Pediatric Readiness Program Education Session

THIS ACTIVITY HAS BEEN PLANNED AND IMPLEMENTED IN ACCORDANCE WITH THE ACCREDITATION REQUIREMENTS AND POLICIES OF THE ACCREDITATION COUNCIL FOR CONTINUING MEDICAL EDUCATION (ACCME) THROUGH THE JOINT PROVIDERSHIP OF LEGACY HEALTH AND OREGON EMERGENCY MEDICAL SERVICES FOR CHILDREN.

LEGACY HEALTH DESIGNATES THIS LIVE ACTIVITY FOR A MAXIMUM OF 1.0 *AMA PRA CATEGORY 1 CREDIT(S)*™. PHYSICIANS SHOULD CLAIM ONLY THE CREDIT COMMENSURATE WITH THE EXTENT OF THEIR PARTICIPATION IN THE ACTIVITY.

PRP

PEDIATRIC READINESS PROGRAM

SERVING OREGON & SW WASHINGTON

Pediatric Seizures in the Emergency Department & An Increase in Pediatric Emergency Room Visits for Headache: Why Is This Happening and What Can We Do?

LAURA BLISS MD
ALISON CHRISTY MD PHD

AUGUST 15, 2024

Objectives

- Distinguish between primary and acute symptomatic seizures.
- Identify indications for ordering an outpatient EEG, obtaining other studies, and prescribing a rescue medication in the ED.
- Discuss options for families after they leave the ED.
- Understand why pediatric patients come to the emergency room for headache, and why emergency room utilization is increasing.
- Discuss emergency room treatment of pediatric headache.

CME Disclosure

No relevant financial relationship(s) to disclose with ineligible companies whose primary business is producing, marketing, selling, reselling, or distributing healthcare products used by or on patients.

ED specific vignettes

- A patient with h/o epilepsy presents with breakthrough seizures in the setting of illness
- A patient presents with a first-time seizure
- A patient is ready to be discharged and needs to be seen by an outpatient Pediatric Neurologist
- A patient presents in status epilepticus

Pediatric Neurologic Emergencies

- Neurological disorders account for 2-12.5% of PED visits[1]
- ~3x frequency of pediatric intensive care unit (PICU) admissions[2]
- Seizures and Headache are the most common pediatric neurologic diagnoses that present to the ED

Table 2
Main diagnoses as a function of the original reason for attending the pediatric emergency department.

Main symptom	Diagnosis	*n* (%)
Seizures	Simple febrile seizure	68 (18.4)
	Complex febrile seizure	29 (7.8)
	Epilepsy	111 (30)
	Status epilepticus	2 (0.5)
Headache	Migraine with aura	38 (10.3)
	Migraine without aura	5 (1.4)
	Tension headache/chronic daily headache	23 (6.2)
	Brain tumor	2 (0.5)
	Subarachnoid hemorrhage	2 (0.5)
	Viral meningitis	2 (0.5)
	Vestibular neuritis	1 (0.3)

Pediatric Seizures in the ED

- **Febrile seizures**
- **Acute symptomatic seizures**
- **Primary/Unprovoked**
  - 1st unprovoked seizure = Not Epilepsy
  - Epilepsy recurrence
    - 2nd unprovoked seizure = Epilepsy
    - Abnormal EEG after 1st unprovoked seizure = Epilepsy

Febrile Seizures

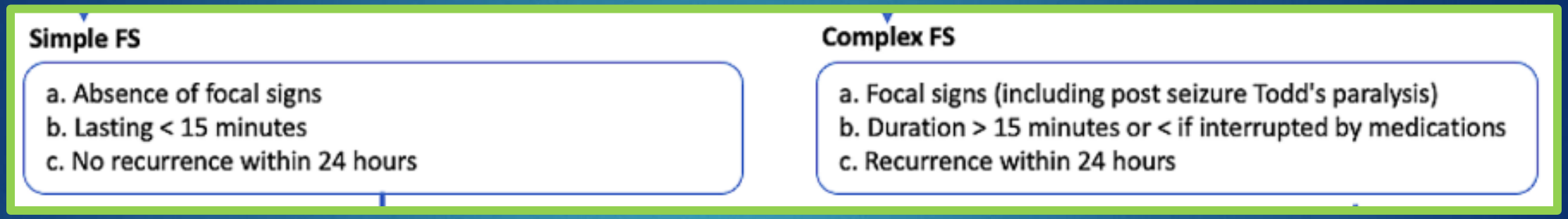
SIMPLE AND COMPLEX

Febrile Seizures (FS)

- Affect ~2–5% of children in the United States
  - **Ages 6 months to 5 years**
- “provoked” epileptic seizures starting during a febrile event/episode that occur in the absence of infection in the central nervous system (CNS)
- In the majority of cases, they do not lead to a diagnosis of epilepsy

Ferreti et. al.

Febrile Seizures (FS)



- **Simple FS**: if well-appearing, blood examinations, neuroimaging, or EEG are generally not required unless needing to determine the cause of the fever.
- **Complex FS**: rEEG and Neurology referral

- **For infants <1yo**: consider lumbar puncture

Ferreti et. al.

Febrile Seizures (FS)

- ~30-50% will have subsequent FS
  - For both simple and complex FS
- Children with simple FS have a 1% risk of developing epilepsy
- Complex FS = 4-15% risk

RED FLAGS FOR RECURRENCE OF FS

Age younger than 18 months
Fever duration of less than one hour before seizure onset
Family history of FS
Occurrence of the FS with a relatively low level of temperature
Preexisting neurodevelopmental abnormality

RED FLAGS FOR FUTURE UNPROVOKED SEIZURE/EPILESPY

Age older than 3 years at the time of the first FS
Complex FS
Family history of epilepsy
Fever duration of less than one hour before seizure onset
Preexisting neurodevelopmental abnormality
Multiple episodes of FS

OTHER RED FLAGS FOR DIFFERENTIAL DIAGNOSIS

Meningeal signs
Altered level of consciousness for more than 1 hour after FS interruption
Abnormalities in vital signs that are disproportionate to body temperature
Abnormalities in vital signs persisting after body temperature normalization

Ferreti et. al.

Acute Symptomatic Seizures

- Seizures occurring within a certain time-period of an inciting event
  - within 24 hours for metabolic derangements
  - within 7 days for stroke, traumatic brain injury (TBI), anoxic injury, demyelinating disease, infection, or intracranial surgery
- Causes:
  - Hypoglycemia
  - Electrolyte disturbances
  - Stroke
  - CVST
  - TBI
  - Autoimmune encephalitis
  - SLE
  - Inborn Errors of Metabolism

Romantseva et. al.

Acute Symptomatic Seizures

Table 2 Medications and illicit drugs that can lower seizure threshold[116–118]

Class	Drugs
Neurostimulants	Amphetamines
Analgesics	Tramadol
Antibiotics	Cephalosporins Fluoroquinolones Carbapenems Penicillins Isoniazid
Antidepressants	Bupropion Lithium Maprotiline Clomipramine
Antipsychotics	Chlorpromazine Clozapine
Illicit drugs	Alcohol Amphetamine Cocaine

Romantseva et. al.

Acute Symptomatic Seizures

- Head imaging not always indicated
  - especially if the patient has a reliable neurological examination

American Academy of Neurology guidelines for neuroimaging after the first seizure in pediatric patients presenting to the emergency department found that neuroimaging findings changed management in only 2% of patients

- Consider urgent head CT if:
  - Patient does not return to baseline
  - Abnormal Neuro exam
  - Prior NSGY procedures

- For neonates and preschool group – obtain head circumference

Romantseva et. al.

Neonatal Seizures in the ED

- Neonatal seizures are underrecognized and non-epileptic events are over-treated
- Electroclinical dissociation – the majority of neonatal seizures are subclinical
  - cEEG necessary
- **Phenobarbital is first-line treatment of neonatal seizures** per expert consensus.
  - At this time, Levetiracetam has not been proven to be non-inferior to PHB

Romantseva et. al.

First unprovoked seizure

WITH PATIENT BACK TO BASELINE

1st time unprovoked seizure

- ~1% of children experience at least one afebrile seizure by adolescence[6]
  - 40–50% of patients with unprovoked seizure can expect a recurrence within 2 years of the initial seizure[7]
  - **ASM typically not prescribed**

- "Unprovoked" if no inciting factors or after evaluation for acute symptomatic cause is negative
- **Description of the event is key**
- **Outpatient rEEG and pediatric neurology referral**
- **Consider rescue medication**

1st time unprovoked seizure – indications for a rescue medication

Weight-Band Dosage Recommendations for Rectal Gel Diazepam: Children 2 to 5 Years

Weight	Dose (mg)	Second Dose
6 to <11 kg	5 mg	May repeat dose in 4 to 12 hours if needed.
11 to <16 kg	7.5 mg	May repeat dose in 4 to 12 hours if needed.
16 to <21 kg	10 mg	May repeat dose in 4 to 12 hours if needed.
21 to <26 kg	12.5 mg	May repeat dose in 4 to 12 hours if needed.
26 to <31 kg	15 mg	May repeat dose in 4 to 12 hours if needed.
31 to <36 kg	17.5 mg	May repeat dose in 4 to 12 hours if needed.
36 to 44 kg	20 mg	May repeat dose in 4 to 12 hours if needed.

IN Midazolam: 0.2 mg/kg once; maximum dose: 10 mg/dose

- Reserve for **prolonged convulsive seizures**
  - > 2 minutes of continuous convulsive activity

OHSU Pediatric Neurology Referral

- Referral is “triaged”
- Current wait times = up to 6 months
- Helpful to get rEEG before neurology appointment

- PCP is point-person until patient is seen by Neurology
  - Medication refills
  - Side effects
  - Further seizure activity

Seizure Recurrence in Epilepsy

Epilepsy Seizure Recurrence

- Common causes: illness, sleep deprivation, medication non-adherence, “outgrew” medication dose
- Drug levels if applicable
- Advise families to tell their Neuro provider they were in the ED
- Discharge summaries are super helpful

- Consider a “benzo bridge”
  - 0.02-0.05mg/kg Clonazepam divided BID x3 days

Epilepsy Seizure Recurrence

What is the safe observation period for seizure recurrence in pediatric emergency departments?

Emel Ulusoy [a], Şebnem Uysal Ateş [b], Hale Çitlenbik [a], Ali Öztürk [a], Nihan Şık [a], Gazi Arslan [c], Durgül Yılmaz [a], Uluç Yiş [d], Semra Hız [d], Murat Duman [a,*]

[a] Dokuz Eylul University, Faculty of Medicine, Department of Pediatrics, Division of Pediatric Emergency Care, Izmir, Turkey
[b] Dokuz Eylul University, Faculty of Medicine, Department of Pediatrics, Izmir, Turkey
[c] Dokuz Eylul University, Faculty of Medicine, Department of Pediatrics, Division of Pediatric Intensive Care Unit, Izmir, Turkey
[d] Dokuz Eylul University, Faculty of Medicine, Department of Pediatrics, Division of Pediatric Neurology, Izmir, Turkey

- Seizure recurrence occurred in up to 24% of patients (n = 149)
  - 87% within 6 hours
  - 95% within 12 hours
- For both patients with and without risk factors: most seizures recurred within 6 hours

Status Epilepticus

- First line – benzodiazepine, can repeat dose
- Second line – IV antiseizure medication that is most available
  - Fosphenytoin 20mg/kg
  - Keppra [levetiracetam] 60mg/kg
  - Lacosamide 4mg/kg
  - Valproic Acid 20-40mg/kg
  - **Neonates**: Phenobarbital 20mg/kg or Keppra [levetiracetam] 60-80mg/kg
- Third line – benzo drip

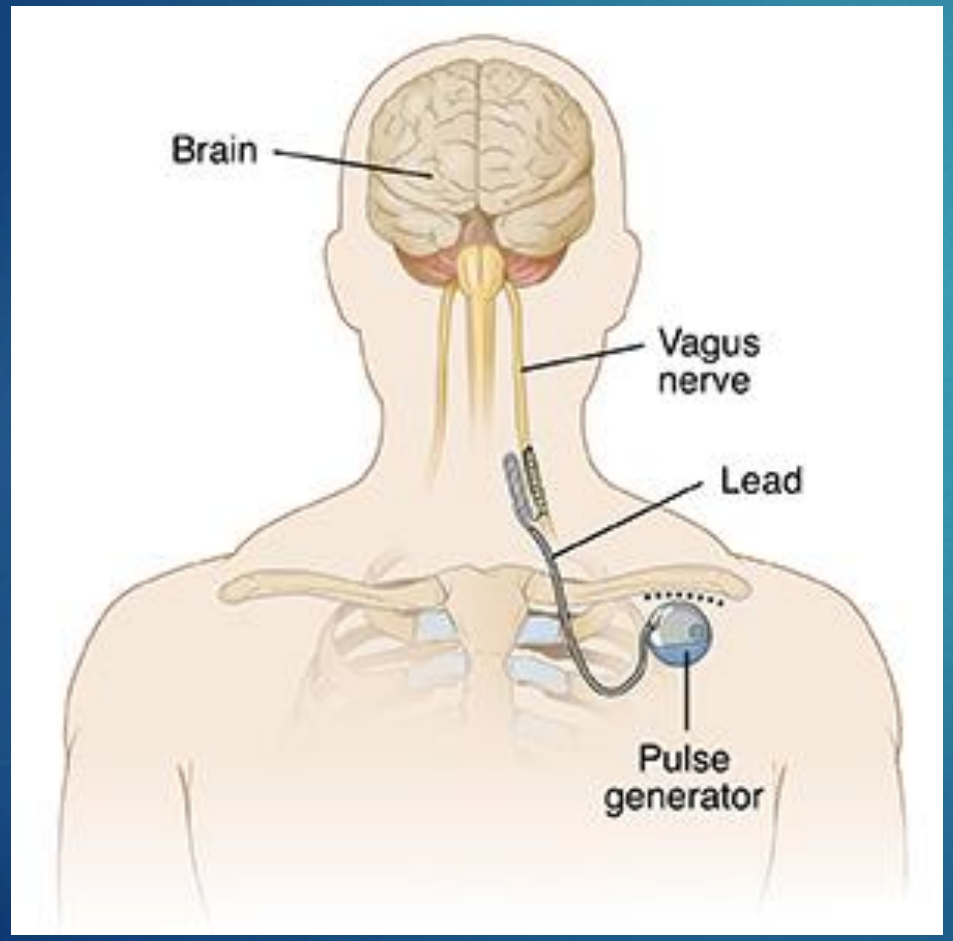
Special Considerations

KETOGENIC DIET AND VNS

Special Cases – Ketogenic Diet

- Common Presentations
  - GI disturbance (vomiting)
  - Metabolic derangements
  - Dehydration
  - Infections
  - Seizures
- Patients often need to be admitted
- **Avoid Dextrose containing IV fluids**

Special Cases – Vagal Nerve Stimulator (VNS)



- VNS settings must be set to 0 on all parameters before obtaining any MRI
- Requires VNS equipment – may need to transfer to an epilepsy center

References

1. Alpern ER et al; Pediatric Emergency Care Applied Research Network. Epidemiology of a pediatric emergency medicine research network: the PECARN Core Data Project. Pediatr Emerg Care. 2006 Oct;22(10):689-99
2. Moreau JF et al; Hospitalizations of children with neurologic disorders in the United States. Pediatr Crit Care Med. 2013 Oct;14(8):801-10.
3. Personnic J et al; Neurological disorders encountered in a pediatric emergency department. Eur J Paediatr Neurol. 2021 May;32:86-92.
4. Ferretti A et al; Best practices for the management of febrile seizures in children. Ital J Pediatr. 2024 May 12;50(1):95.
5. Romantseva L, Lin N. Acute Seizures-Work-Up and Management in Children. Semin Neurol. 2020 Dec;40(6):606-616.
6. Murphy CC, Trevathan E, Yeargin-Allsopp M. Prevalence of epilepsy and epileptic seizures in 10-year-old children: results from the Metropolitan Atlanta Developmental Disabilities Study. Epilepsia. 1995 Sep;36(9):866-72.
7. Woo S, Nah S, Kim M, Moon J, Han S. Predictors of seizure recurrence in emergency department pediatric patients with first-onset afebrile seizure: A retrospective observational study. Am J Emerg Med. 2021 Dec;50:316-321.
8. Ulusoy E, Uysal Ateş Ş, Çitlenbik H, Öztürk A, Şık N, Arslan G, Yılmaz D, Yiş U, Hız S, Duman M. What is the safe observation period for seizure recurrence in pediatric emergency departments? Epilepsy Behav. 2023 Feb;139:109049.

PROVIDENCE Children's Health

An increase in Pediatric ER visits for headache: Why is this happening, and what can we do?

Alison Christy, MD, PhD, FAAN
Director of Pediatric Neurology, Providence Health and Services Northern Oregon
Chair of the History Section of the American Academy of Neurology
Deputy Editor, *Journal of Child Neurology*
www.Neurdle.com **www.NeurdGames.com**

Disclosures:

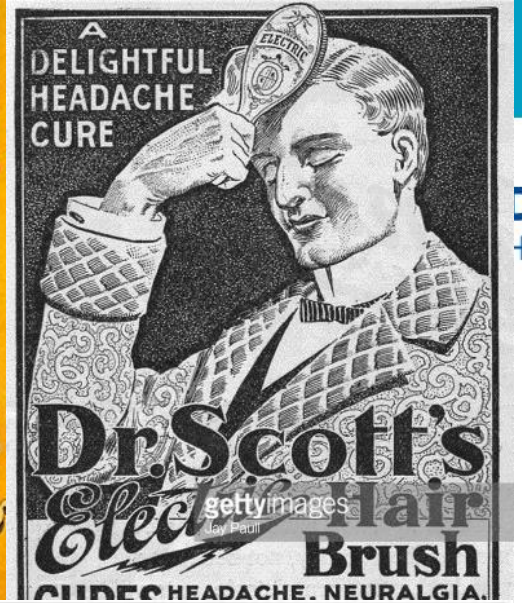
- Alison Christy, faculty for this educational event, is a researcher for/has received research funding from AbbVie, Biohaven/Pfizer, and Eli Lilly.

- All of the relevant financial relationships listed for this individual have been mitigated.

- All other planners and faculty for this educational activity have no relevant financial relationship(s) to disclose with ineligible companies whose primary business is producing, marketing, selling, re-selling, or distributing healthcare products used by or on patients.


A HELPFUL HINT TO WIVES
ON EASING SEVERE HEADACHE AT TIMES WHEN YOU MUSTN'T FAIL
WHY MARY— TAKE SOME BAYER ASPIRIN
OH ANN— MY PAIN IS TERRIBLY BAD— DO YOU THINK—
I DON'T THINK— I KNOW. BAYER ASPIRIN RELIEVES HEADACHE FAST. NOW YOU TAKE THESE TABLETS — IT'S JUST AMAZING HOW QUICKLY THEY TAKE HOLD
I CAN'T BELIEVE IT—HARDLY A TRACE OF MY HEADACHE LEFT — I DON'T SEE HOW BAYER ASPIRIN CAN WORK SO FAST—HERE'S BOB AND MR. JONES NOW.
AFTER DINNER
BOB, YOU HAVE A WONDERFUL WIFE—JUST THE KIND OF PEOPLE I CAN DEPEND ON. WHEN YOU GET YOUR NEXT PAY ENVELOPE GET READY FOR A SURPRISE.
The REASON
Bayer Aspirin Works So FAST
Drop a Bayer Aspirin tablet into a glass of water.
By the time it hits the bottom of the glass it is disintegrating.


DRINK
Coca-Cola
TRADE MARK
Delicious
Refreshing
ures Headache,
Relieves Exhau
AT SODA FOUNTAINS

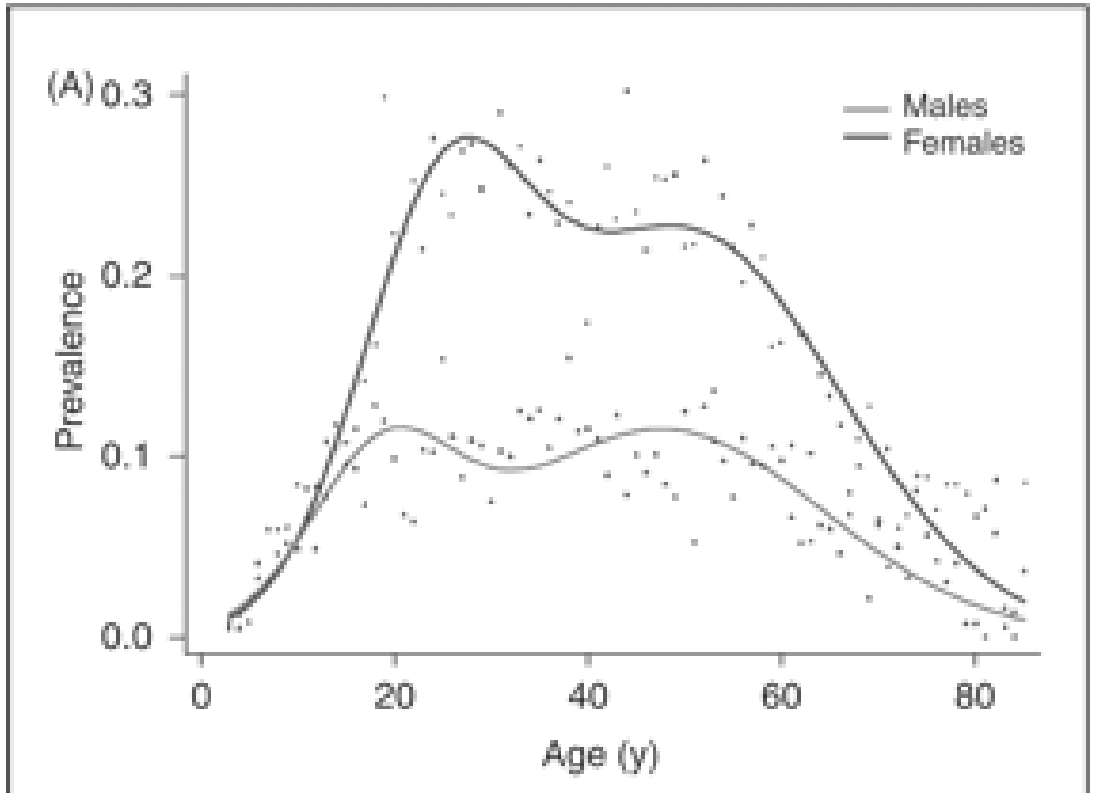

A DELIGHTFUL HEADACHE CURE
Dr. Scott's
Brush
HEADACHE, NEURALGIA


THE ORIGINAL CREATION
TA! RA! RA! BOOM DE AY!
As Sung by Miss Lottie Collins
in Miss Helyett.
BROMO-SELTZER CURES
all HEADACHES and NEURALGIA

ME-GRIM-INE
CURES HEADACHES AND NEURALGIA


When Boredom and Emotional Fatigue Bring on
"Housewife Headache"...
Making beds, getting meals, acting as family chauffeur—having to do the same dull work day after day—is a mild form of torture. This can bring on nervous tension, fatigue and what is now known as 'housewife headache'. For this type of headache you need strong yet safe relief. So next time take Anacin®. Anacin gives you twice as much of the strong pain reliever doctors recommend most as the other leading extra strength tablet.
Minutes after taking Anacin, your headache goes, so does its nervous tension and fatigue. Lets you feel better all over. Despite its strength, Anacin is safe taken as directed. It doesn't leave you depressed or groggy. Next time take Anacin Tablets!

Headaches



Age-specific, 1-year period prevalence of self-reported, physician-diagnosed migraine.

Victor et al., *Cephalgia*, 2010

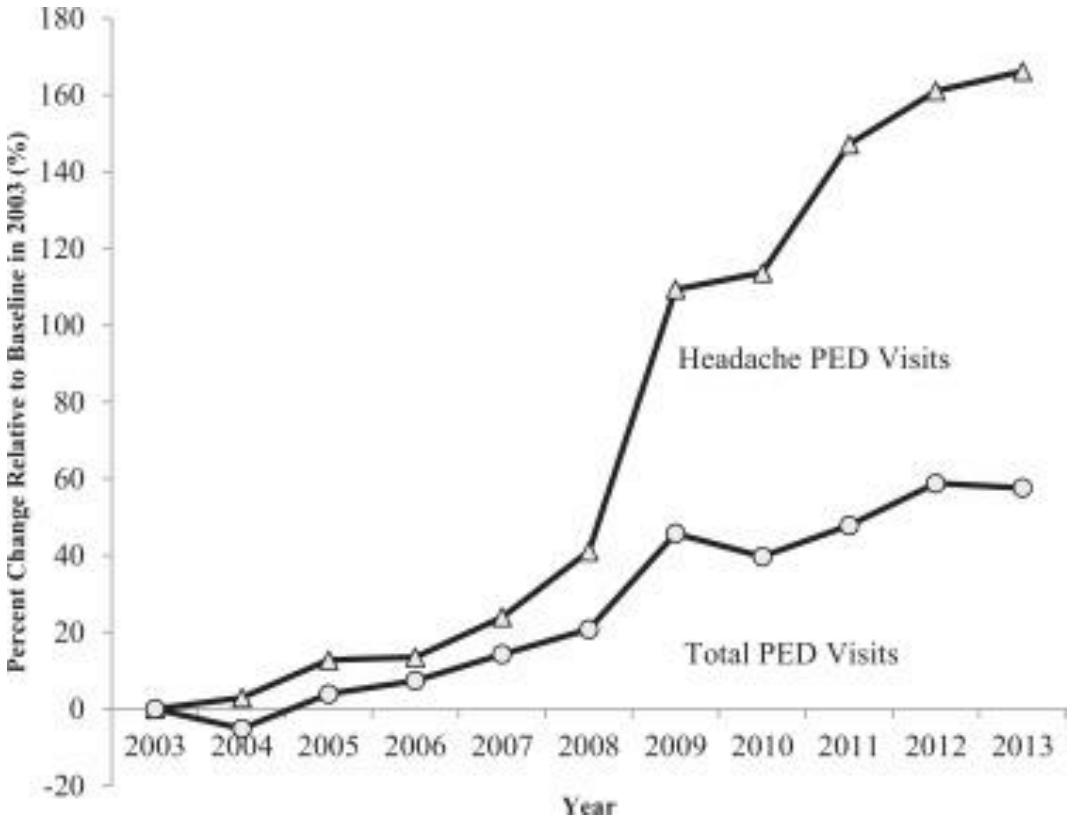
When to Worry: Is it a TUMOR?

- **Children with headaches from a serious brain pathology have neurological signs on examination**
  - **85% in 8 weeks, all in 24 weeks**

Imaging

- Recent onset
- Change in quality or frequency
- Abnormal exam
- Seizures
- Age < 3

- Rule of thumb:
  - if acute, get a CT
  - if more than one month, MRI

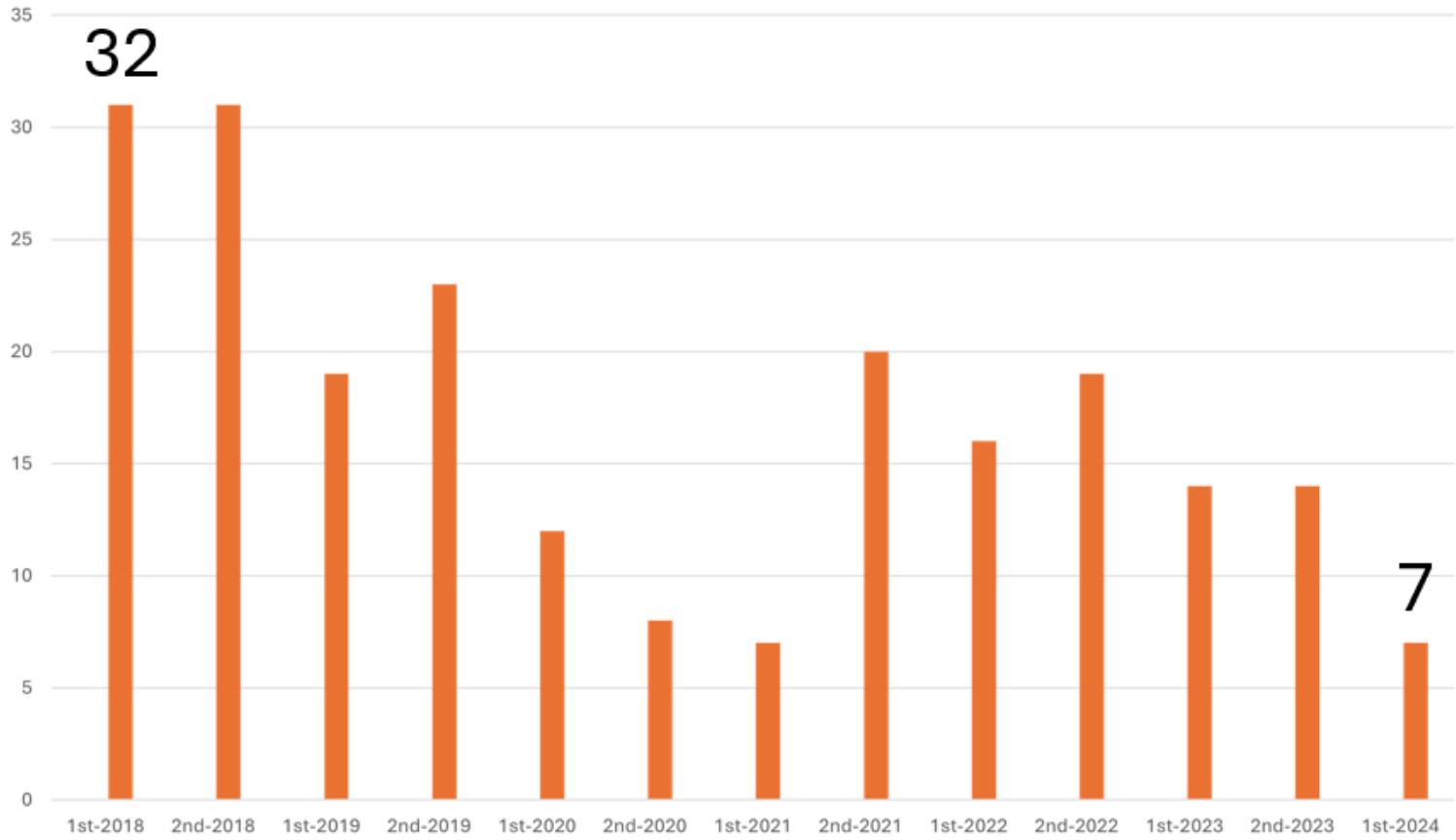


A Modern Epidemic: Increasing Pediatric Emergency Department Visits and Admissions for Headache

Pediatric Neurology.

Perry, Michelle C; Yaeger, Susan K... Show all. Published November 30, 2018. Volume 89. Pages 19-25. © 2018.

ED visits for Migraine/Headache at Providence in Portland, Under 18, 2018-2024



Migraine management

The three-legged stool:

- Acute symptomatic treatment
- Preventative treatment
- Lifestyle modifications

Lifestyle factors that influence headache

- Diet
- Hydration
- Sleep
- Exercise
- Caffeine
- Stress
- Menstrual cycle
- Electronics

Migraine management: Preventative

- **More than two migraines per month that are not fully controlled with acute treatments**

- CHAMP trial: amitriptyline vs topiramate vs. placebo
- All worked equally well
  - Frequent follow-up
  - Start with supplements
  - Lowest possible doses

Migraine management: Alternative preventative therapy

- Magnesium gluconate
- Riboflavin (Vitamin B2)
- Ubiquinone (Coenzyme Q10)

- Dietary Supplements (Migrelief, Migravent, Dolovent)

- Acupuncture
- Biofeedback, relaxation, yoga, cognitive behavioral therapy (CBT)
- Breathing, meditation

Migraine management: Preventative

- **More than two migraines per month that are not fully controlled with acute treatments**

- Amitriptyline – 10 mg qHS
- Cyproheptadine – 2 mg qHS
- Topiramate - 25 mg qHS
- Gabapentin - 100 mg qHS
- Propranolol – 20 mg qHS

  - OnabotulinumtoxinA (Botox)
  - CGRP inhibiting monoclonal antibodies (Erenumab, Fremanezumab-vfrm, Galcanezumab)
  - Rimegepant

Migraine management: Acute symptomatic treatment

Non-specific analgesics

- Ibuprofen, acetaminophen, naproxen, analgesic combinations
- Full dose, at headache onset, no more than 3 days a week

Triptans

- Sumatriptan, rizatriptan, almotriptan, frovatriptan

Anti-emetics

- Diphenhydramine
- Ginger
- Ondansetron
- Metoclopramide
- Prochlorperazine

CGRP inhibitors

- Ubrogepant
- Rimegepant

Migraine management: In the ED

- "Migraine cocktail"
  - Ketorolac
  - Nausea medications (metoclopramide)
  - IV Diphenhydramine
  - IV fluids
  - Triptan

Review Article | Full Access

Ketorolac in the Treatment of Acute Migraine: A Systematic Review

Erin Taggart MD (Candidate), Shandra Doran MD, PhD, Andrea Kokotillo MD (Candidate), Sandy Campbell MLS, Cristina Villa-Roel MD, MSc, PhD (Candidate), Brian H. Rowe MD, MSc

FULL TEXT ARTICLE

Diagnostic Testing and Treatment of Pediatric Headache in the Emergency Department

David C. Sheridan MD, Garth D. Meckler MD, MSHS, David M. Spiro MD, MPH, Thomas K. Koch MD and Matthew L. Hansen MD

Journal of Pediatrics, The, 2013-12-01, Volume 163, Issue 6, Pages 1634-1637, Copyright © 2013 Mosby, Inc.

Migraine management: At home

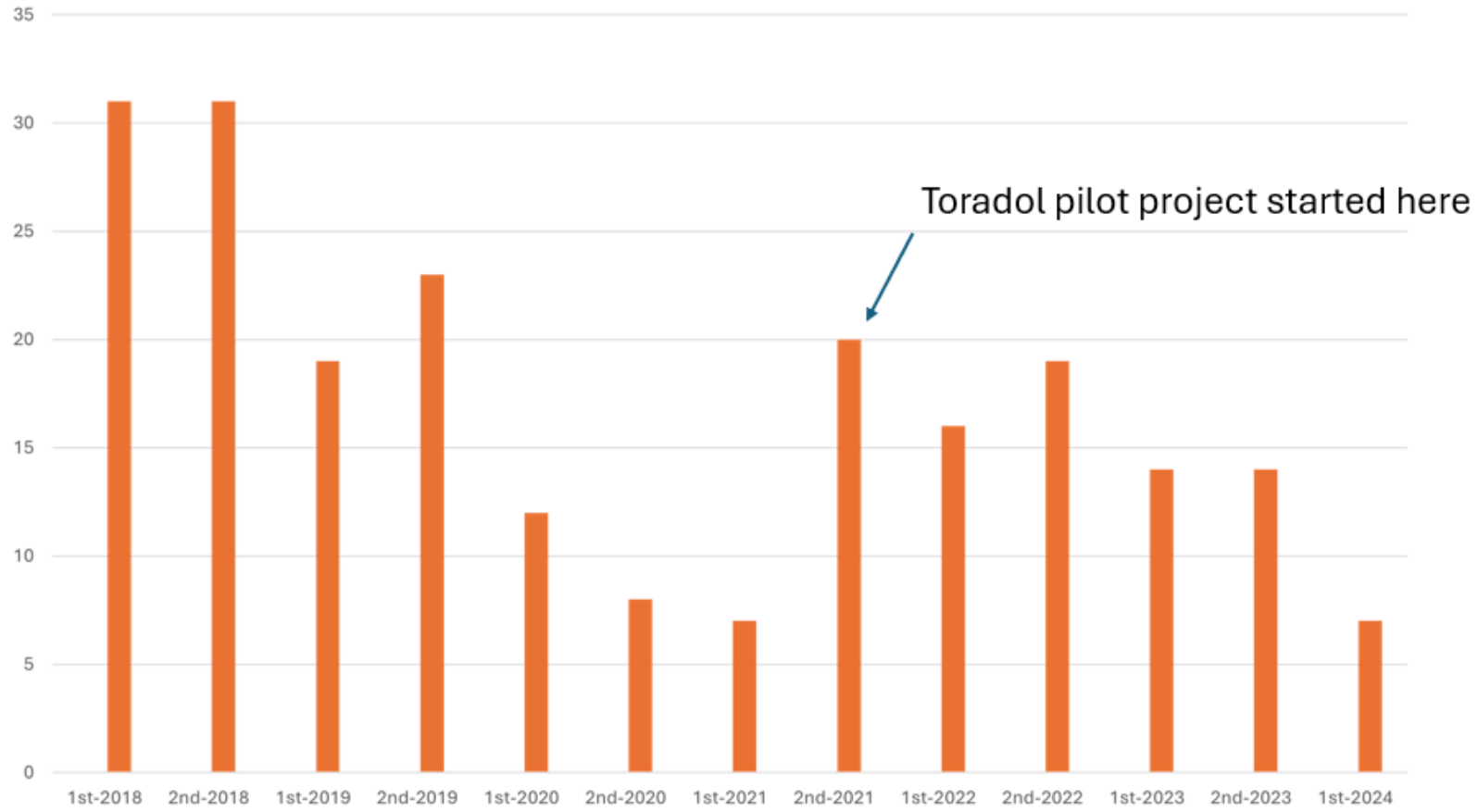
- “Migraine cocktail”
  - Ketorolac: 10 mg PO OR 600-800 mg ibuprofen
  - PO Nausea medications
  - PO Diphenhydramine
  - PO fluids
  - PO Triptan

- Ketorolac shot in clinic:
  - 15 mg (less than 45 kg) or 30 mg (more than 45 kg)
- Ordered by physician, given by the MA
- Physician doesn’t see patient

Unmeasurable: the benefit of another option

- Most headaches will diminish with time
- “If this headache isn’t gone by tomorrow, we can bring you in for a Toradol [ketorolac] shot”

ED visits for Migraine/Headache at Providence in Portland, Under 18, 2018-2024



Next steps

- Offering IV fluids in clinic
- Possibly nausea medications

Thank you!

- Alison Christy
- Alison.Christy@providence.org

- Huge thanks to Pediatric Specialty Clinic nurses **Jessica Polverini** and **Nicole Jacobson**

PRP

PEDIATRIC READINESS PROGRAM

SERVING OREGON & SW WASHINGTON

Scan this QR code with your phone

Thank you!

Remember to claim credit for this event!

1. Go to HTTPS://CMETRACKER.NET/LHS
2. Click on the claim credit button
3. Log in and claim your credit
4. To claim credit up to 30 days after date of presentation, CONTACT CMEREQUESTS@LHS.ORG FOR ASSISTANCE

FOR MORE INFORMATION VISIT
WWW.LEGACYHEALTH.ORG/PEDINET