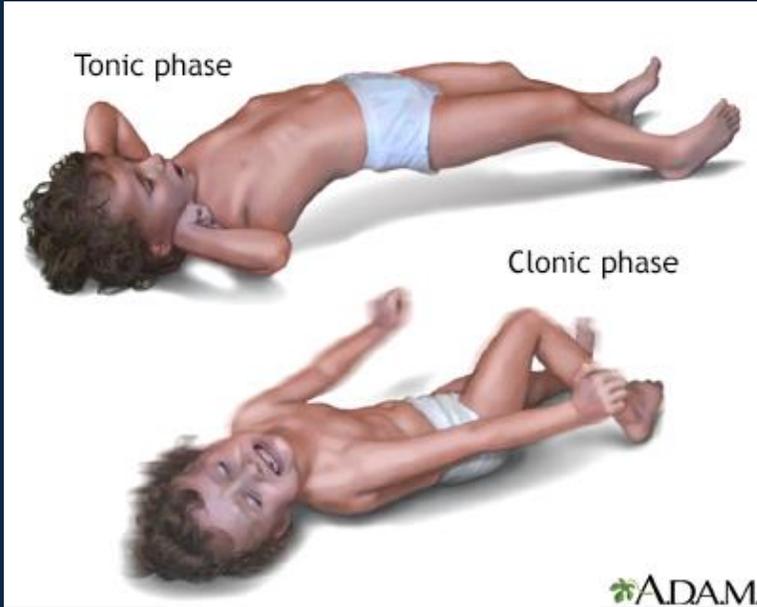


Provoked seizure, not epilepsy!

“Simple” Febrile Seizure



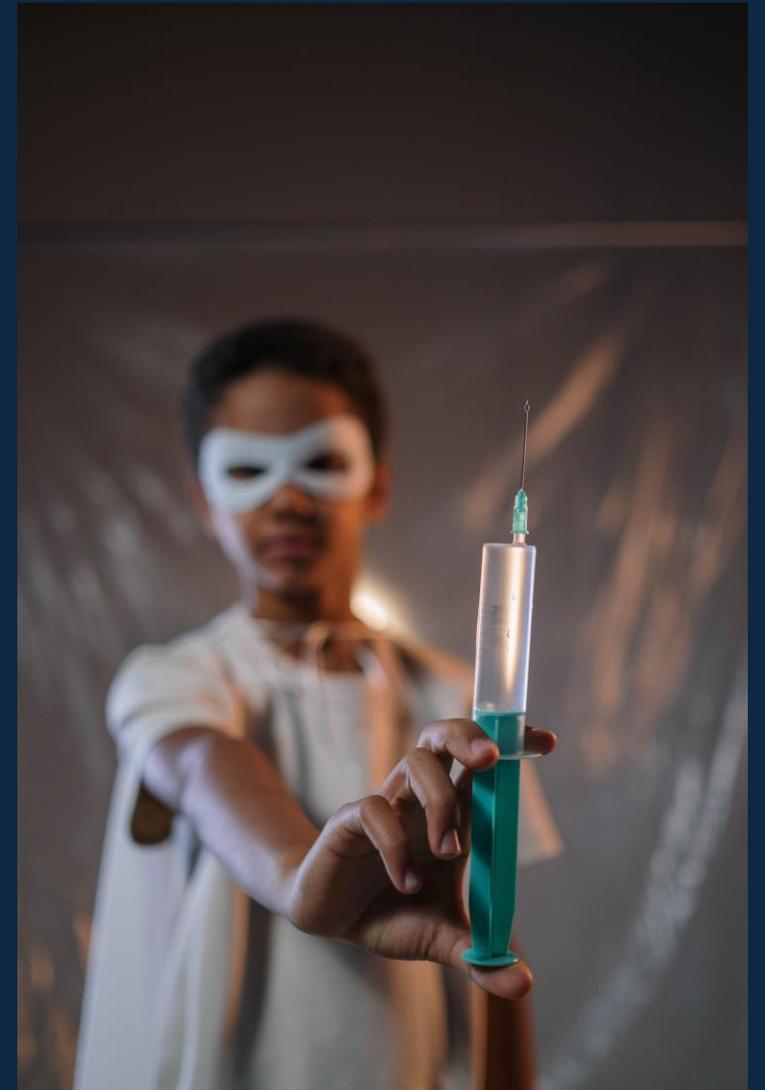
“Complex” Febrile Seizure



Unilateral involvement or Focal seizures also qualify

Considerations in Febrile Seizures

- Vaccination status
- Are they within the age range?
- What was the infectious trigger?
 - Symptoms before?
 - Sick contacts?
 - Travel outside the country?



History of CNS infections



RISK FACTORS



- Unimmunized
- Immunocompromised
- Age < 5 years old
- Crowded living conditions

INFANTS



Fever, possibly with cold hands & feet



Refusing feeds or vomiting



High pitched moaning cry or whimpering



Dislike of being handled or fretful



Neck retraction with arching of back



Blank & staring expression



Child is difficult to wake, lethargic



Pale, blotchy complexion

Floppy or stiff or jerking movements

CHILDREN



Physical Exam features of CNS infections



Does this change management?

- Operationally
 - PPE
 - ER Report
- Patient Care
 - Treat fever
 - Treat seizures as above
 - IV Fluid resuscitation

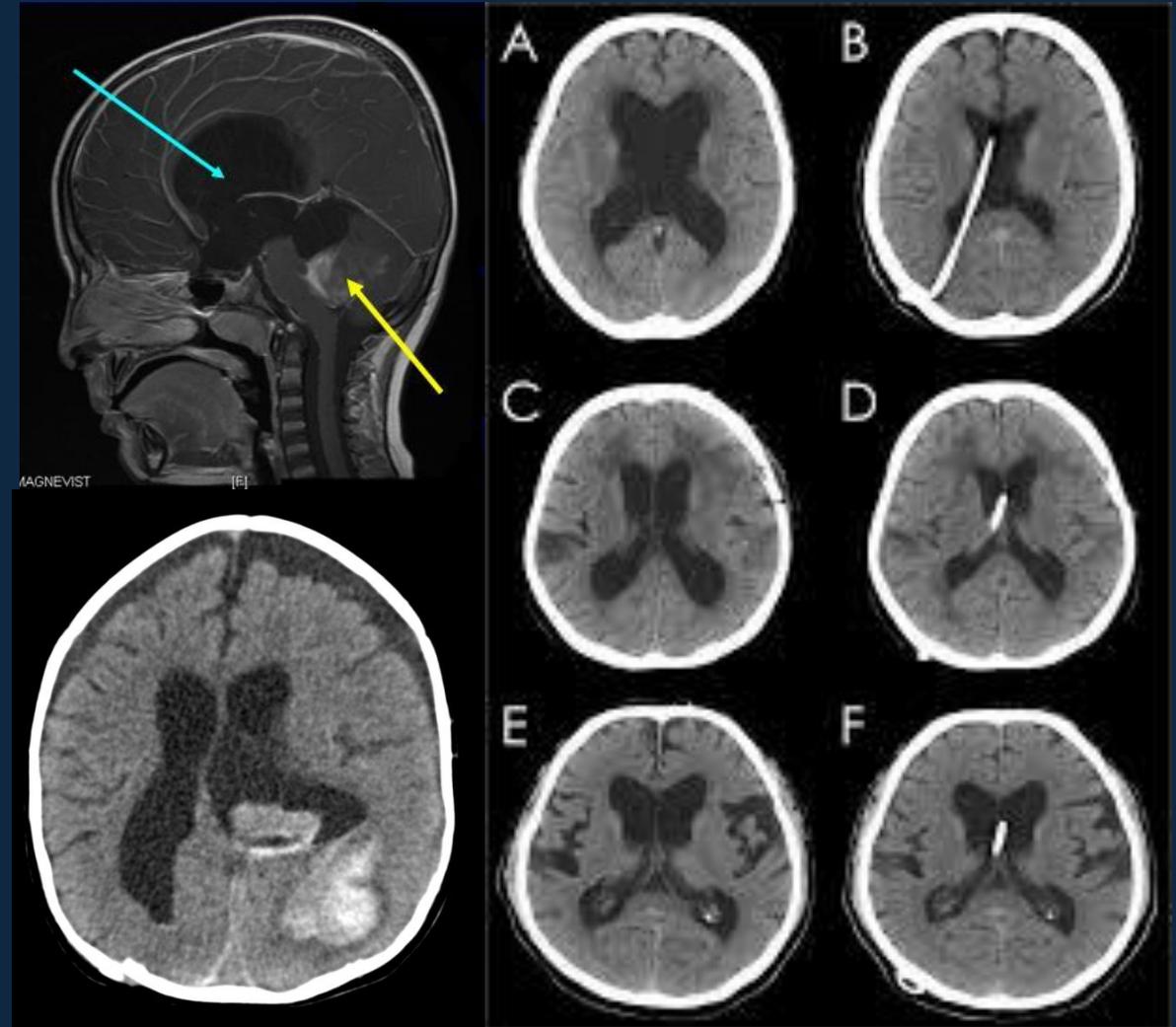


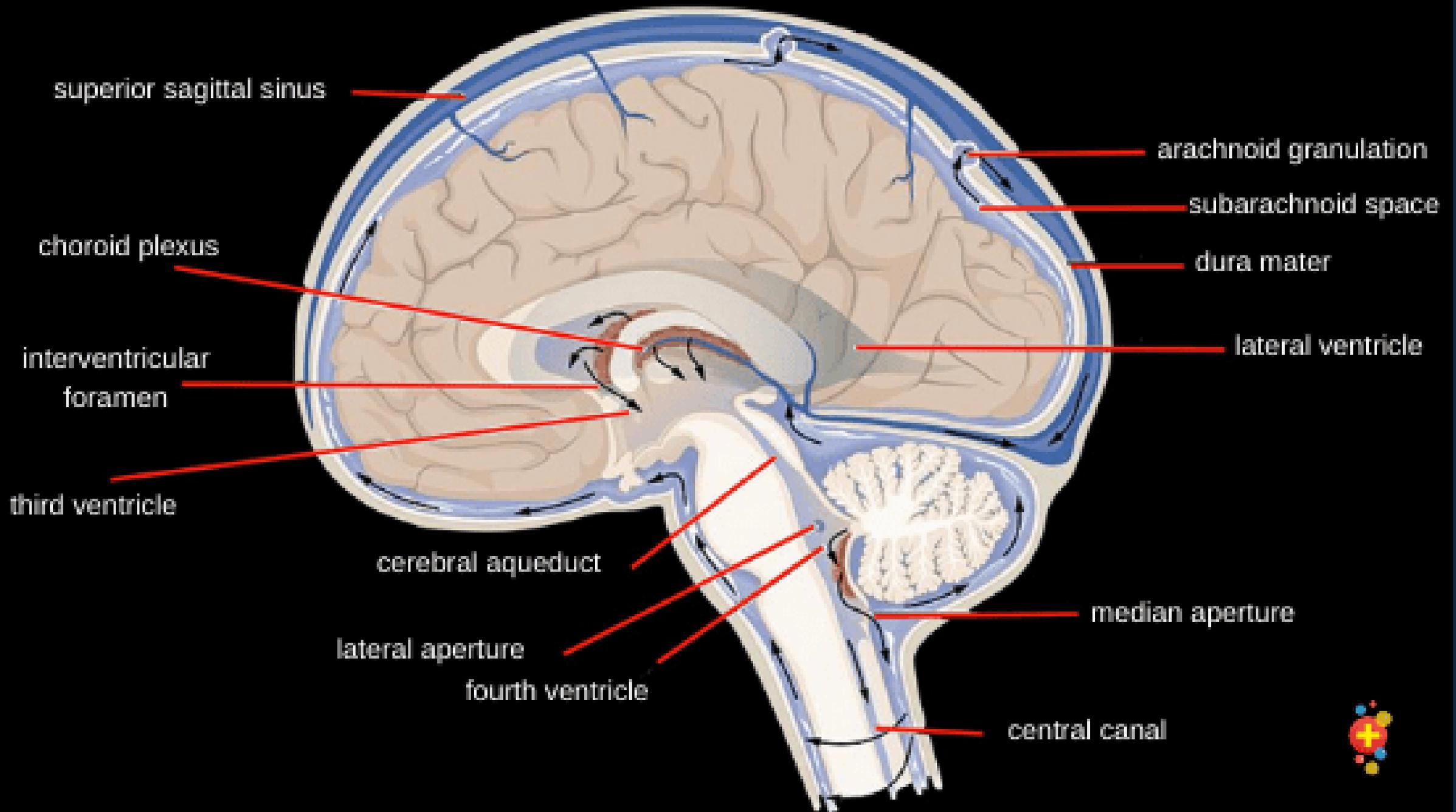
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Masses, Obstructions and Hydrocephalus

- Hydrocephalus
 - Increased fluid within ventricles of brain
- Masses
 - Primary malignancy
 - CNS abscess/infections
 - Hematoma/Bleeding/AV malformation





Physical presentation

- Infants

- Macrocephaly
- Frontal bossing
- Bulging fontanelle
- Sunset phenomenon
- Vomiting/Irritability

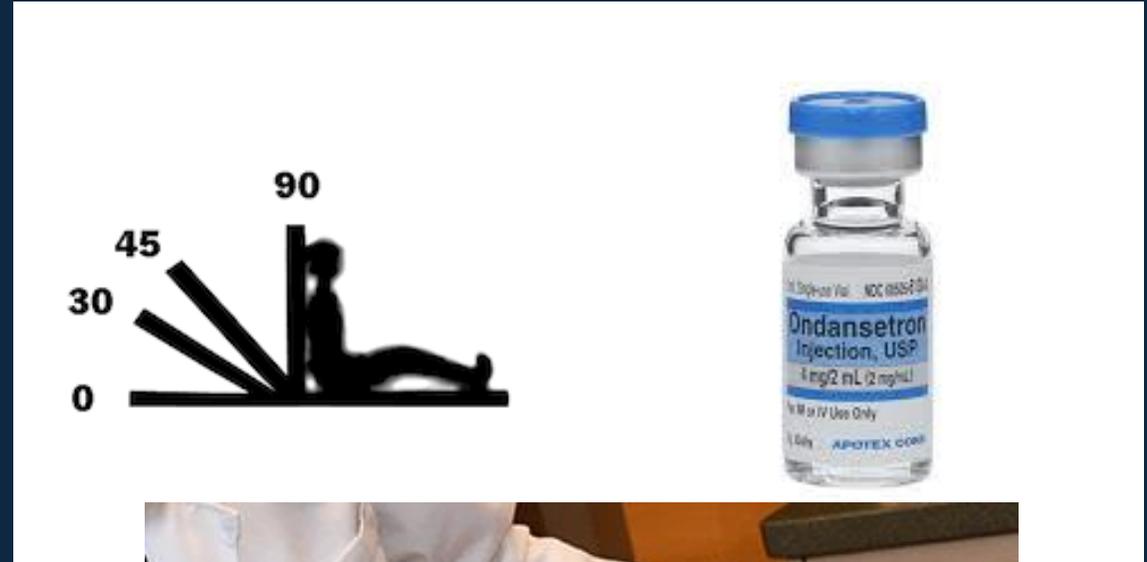
- Older children

- Headache
- Vomiting
- Diplopia



Pre-hospital approach to care

- Elevate head of bed 30 degrees
- Reassess frequently
- Patient comfort
 - Eye protection from light
 - Ear protection from noise
- Treat symptoms!

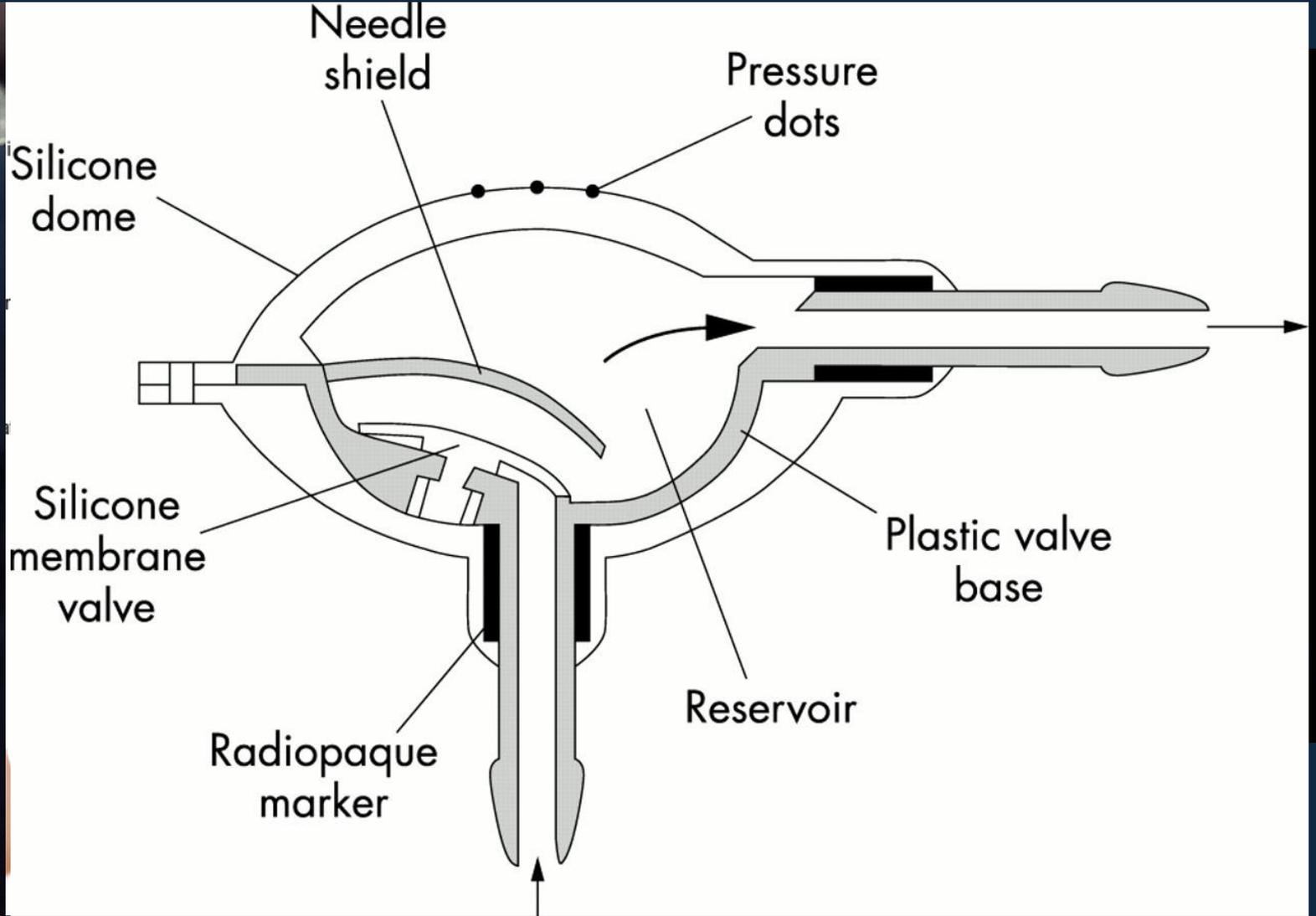


DON'T FORGET ABOUT PAIN



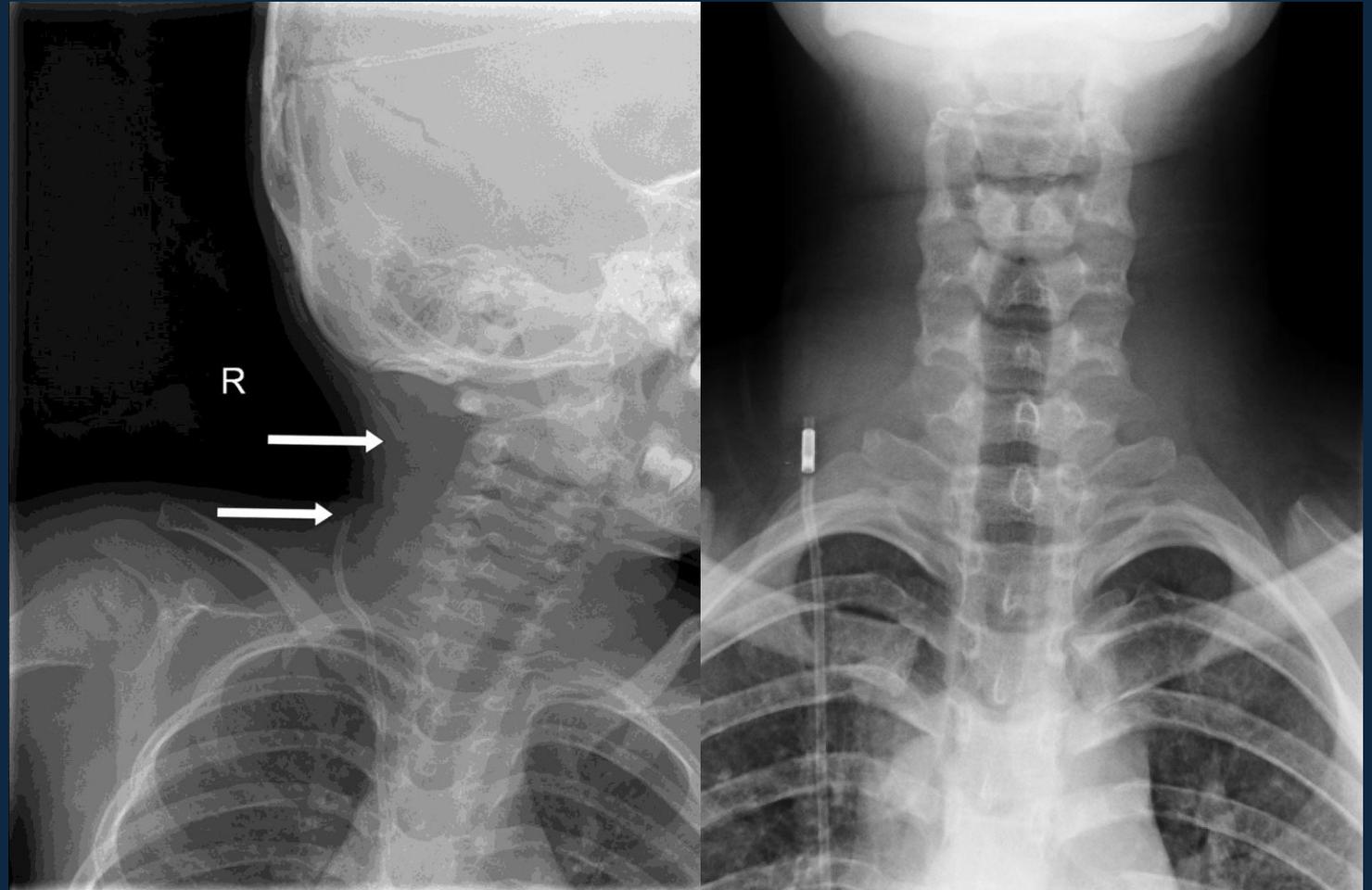


Ventriculoperitoneal (VP) Shunt



Special Population – VP Shunts

- Malfunctions
 - Headache
 - Nausea/Vomiting
 - Altered mental status
- Causes
 - Disconnection
 - Kink
 - Obstruction of tubing
 - Migration
 - Infection



VP Shunt – Prehospital care

- Physical assessment
 - Palpate reservoir
 - Obtain a good temp
 - Neurologic reassessments (especially for long transports)
- Treatment
 - Symptom control (as discussed)
 - Transport to primary pediatric center
 - Neurosurgery center preferable*



Take Home Points

- Rapid neuro assessment: Eyes, GCS and motor function
- Most neurologic emergencies in children will be seizures
- Treat seizures aggressively and early
- <10 clonic features could be syncope -> EKG
- Screen for traumatic injury
- CSF obstruction, treat symptoms aggressively

A close-up photograph of two young boys on a beach. The boy in the background is smiling broadly, showing his teeth, and has his hand resting on the head of the boy in the foreground. The boy in the foreground is also smiling and looking down. The background shows a sandy beach and a blue body of water.

Thank you for
your attention!

Questions, comments?

Additional Resources/Reading



Pediatric Neuro Exam Examples



Don't Forget the Bubbles – PEM Topic Review

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