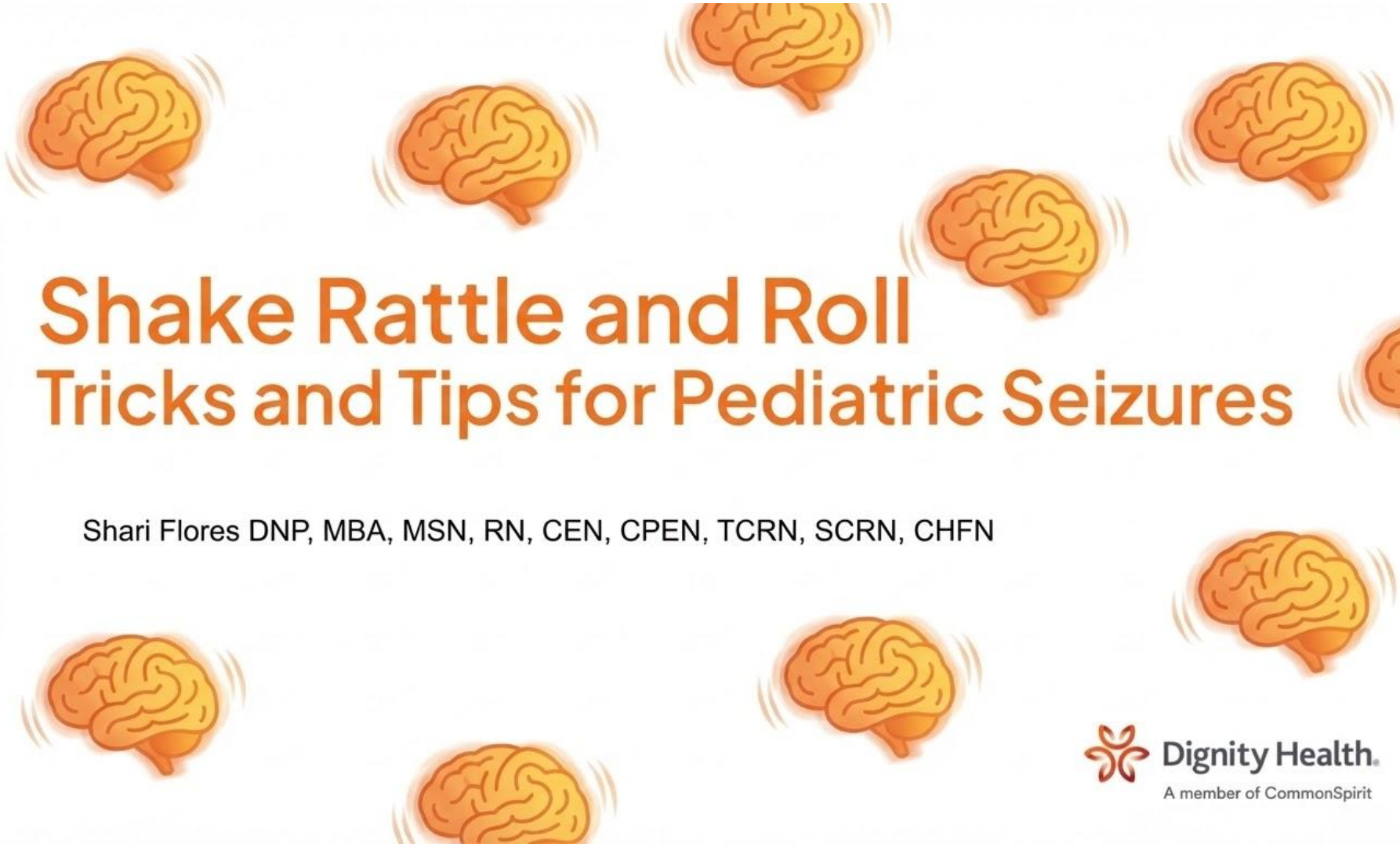

Shake Rattle and Roll
Tricks and Tips for Pediatric Seizures

Shari Flores DNP, MBA, MSN, RN, CEN, CPEN, TCRN, SCRN, CHFN

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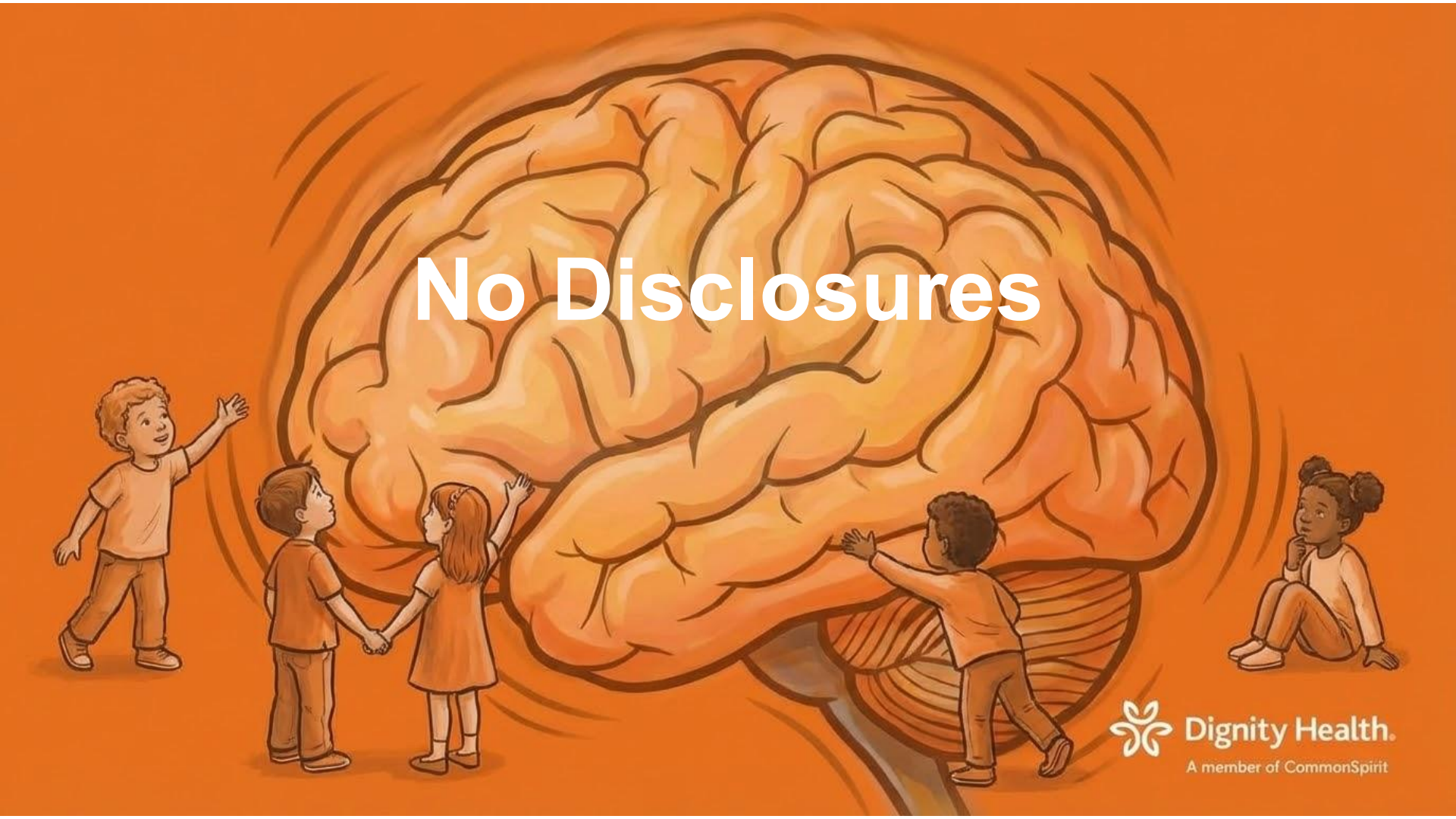
No Disclosures
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Learning Objectives

- Be able to identify common pediatric seizure disorders.
- Understand the difference between focal and generalized seizures.
- Recognize seizure semiology.
- Highlight the interventions for febrile seizure patients.

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Your eyes can not see what your brain does not know!

D.H. Lawrence

Pediatric Seizure Prevalence

Approximately 5% of children will have a seizure by the age of 16

Most Common Cause

The most common cause of pediatric seizure is a febrile seizure

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Seizure First Aid - Epilepsy Foundation

1) Stay

2) Safe

3) Side

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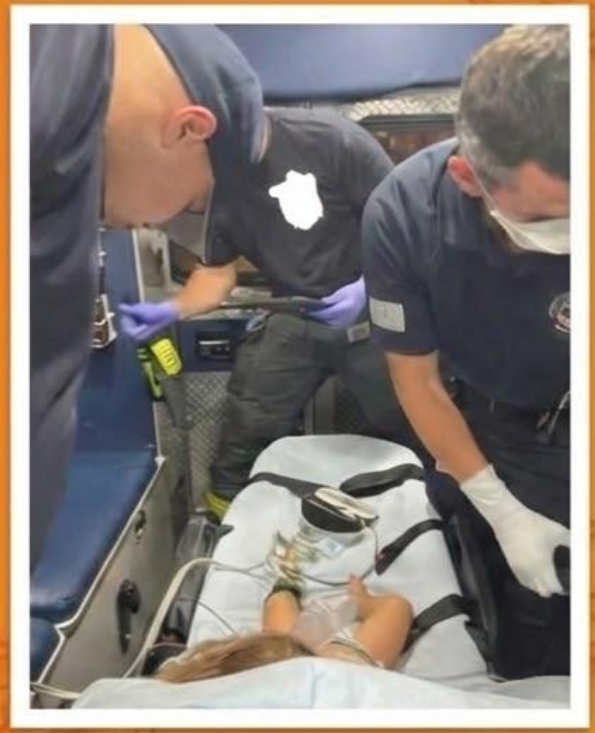
STOP SCREAMING

I'M SCARED TOO



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Doesn’t have to be
diesel wide open

take a moment to be **the eyes of the event** for the neurology team

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Basic EMT Assessment

- Airway
- Breathing
- Circulation

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Witnessing the Event: Determining Electrical Activity (Simple or Complex)

The electrical activity can be on both sides of the brain or just one side of the brain.

Simple: Generalized involving both cerebral hemisphere

- ↔ Symmetrical involvement
  - Tonic Clonic
- Time Duration < 15 minutes
- 1x Frequency: One seizure in 24 hours

Complex: Focal only one type of hemisphere involved

- → Unilateral
- Time Duration > 15 minutes
- multiple Frequency: > One ine in 24 hours

Make it simple - Within these 2 main types, there are many different names that describe the kinds of epilepsy. These terms are used to describe seizures more precisely.

Myoclonic

These seizures cause occasional, brief jerking, usually on both sides of the body. The person usually does not lose consciousness.

Clonic

These seizures cause repeated jerking in a rhythm on both sides of the body, including the face and neck.

Tonic

These seizures cause muscle stiffness. The person usually loses consciousness.

Atonic

These seizures cause muscles to relax, especially in the legs. These may also be known as drop attacks since the person often falls to the ground if standing.

Simple vs. Complex Seizures

Simple Seizure

The patient will be unresponsive or not aware of their surroundings or cannot remember the event.

Injuries from falling, tongue biting, and incontinence are common.

After the seizure, the person is sleepy, confused, and feels weak.

Complex Seizure

The patient generally remains aware of what is happening.

A seizure beginning in the back of the brain (occipital lobe) can cause vision changes, such as flashing lights. A seizure beginning in the hypothalamus can cause uncontrolled laughter.

Some people sense when a seizure is about to start, called an “aura.” Sometimes people are confused afterward, but not always.

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Eye Deviation in Stroke vs. Seizure

STROKE (Destructive Lesion)

Eyes typically look TOWARD the lesion.

SEIZURE (Irritative Lesion)

Eyes look AWAY from the lesion.

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Photo Credit: https://www.jpeds.com/article/S0022-3476%2819%2930682-1/fulltext

Postictal vs Ictal State

Ictal State

Latin for “blow” or “thrust”.

Postictal State

Greek term “Fish” - Ichthys.

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Biggest assessment: Simple or Complex Seizure

Simple Seizure

- Bilateral Movements
- <15 Minutes
- Unaware of surroundings

Complex Seizure

- Unilateral
- >15 minutes
- May remember the event

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Newborn Assessment & Observation

Neonatal

28 days or less

44 weeks gestation

Seizures are more common in Neonates than any other time in their lives

Hypoxic Ischemic Encephalopathy

1-5/1000

births

Intraventricular hemorrhage

15/1000

preterm births

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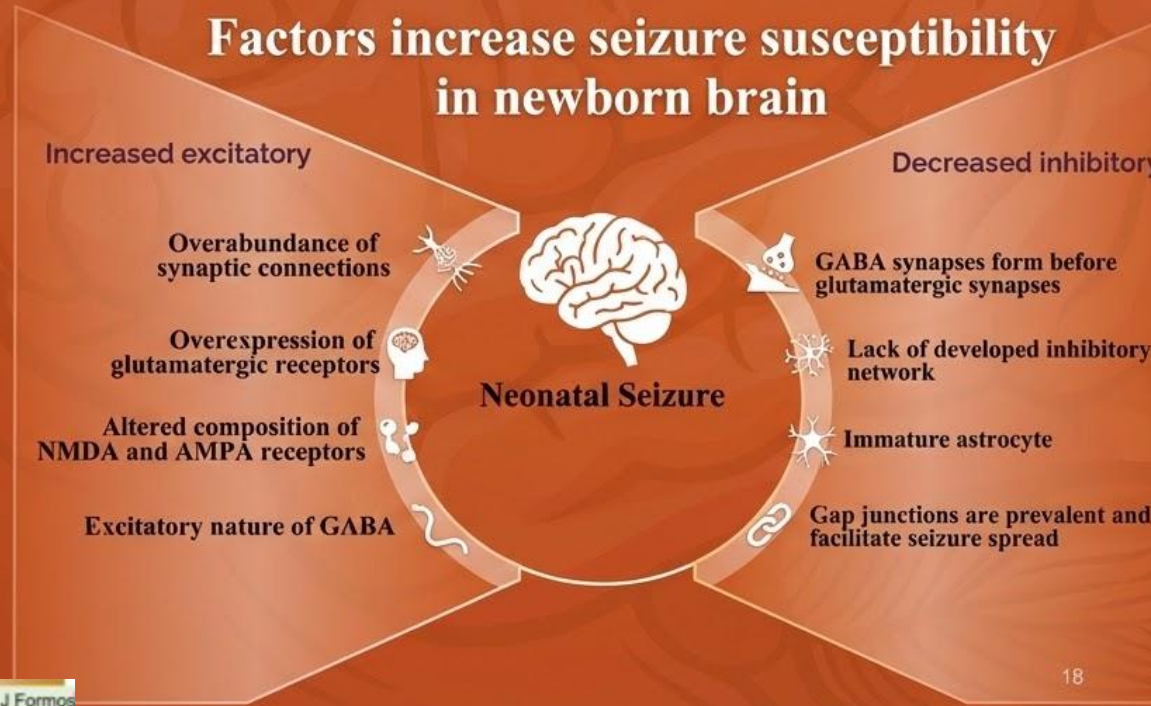
The premature brain is more vulnerable

- It is immature in development
- Neurons in the neonatal cortex have more excitatory potential
- Decreased inhibitory activity



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Huang LT, Tain YL, Lai MC, Yang SN. Neonatal seizures: dialogues between clinic and bench. J Formos Med Assoc. 2012 May;111(5):239-44. doi: 10.1016/j.jfma.2011.12.007. Epub 2012 Apr 7. PMID:

Decreased Myelination of the Neurons - Complex Seizure Activity (Focal presentation)

SUBCLINICAL SEIZURES

- If the electrical activity does not sweep across the motor cortex no movement will occur

80% of neonatal seizures

- Apnea
- Involve Mouth
  - Tongue Movement
  - Lip Smacking
- Eye - Deviation or pupil change
- Temperature control

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https://www.flintrehab.com/primary-motor-cortex-damage/?srsltid=AfmBOop7vUDkhFqFlwX_6SJ13glTCWkTJPmIx-0d39LNL0YUDKz0fEFR

Babies make really weird movements so it is difficult to determine if its a seizure

- **Jitteriness - Tremors of hand or feet**
  - Stimulation - Unwrap a swaddle
  - Cold room temp
    - If you hold the hands you can stop
    - No changes in 02 sats
    - No bradycardias

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Sleep Myoclonus Brief, sudden and involuntary jerky movement that occur during sleep

- Isolated
- Nor rhythmic

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Neonatal experts are BAD at identifying seizures based

Malone A, Ryan CA, Fitzgerald A, Burgoyne L, Connolly S, Boylan GB. Interobserver agreement in neonatal seizure identification. Epilepsia. 2009 Sep;50(9):2097-101. doi: 10.1111/j.1528-1167.2009.02132.x. Epub 2009 Jun 1. PMID: 19490044.

Epilepsia, SW9-2007-2101, 2009
doi. 11.1111/j.1528-1167.2009.02132.x

FULL-LENGTH ORIGINAL RESEARCH

Interobserver agreement in neonatal seizure identification

*Aileen Malone, *C. Anthony Ryan, †Anthony Fitzgerald, *Louise Burgoyne, ‡Sean Connolly, and ¤Geraldine B. Boylan

*Department of Paddiatrics and Child Health, University College Cork, Ireland; [Department of Epidemiology and Public Health, University College Cork, Cork, Ireland, and [Department of Clinical Neurophysiology, St. Vincent's University Hospital, Dublin, Ireland

SUMMARY

Objectives: Accurate diagnosis of neonatal seizures is critically imparicare and it often made clinically, include EEG (electronreuphoisoraphy) monitoring. This observational study aimed to determine the accuracy and interobserver rellabllity of healthcare professionals in distinguishing clinically manifested seizures from other neonatal movements, when presented with clinical histories and digital video recordings only.

Methods: Twenty digital video recordings of paroxysmal movements in term and preterm infants were selected from a video-EEG database. The movements were categorized m seizure and nonseizure using EEG. Health care professionals (n = 137) from eight neonatal intensive care units (NICUs) were shown the video recordings with additional relevant clinical data, excluding EEG findings. The observers were asked to indicate which movements they contidered to be seizure or nonseizure. A multirator Rappa statistic was used to assess agreement between observers and with the true diagnosis.

Results: Twenty video clips (11 seizure, 9 nonseizure) were evaluated by 91 doctors and 46 other professionals. The average number of correctly identified events was 10/20. Clonic seizures were correctly identified most frequently (range 36.5–95.6% of observers). Subtle seizures were poorly identified (range 20.4–49.6% of observers). The interobserver agreement (Kapps) for doctors and other health care professionals was poor at 0.21 and 0.29, respectively. Agreement with the correct diagnosis was also poor at 0.09 for doctors and –0.02 for other healthcare professionals.

Discussion: It is often impossible to accurately differenitate between selzure-selzure and nonseizure movements in infants using clinical evaluation alone. In addition, doctors do not have a higher capacity for discriminating between neonatal paroxysmal events than other health care professionals. Until reliable continuous neurologic monitoring of newbern babies is available, it is likely that some babies with seizures will rernaie undetected and others with nonselzure movements will continue to be treated with potentially harmful anticonvulvants.

KEY WORDS: Seizures, Neonate, EEG, Tonic, Clonic, Subtle.

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Photo Credit: https://www.bmedreport.com/archives/20916

Febrile Seizures

6 months - 5 Years

Family History

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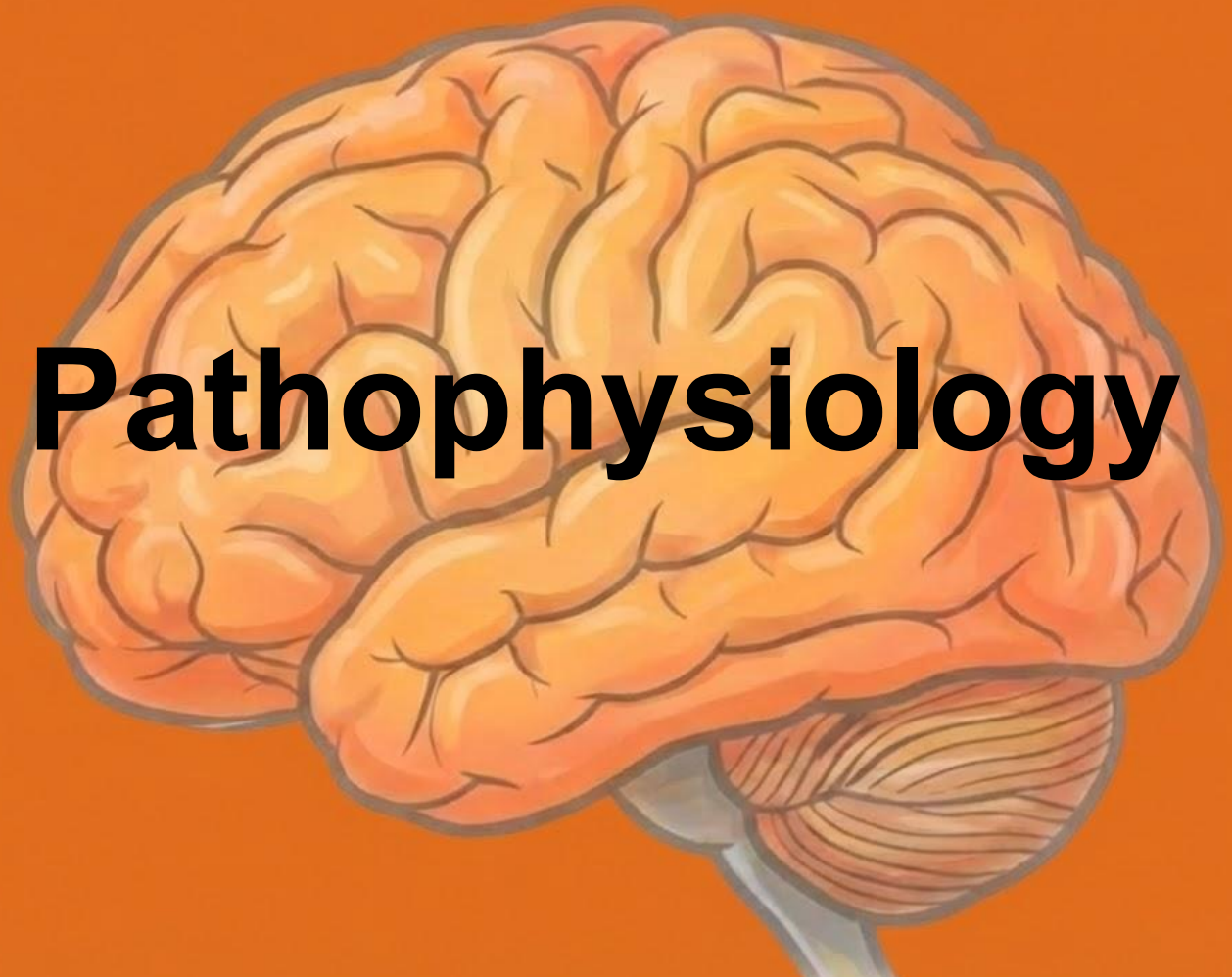
Pathophysiology



Primarily Viral Infection

- **HHV** - Human Herpes Virus
  - HHV6 Roseola Infantum
    - Fever, Rash, Febrile Seizure

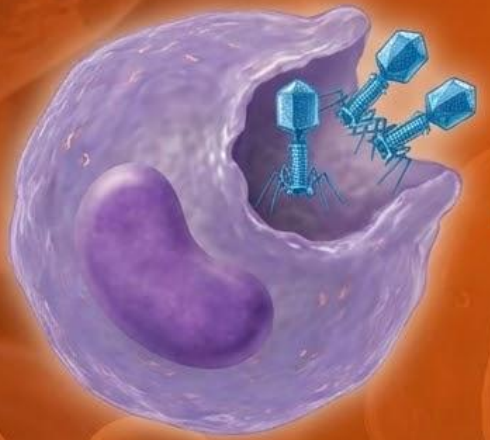
H1N1 - Influenza

- Recent Vaccination - Immunological Reaction
  - MMR - Mumps, Measles and Rubella
  - dTAP - Diphtheria, Tetanus and Pertussis

Cellular Level Action

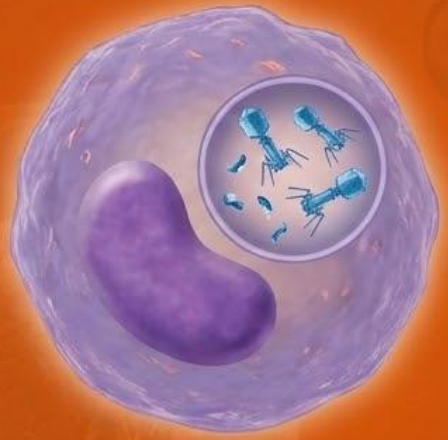
T Cells can not recognize free floating pathogens they need to be presented in epitopes 8 -15 amino acid long!!

1. Pathogen Exposure & Engulfment



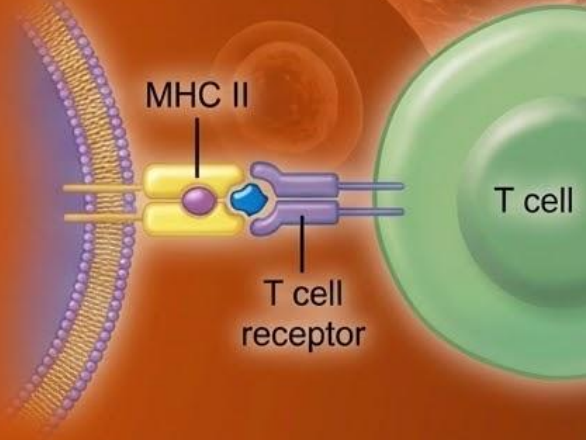
Macrophages encounter and engulf pathogens.

2. Pathogen Processing



The pathogen is digested into peptide fragments (epitopes).

3. Antigen Presentation (MHC II)



Epitopes are displayed on MHC II molecules for T cell recognition.

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Photo Credit: https://www.scientificamerican.com/article/spy-virus-eavesdrops-on-bacteria-then-obliterates-them/

Cellular Level Action

T Cells (a type of white blood cell called a lymphocyte) - they are the managers of the immune system - they identify and destroy infected cells or active an a whole army to attack

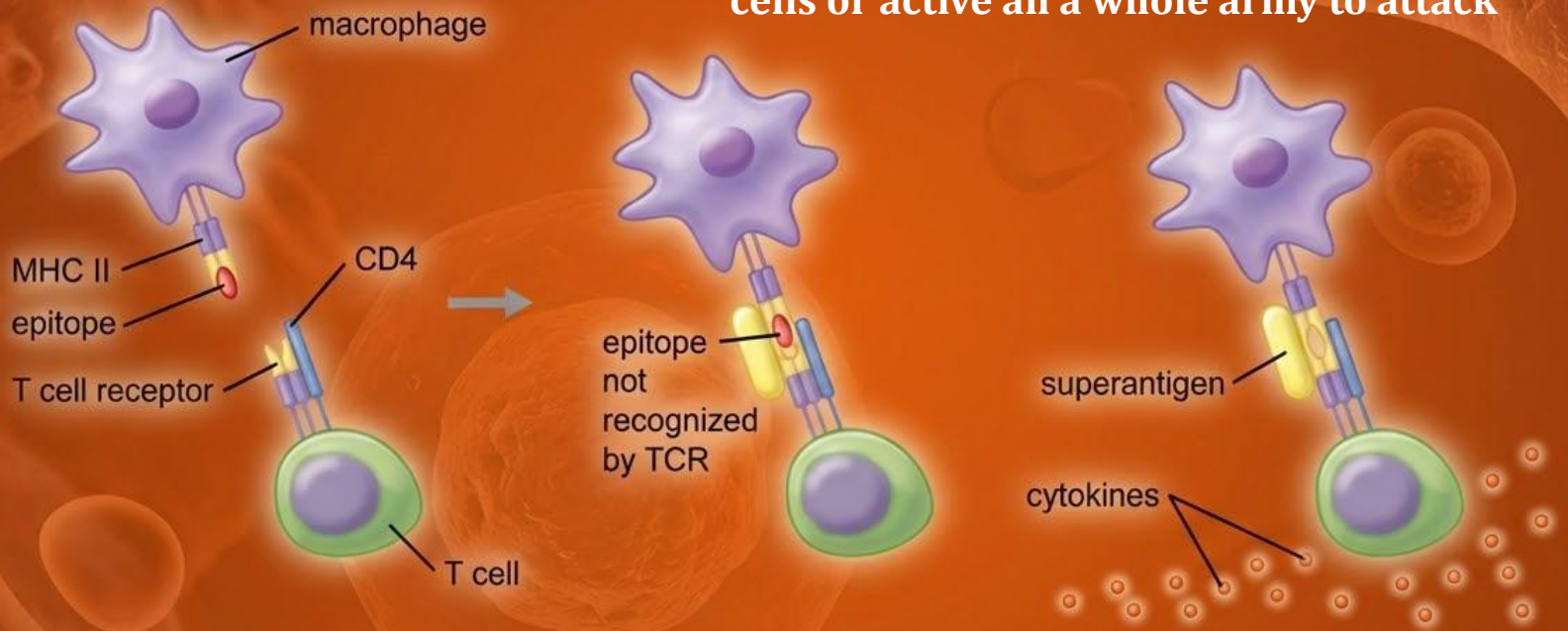

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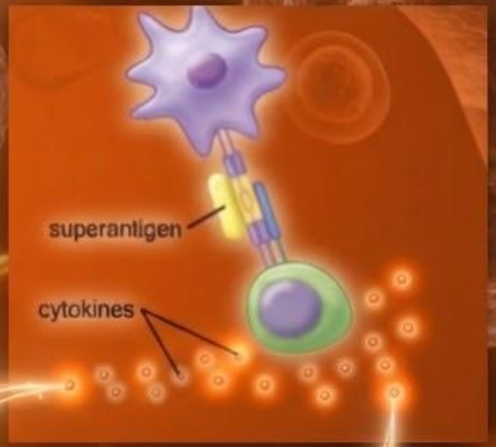
Photo Credit: https://courses.lumenlearning.com/suny-microbiology/chapter/t-lymphocytes-and-cellular-immunity/

Cytokine Released - Hype Team!!

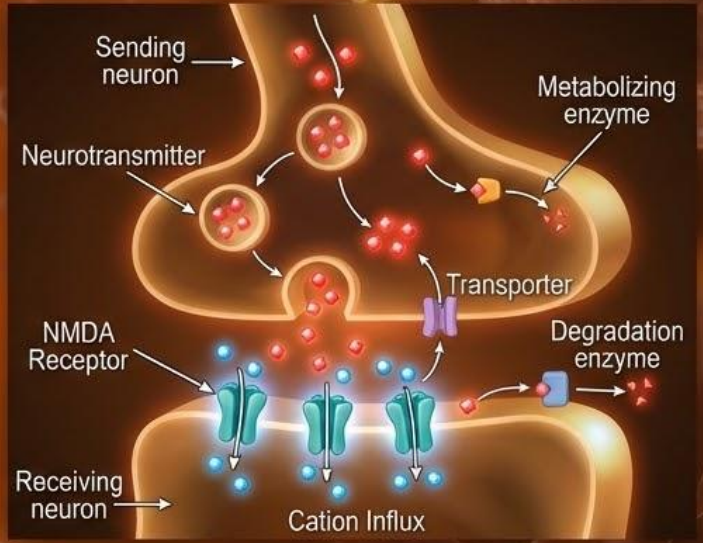
- **IL - 1** (Interleukin 1)
- **IL - 6** (Interleukin 6)
- Tumor Necrotic Factor Alpha



This triad will act on specific neuron receptors to hyperactive NMDA Receptors

NMDA Receptors & Seizures

- NMDA Receptors cause cation influx
- Influx makes the neuron very positive
- Increased positive charge leads to more action potentials
- Excessive action potentials can lead to seizures



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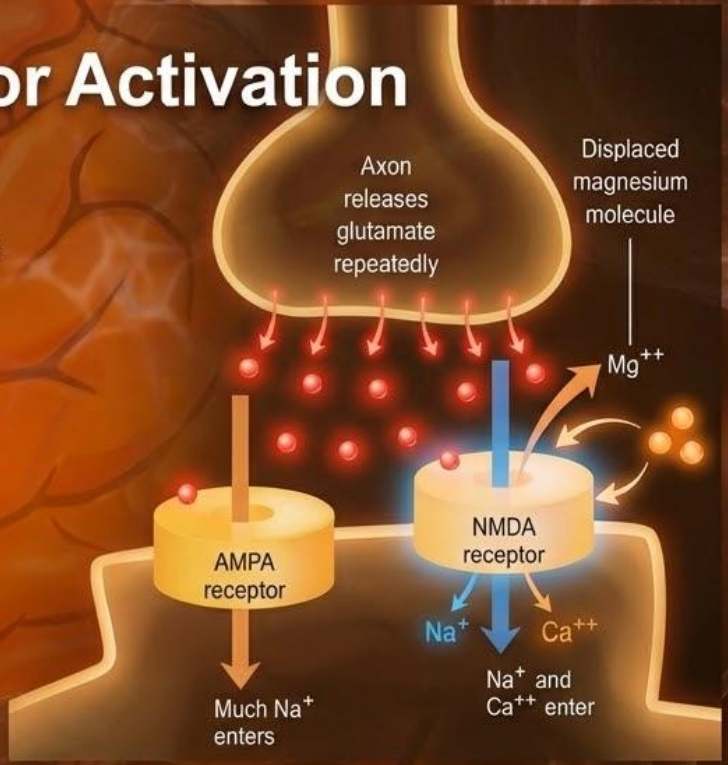
Cytokines & NMDA Receptor Activation

- Cytokines do not directly cause the seizure.
- They increase NMDA receptor stimulation, enhancing glutamate binding.
- More glutamate leads to increased Na^+ and Ca^{++} influx.



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Cytokine Released - Hype Team!!

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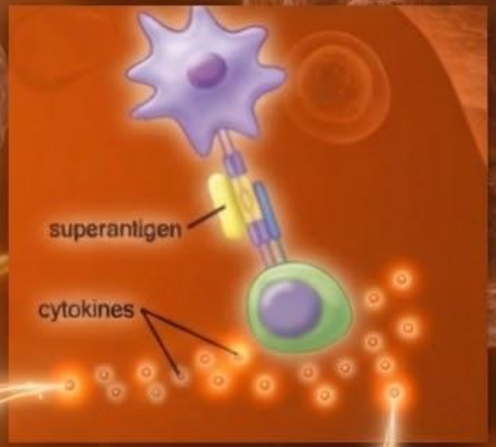

The cytokines also interact with the hypothalamus

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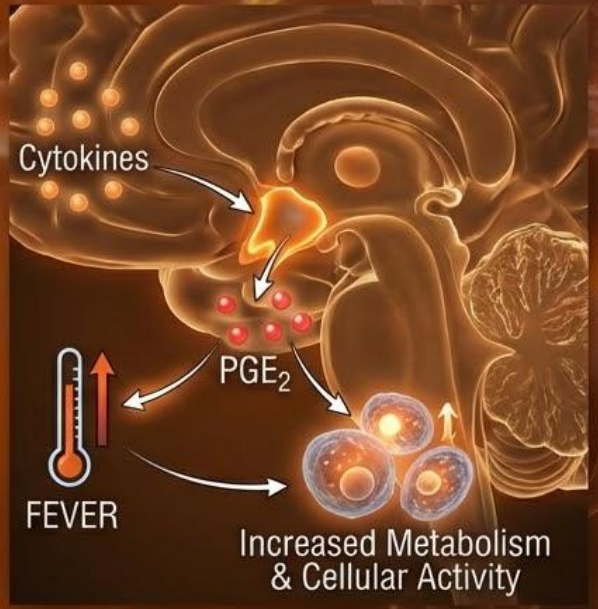
Hypothalamus

- Regulates body temperature
- Cytokines interact with the hypothalamus, triggering PGE2 release
- PGE2 increases the body's temperature set point, causing FEVER
- Fevers increase metabolism and cellular activity



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Right back where we started

NMDA Receptors & Seizures

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- Influx makes the neuron very positive
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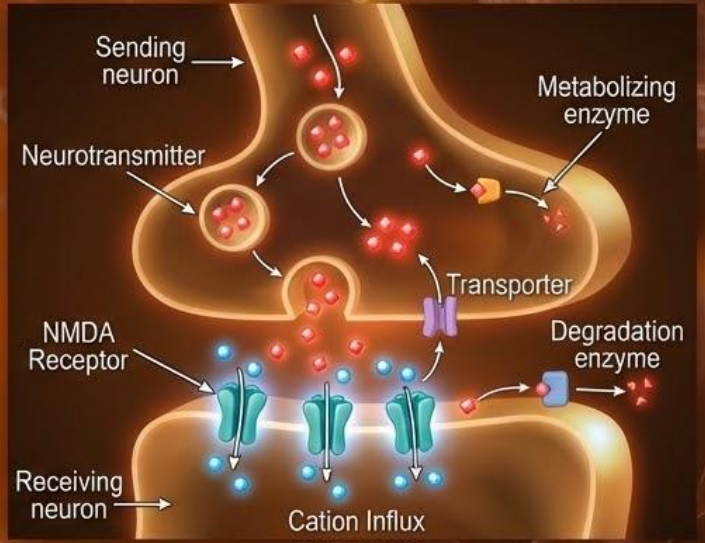

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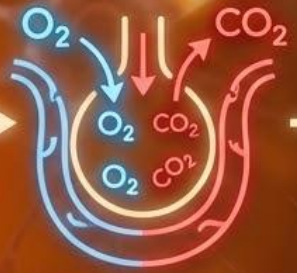
Fevers Increase Metabolism and Increase Oxygen Utilization

- Need to bring more O2 into the body
  - Breath faster
  - Breath deeper
- When oxygen comes in
  - CO2 goes out
    - CO2 levels drop



Respiratory Alkalosis

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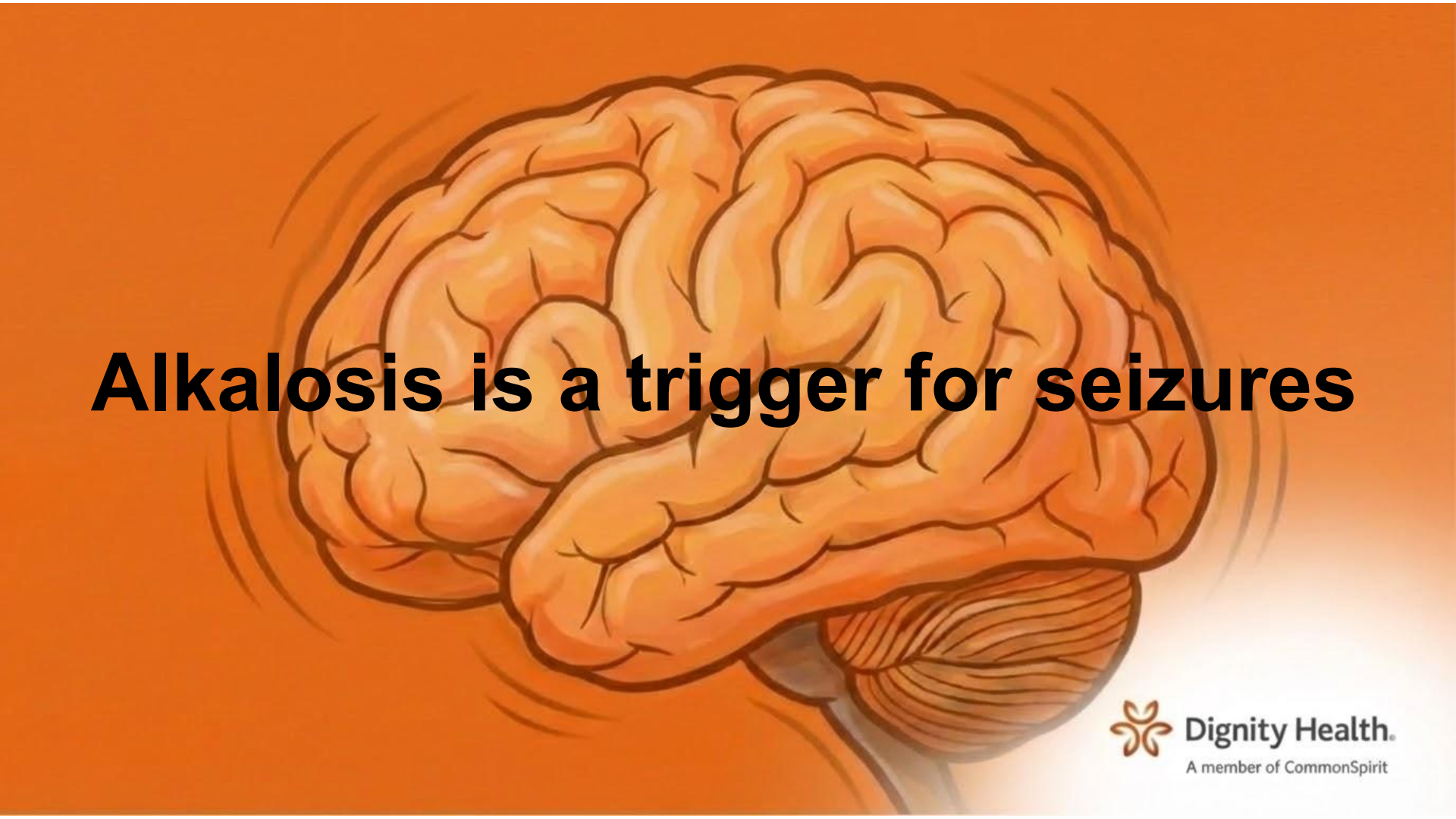
Alkalosis is a trigger for seizures
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3 Takeaways of Pathophysiology

1. NMDA Receptor Sensitivity

Cytokines increase sensitivity of NMDA receptors.

2. Increased Metabolic Rate

Increasing the body's temperature increases the metabolic rate of neurons and increasing the firing of neurons.

3. Respiratory Alkalosis

Increase of metabolism will increase oxygen demand which increases respiratory rate leading to respiratory alkalosis.

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Why you should transport a febrile seizure patient?

They need a diagnosis causing the fever

Viral & Post Vaccination


Viral Infections


Exanthems - Rash


Lesions in Oral Cavity


Post Vaccination

Common Infections


Respiratory Infection


Urinary Tract Infection (UTI)


GI Tract Infection

Meningeal Signs


Meningeal Signs


Neck Stiffness


Headaches

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Once they arrive at the hospital

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Lab Work for Seizures

CBC / CMP

- Complete Blood Count
- Comprehensive Metabolic Panel

Glucose & Sodium

- Glucose Level
- Sodium Level (Hyponatremia <115)

Blood Cultures & Lumbar Puncture

- Blood Cultures
- If complex: Lumbar Puncture

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Hyponatremic Seizures in Infancy

hyponatremia was found to be the underlying etiology in 70% of afebrile infants with an otherwise normal physical exam

- **Water intoxication**
  - Over diluting water
  - Free Water
- **Inappropriate ADH release**
- **Renal Salt Wasting**
- **Cystic Fibrosis - Salt Wasting**

Seizures from hyponatremia were more likely to be associated with status epilepticus, emergency intubation and hypothermia

- **Treatment 2-3cc/kg of 3% NaCL**

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Radiographic Imaging for Seizures

CT Scan Findings

- Lesion
- Abscess
- Blood - Trauma
- Tumor

Associated Symptom

Vomiting when first waking for the day

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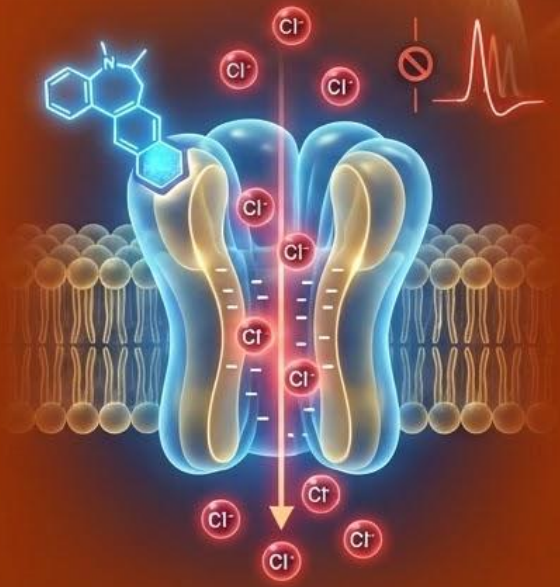
Treatment

Often No Treatment is Needed

Benzodiazepines

Benzodiazepines: binds to GABA receptor making them more sensitive causing Cl- to rush in. The high amount of negative electrons stops the action potential.



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Treat to Prevent Fever

Never Give Aspirin

Acetaminophen/NSAID to target Hypothalamus

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Hypothalamus

- Regulates body temperature
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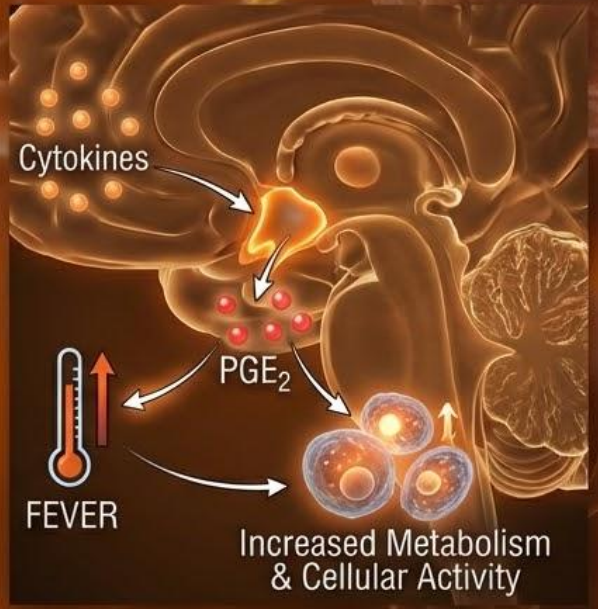

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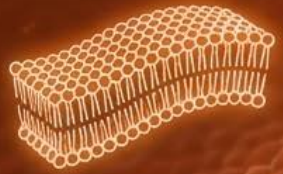
THE FEVER PATHWAY & NSAID MECHANISM

HYPOTHALAMUS CELL MEMBRANE



Lipids converted by Phospholipase A2 to Arachidonic Acid.

Inflammatory Stimuli

CORTICOSTEROIDS

Phospholipase A2

ARACHIDONIC ACID

Arachidonic Acid converted to Prostaglandins (PGE2) by COX.

NSAIDs

COX 1 or 2

PGG2

POX

ACETAMINOPHEN

PROSTAGLANDINS (PGE2)

FEVER

NSAID ACTION: NSAIDs block COX enzymes, preventing Prostaglandin production.

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Arizona Epilepsy Statistics

77,000 people have epilepsy
- 11, 200 children

Higher rates in elderly and Native American populations

2020 Study - **40.6%** treatment gap for individuals with epilepsy on AZ Medicaid programs

10% of known epilepsy patients are using ED for seizure related issure suggesting better outpatient management

EPILEPSY FOUNDATION ARIZONA

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Epilepsy Foundation of Arizona

Camp Candelight 2026
Whispering Hope Ranch
Payson

22 Seizure First Aid Trainings
reaching 345 people

EPILEPSY FOUNDATION®
ARIZONA

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Arizona Seizure Safe School Act

April 29, 2022 Doug Ducey

Seizure Management Plan

Parents complete a seizure management plan

Staff Training

Staff trained in seizure first aid

Rescue Medication & VNS

At least one school employee other than a school nurse is trained to administer rescue medication and use vagus nerve stimulation magnet

Good Samaritan Clause

Good Samaritan clause

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Epilepsy Foundation of Arizona

Seizure First Aid Ready Course

30 Minute - On Demand

Seizure Recognition and First Aid Training

90 Minute
2 Year Certification with CE

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ARIZONA

Seizure First Aid

How to help **someone** having a seizure **in a wheelchair**

1

STAY with the person until they are awake and aware after the seizure.

✓**Time** the seizure ✓Remain **calm**
✓Check for **medical ID** ✓Follow **Seizure Action Plan**
✓**Rescue medicines can be given** if prescribed by a health care professional

2

The wheelchair position should be **SAFE**.
Keep the person in the wheelchair.

- ✓ **Move or guide away from harm**
- ✓ **Pad the wheelchair** to prevent injury
- ✓ **Use wheelchair lock** to keep wheelchair in place
- ✓ **Put seatbelt on loosely** to keep them from falling out
- ✓ **Stand in front of the wheelchair** to prevent them from slipping out

3

Turn the person's chin down and to the **SIDE**.
Support their head to help keep the airway clear.

✓In some situations, the person may need to come out of the wheelchair. Call for help and guide them gently to the floor Turn the person onto their **SIDE** with their head turned to the side if they are not awake and aware.

- ✓ **Loosen tight clothes** around neck
- ✓ Put **something small and soft** under the head

Call 911 if...

- Seizure lasts longer than 5 minutes
- Person does not return to their usual state
- Person is injured, pregnant, or sick
- Repeated seizures
- First time seizure
- Difficulty breathing

Do NOT

✗ Do **NOT** restrain.
✗ Do **NOT** put any objects in their mouth.

Learn More and Register for Training: **epilepsy.com/firstaid**

EPILEPSY FOUNDATION

This publication was created by the Epilepsy Foundation, a nationwide network organization. | **National 24/7 Helpline 1.800.332.1000 | epilepsy.com**

Seizure First Aid

How to help someone having a seizure

1

STAY with the person until they are awake and alert after the seizure.

✓**Time** the seizure ✓Remain **calm**
✓Check for **medical ID**

2

Keep the person **SAFE**.

✓Move or guide away from **harm**

3

Turn the person onto their **SIDE** if they are not awake and aware.

✓Keep **airway clear**
✓**Loosen tight clothes** around neck
✓Put **something small and soft** under the head

Call 911 if...

- Seizure lasts longer than 5 minutes
- Person does not return to their usual state
- Person is injured, pregnant, or sick
- Repeated seizures
- First time seizure
- Difficulty breathing
- Seizure occurs in water

Do NOT

✗ Do **NOT** restrain.
✗ Do **NOT** put any objects in their mouth.
✓**Rescue medicines can be given** if prescribed by a health care professional

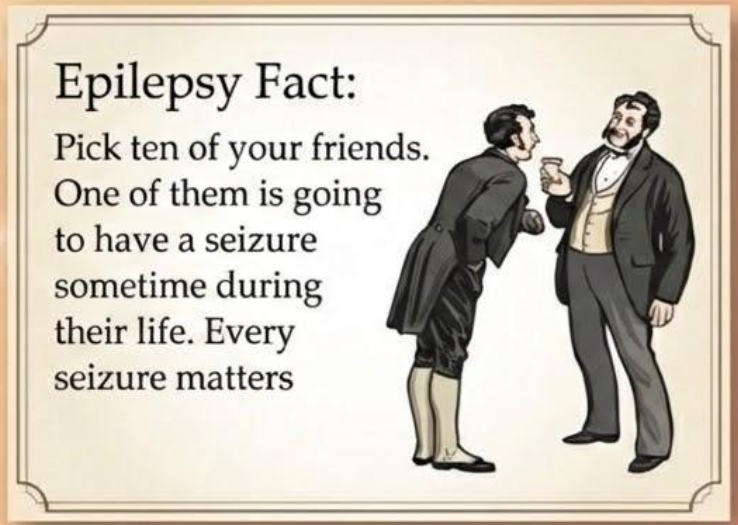
Learn more: **epilepsy.com/firstaid**

EPILEPSY FOUNDATION | epilepsy.com

24/7 Helpline: 1-800-332-1000

Thank you for all you do everyday for every patient!

Shari Flores DNP, MBA, MSN
shari.flores@commonspirit.org



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