Catherine Otten MD

September 27th, 2016

Pediatric Headache

Department of Pediatric Neurology

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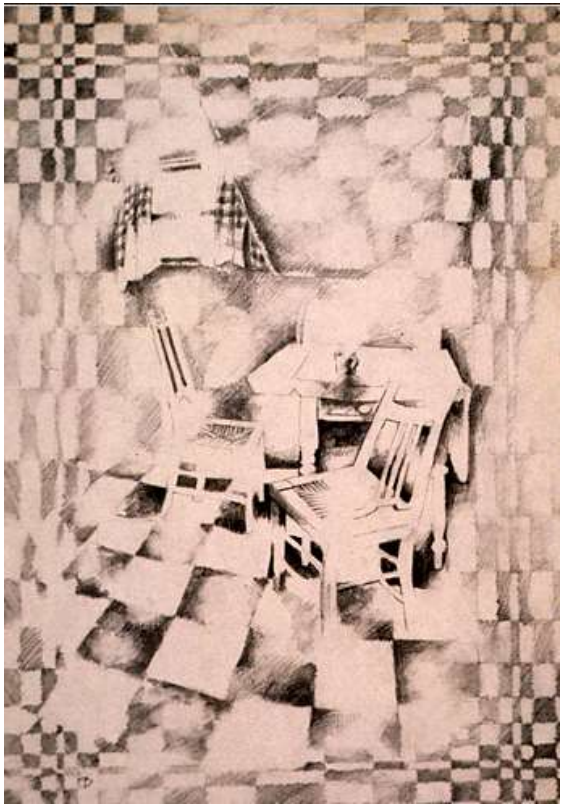
Pediatric Headache

- Prevalence and Population
- History and physical
- Types of headache
  - Primary
  - Secondary
  - Cranial neuralgias
- Red flags
  - When to obtain imaging
- Treatment
  - Abortive
  - Preventative
  - Non-pharmacologic



New York Times, 2/28/2008

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Headaches Are A Common in Pediatrics

Age	Headache prevalence	Recurring headache
7 years old	37-51%	2.5%
15 years old	57-82%	15%

- Migraines more prevalent earlier in boys, but girls surpass by puberty
  - Mean age of onset is 7.2 years in boys, 10.9 years in girls
- Prevalence of *chronic daily headache* is 1-2% in adolescents
- Tension-type headaches have a prevalence of 10-23% in ages 7-19
- **Headache precursors** are also common in pediatrics
  - Abdominal migraine
  - Benign paroxysmal vertigo
  - Cyclic vomiting syndrome

Laurell et al, *Cephalalgia* 2004; Bille et al, *Med Pregl* 1962; Stewart et al, *JAMA* 1992; Wang et al, *Headache* 2009)

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Detailed Headache History Is Necessary

Pattern of headache
- Triggers
- Timing
- Location
- Associated symptoms
- Severity
  - How much school and activities are missed?

Past medical history
- Previous medication trials

Sleep patterns
- Insomnia
- Nighttime awakenings

Exercise

Diet
- Caffeine
- Food triggers
- Skipped meals

Social history
- Activities
- Stressors
- School environment
- 504 Plan
- Mood/Depression screen

Family history
- Migraine
- Motion sickness

Types of headache

Primary Headache

- Migraine
- Tension-type

Secondary Headache

- Post-traumatic headache
- Medication or substance-induced headache
- Infectious headache
- Headache secondary to dental disease
- Vascular headache
- Idiopathic intracranial hypertension
- Structural malformations and masses

Cranial Neuralgias

- Ophthalmoplegic migraine
- Cluster headache
- Paroxysmal Hemicrania

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Types of headache
Migraine without aura

Diagnostic criteria*

- 5+ attacks
- Attacks lasting 1—72 hours
- Headache has 2:
  - ✓ Unilateral location
    - Children may have bitemporal or frontotemporal pain
  - ✓ Pulsating quality
  - ✓ Moderate or severe pain intensity
  - ✓ Worsened by routine physical activity
- During headache, at least 1:
  - ✓ Nausea and/or vomiting
  - ✓ Photophobia and phonophobia
    - May have to infer based on child's behavior
- Not due to another disorder

*per the International Headache Society 2015

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Types of headache
Migraine with aura

Aura = reversible focal neurological symptoms

- Lasts 5—60 minutes
- Appears over 5 minutes
- Pathophysiology theory
  - Polygenic ion channelopathy
  - Cortical spreading depression
  - Activation of the trigeminal system
  - Central and peripheral sensitization

Types of headache
Migraine Aura

- *Visual*
  - Scotoma
  - Binocular
  - Field deficit
  - Teichopsia
  - Metamorphopsia

- *"Alice-In-Wonderland" syndrome*
  - May arise from parietal or posterior temporal cortex
  - Objects change size or shatter
  - Micropsia or macropsia

- *Cognitive*
  - Aphasia
  - Confusion
  - Vertigo

- *Sensory*
  - Paresthesia
  - Dysesthesia
  - Perioral and hand numbness

- *Motor*
  - Hemiparesis or monoparesis

Migraine Triggers Are Often Environmental

- Poor sleep
- Dehydration
- Exercise
- Concurrent illness
- Stressors
- Foods
  - Chocolate
  - Citrus
  - Cheese
  - MSG
  - Caffeine
  - Processed meats
  - Aspartamine
  - Alcoholic beverages

Migraine Variants

- Basilar migraine
  - More frequent in younger children
  - Case report of decreased PCA perfusion on SPECT (La Spina, *Headache* 1997)
  - Symptoms attributable to posterior fossa
    - Pallor
    - Emesis
    - Vertigo
    - Ataxia
    - Nystagmus
    - Diplopia

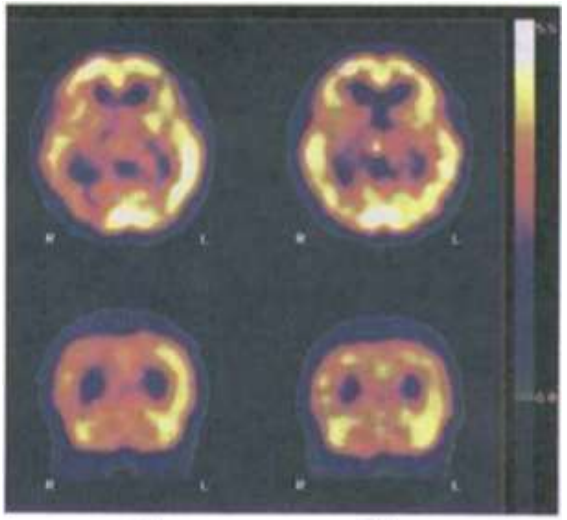

Fig 3.—Single photon emission computed tomography demonstrating relative hypoperfusion in the right parietal and occipital regions in the aura period (A). Normal findings a week later (B).

- Familial hemiplegic migraine
  - CACNA1A, ATP1A2, or SCN1A mutation
  - Headaches are associated with prolonged hemiplegia, numbness, aphasia, encephalopathy
  - May be acetazolamide-responsive

Diagnostic Testing in Pediatric Migraine

- Complete neurologic exam
  - Fundoscopic exam with visual acuity and fields
  - Ophthalmologic exam if visual concerns
- Routine neuro-imaging is not indicated
  - Obtain if concerns for increased intracranial pressure or abnormal neurologic exam

Red Flags Indicate Neuroimaging

- Age < 7 years
- New daily persistent headache
- Occipital location
- Morning headaches
- Progressive worsening
- Worsened pain with cough or sneeze
- Papilledema
- Neurologic exam abnormalities
- Sleep-associated headache
- History of chronic disease
    - Immunosuppression
    - Neurofibromatosis I
    - Tuberous sclerosis
    - Chiari I malformation
    - Hypercoagulable disorder
    - Seizures
    - VP shunt

13 year-old with headache

CASE

- Sporadic headaches for 2-3 years
- Worsening, now QOD
- Occipital pain is 8/10
- Worse with bright lights or loud sounds
- Tylenol provides some relief
- Sumatriptan → limited benefit
- Missing school 2-3 days/week
- Worse with exercise

→ Is this migraine?

→ Is neuroimaging needed?

13 year-old with headache

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- Worse with exercise

→ Is this migraine?

→ Is any neuroimaging needed?

13 year-old with headache

CASE

- Mental status normal: Using age-appropriate language, makes good eye contact.
- Cranial nerves intact, specifically full visual fields and normal visual acuity, but is unable to tolerate funduscopic exam.
- Motor exam reveals full and symmetric strength, patellar reflexes symmetric with crossed adductors.
- Sensation intact to multiple modalities.
- Coordination and Gait normal.

→ Is this migraine?

→ Is neuroimaging needed?

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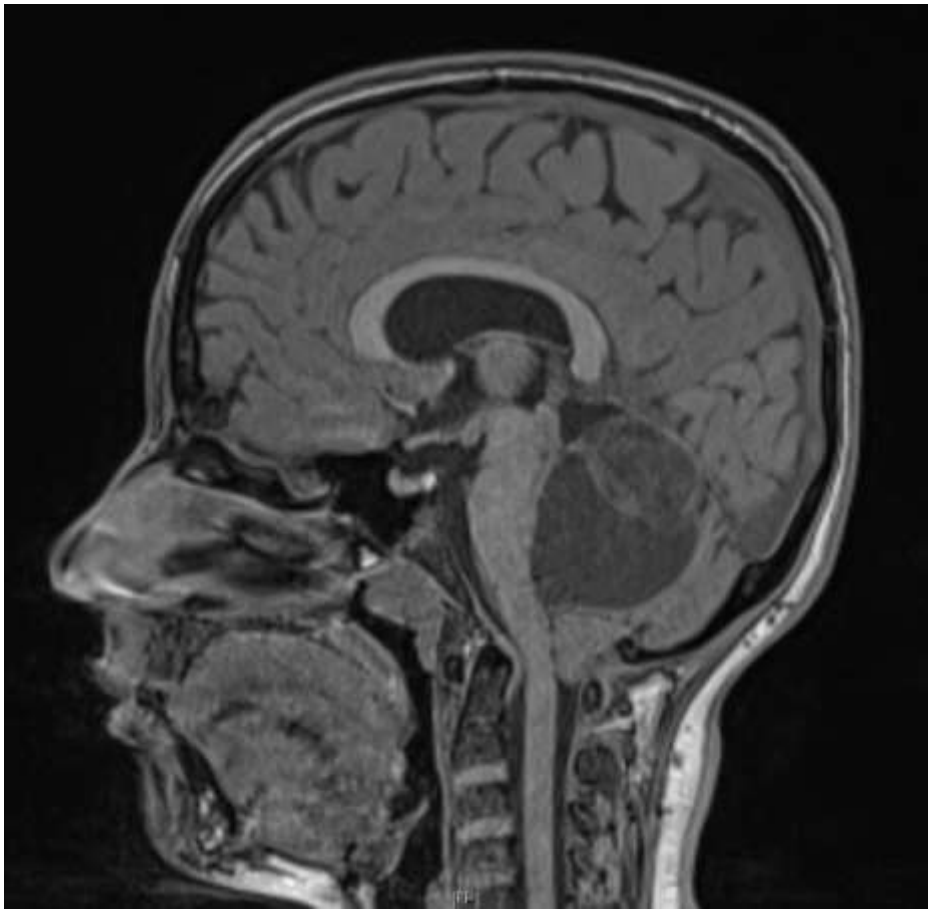
- Sensation intact to multiple modalities.
- Coordination and Gait normal.

→ Is this migraine?

→ Is any other testing needed?

13 year-old with headache

CASE MRI and MRV



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Types of headache

Primary Headache

- Migraine
- Tension-type

Secondary Headache

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Cranial Neuralgias

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Primary Headache
Tension-type headache

- Pain
  - "Band-like"
  - Bilateral
  - Mild to moderate intensity
  - May radiate down neck
- Similar triggers to migraine
- May be chronic or episodic
- No photophobia, phonophobia
- Not worsened by activity
- Often afternoon in children, midday or morning in teens

→ Differentiating from migraine helps guide preventative strategies that address cervicogenic onset

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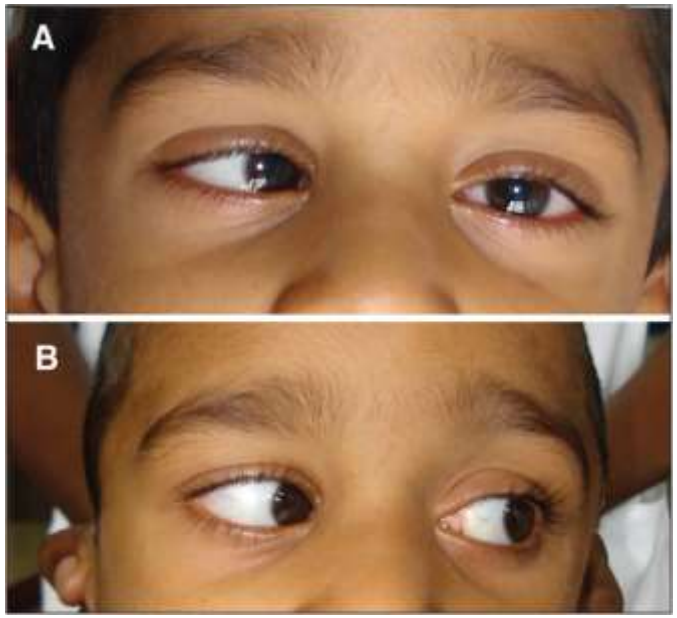
Cranial Neuralgias
Ophthalmoplegic migraine

- Differentiated from retinal migraine
- Characterized by ophthalmoparesis and headache
  - Ptosis, adduction deficits, skew deviations
  - Retro-orbital pain
  - Signs may persist after pain resolves
  - Inconsistent pupillary involvement
- Imaging often indicated
  - Must be distinguished from aneurysm or mass lesion



Cranial Neuralgias
Cluster Headache

Unilateral painful headache

Autonomic features

- Ipsilateral eye redness
- Tearing
- Congestion
- Rhinorrhea
- Sweating
- Ptosis or miosis

Low prevalence of 0.1% in pediatrics

Oxygen may abort attack

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Lampl et al, *Pediatric Neurology* 2009.

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Types of headache
Secondary headaches

CASE

15 year-old adolescent teenager

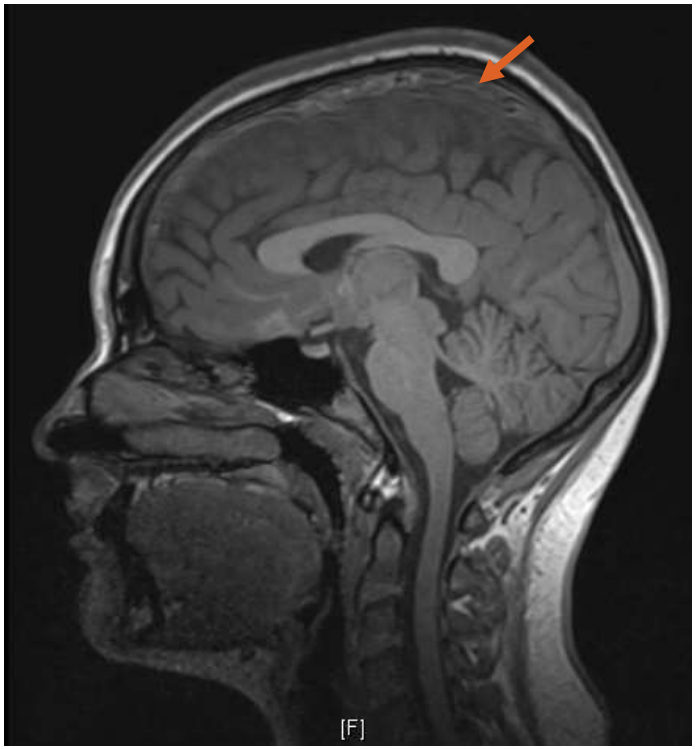
- Acute viral gastroenteritis → dehydration
- Severe holocephalic headache
- Worse with emesis and supine position
- Bilateral CN 6 palsies
- Papilledema on exam

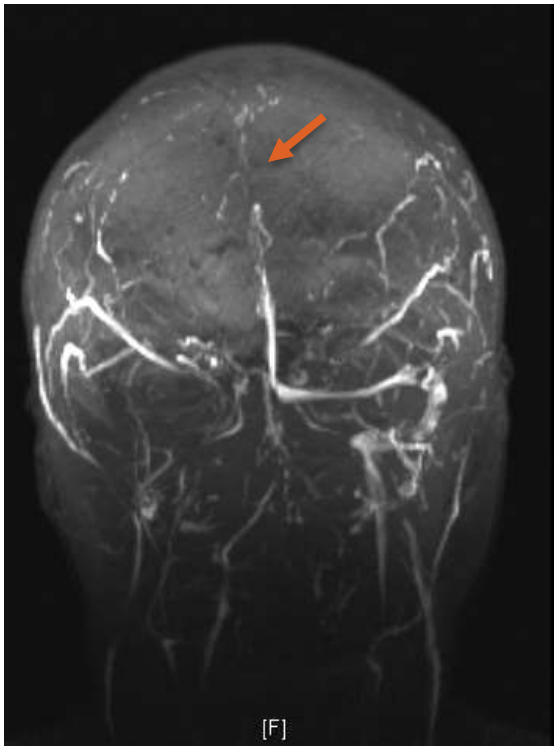
**CN 6 palsy is a "falsely-localizing sign" that can indicate elevated ICP*

Types of headache
Secondary headaches

CASE

MRI/MRV: Multi-sinus central venous sinus thrombosis





Types of headache
Secondary headaches

Idiopathic intracranial hypertension

- “Pseudotumor cerebri”
- Daily headache with diplopia and vision changes
- Positional headache: worse when supine
- Associations
  - OCPs
  - Obesity or rapid weight gain
  - Hypervitaminosis A
  - Steroids
  - Retinoids
  - Sarcoidosis
  - Sleep apnea
  - Systemic lupus erythematosus
  - Cyclosporine
  - Thyroid replacement
  - CSVT

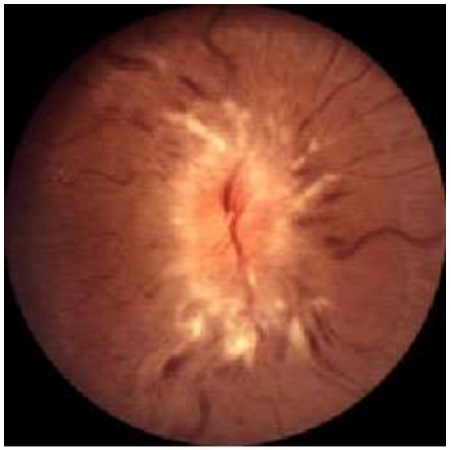


Figure 2: Optic nerve with papilledema

Types of headache
Secondary headaches

CASE

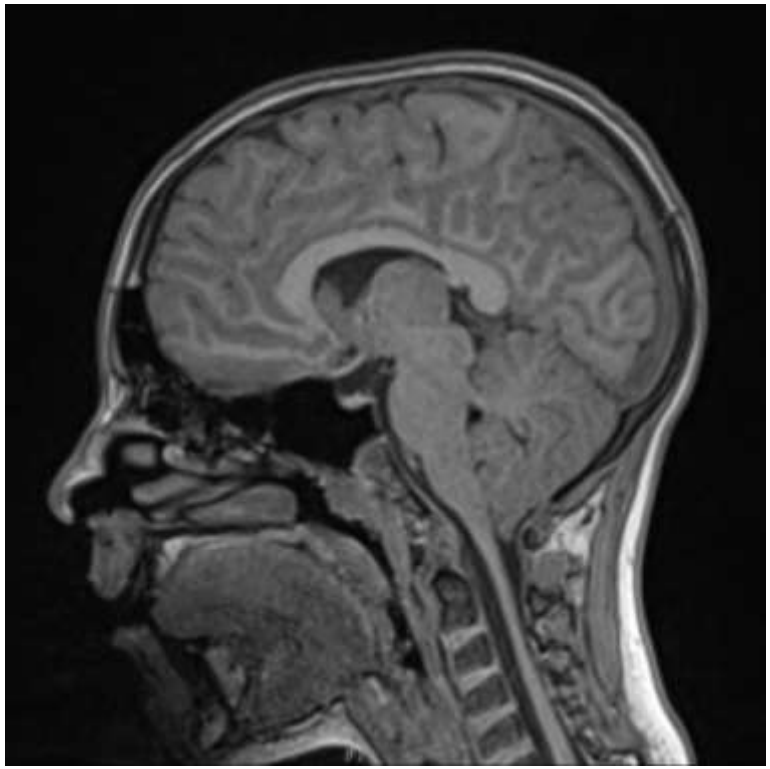
8 year-old boy with increasing headaches

- Daily occipital headaches
- Unresponsive to OTC medications
- Worse with coughing and defecation
- Relieved by hanging upside down at the playground
- Associated with burning arm pain

Types of headache
Secondary headaches

CASE

8 year-old boy with increasing occipital headaches induced by straining



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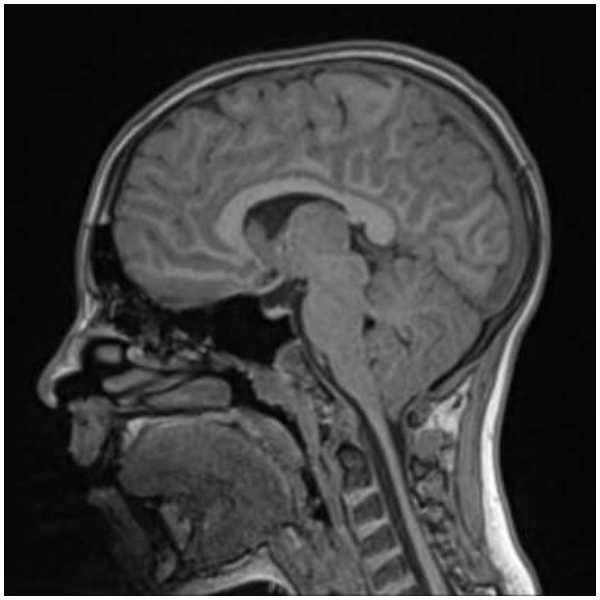
Types of headache
Secondary headaches

CASE

Chiari I malformation

- Cerebellar tonsillar ectopia > 5mm below the foramen magnum
- Can be associated with syrinx
- Headaches induced by straining or Valsalva
- Occipital headaches
- Nystagmus, ataxia, cranial nerve findings
- Can also be seen incidentally
- Posterior fossa decompression can be considered for severe cases



Types of headache
Secondary headaches

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Pediatric Headache

Prevalence and Population

History and physical

Types of headache

- Primary
- Secondary
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Red flags

- When to obtain imaging

Treatment

- Abortive
- Preventative
  - Pharmacologic
  - Non-pharmacologic

Treatment
Abortive

Principles of abortive therapy

- Useful in episodic headaches
- Dosage often inadequate if OTC
- Limit use to prevent medication overuse headache
  - < 2-3x/week for NSAIDS
  - < 2x/week for triptans
  - < 9 days/month for caffiene
- Avoid narcotics
- Avoid barbituates (Fioricet)
- Preventative therapy should be considered if abortives are required > 2x/week

Treatment
Abortive

Outpatient Options

- NSAIDs
- Acetaminophen
- Triptans

NSAIDS = triptan > acetaminophen

(Systemic reviews by Damen et al, *Pediatrics* 2005 and Evers et al, *Neurology* 2006)

Treatment
Abortive

Outpatient Options

Triptans

- Rizatriptan (Maxalt)
  - Longitudinal study by Hewitt et al, *Headache* 2012
  - 46% were pain-free in 2 hours
  - Safe in ages 12-17
    - Common side effects: nausea, dizziness, headache, chest pain and fatigue
    - Most common adverse event was intentional overdose
- Zolmitriptan (Zomig)
- Sumatriptan (Imitrex)
  - RTC of 738 teens showed adequate tolerance, but limited benefit due to high placebo response (Winner et al, *Headache* 2006).
- Almotriptan

- Avoid with cardiac disease or hypertension
- Intranasal, subcutaneous, and oral forms
- Not all triptans are equal, switching agents can be helpful

*approved in pediatric/adolescent age range

Treatment
Abortive

ER Options

- NSAIDs
- IV fluid bolus
- Caffeine
  - Oral or IV
- Valproic acid
  - Open-label retrospective study showed 78% patients pain-free after 1000 mg valproate (Rieter et al, *Headache* 2005).
- Magnesium
- Anti-emetics
  - Prochlorperazine
  - Zofran
  - “Ben-Reg”
- Steroid pulse

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Treatment
Abortive

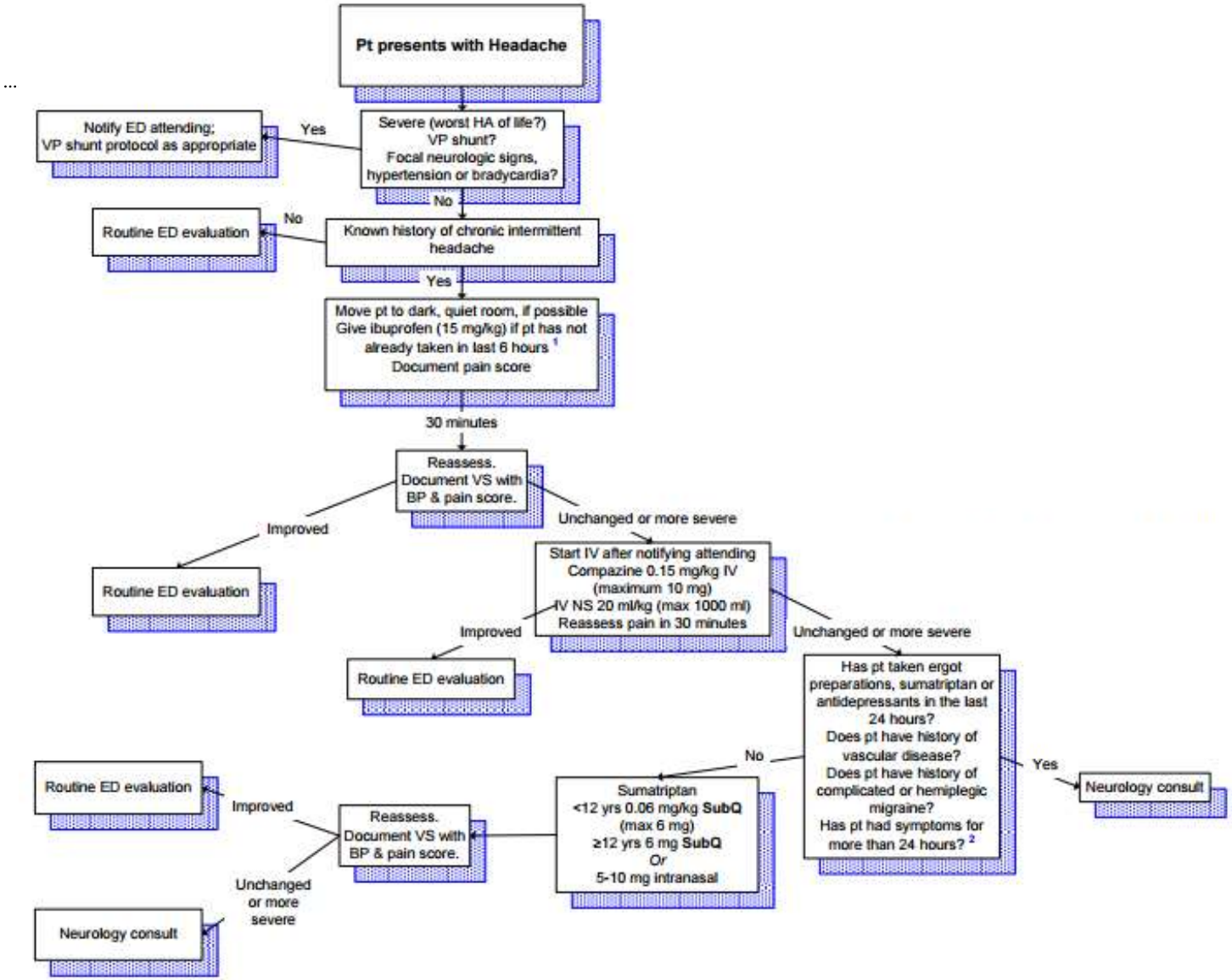
ER Options

Pediatric evidence for anti-emetics

- Prochlorperazine resulted in 50% pain reduction
  - Prospective small pediatric study (Trottier et al, *Am J Emerg Med* 2012).
  - Benadryl co-administration still resulted in 5% akisthesia

- Prochlorperazine > ketorolac
  - RTC in ER of 62 pediatric patients (Brousseau et al, *Ann Emerg Med* 2004).

Treatment
Abortive



Pediatric Headache

Prevalence and Population

History and physical

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Red flags

- When to obtain imaging

Treatment

- Abortive
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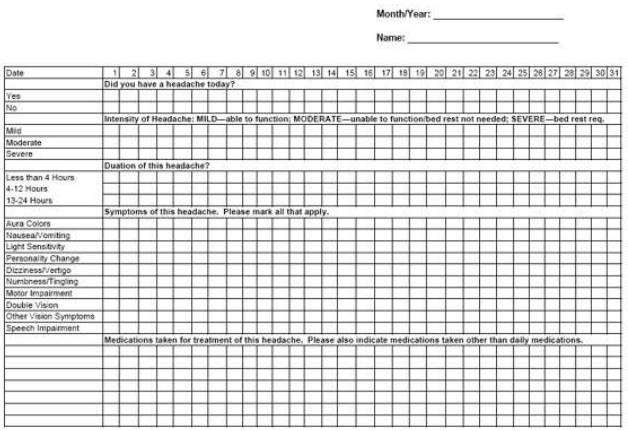
  - Pharmacologic
  - Non-pharmacologic

Treatment
Preventative

- Principles of preventative therapy
  - **Expectations**: Prophylactic medications take weeks to reduce symptoms
  - Headache diary tracks symptoms and triggers
  - Stress **non-pharmacologic** strategies in combination with medicine.



Month/Year: _____

Name: _____

Date	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Did you have a headache today?																															
Yes																															
No																															
Intensity of Headache: MILD—able to function; MODERATE—unable to function/bed rest not needed; SEVERE—bed rest req.																															
Mild																															
Moderate																															
Severe																															
Duation of this headache?																															
Less than 4 Hours																															
4-12 Hours																															
13-24 Hours																															
Symptoms of this headache. Please mark all that apply.																															
Aura Colors																															
Nausea/Vomiting																															
Light Sensitivity																															
Personality Change																															
Dizziness/Vertigo																															
Numbness/Tingling																															
Motor Impairment																															
Double Vision																															
Other Vision Symptoms																															
Speech Impairment																															
Medications taken for treatment of this headache. Please also indicate medications taken other than daily medications.																															

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Treatment
Non-pharmacologic

- "**SMART**" headache management
  - **S**leep: Sleep hygiene often poor
  - **M**eals: Regular, healthy, and includes breakfast
  - **A**ctivity: Regular exercise
  - **R**elaxation
  - **T**rigger reduction

And appropriate **oral hydration** fluids!

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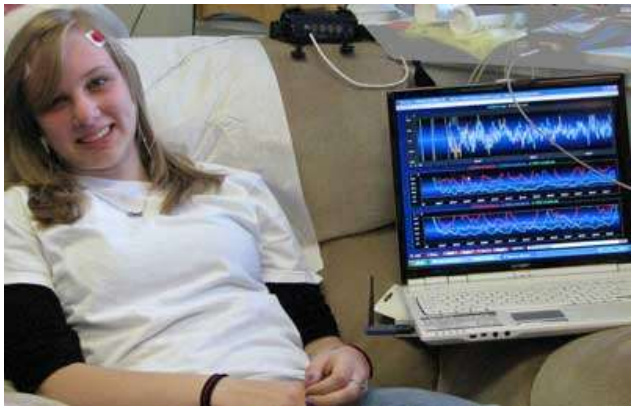
Treatment
Non-pharmacologic

- Biofeedback
- CBT/Relaxation techniques
  - May be equivalent to propranolol (Olness et al, *Pediatrics* 1987)
- Massage Therapy
- Accupressure/Accupuncture
- Counseling
- Physical Therapy
  - Most helpful in tension headaches



Treatment
Preventative

- Tricyclic anti-depressants
  - Amitriptyline or nortriptyline
    - Dangerous in overdose
- Anti-hypertensives
  - Propranolol
  - Verapamil
- Anti-epileptics
  - Topiramate : Low dose
  - Carbamazepine
  - Gabapentin
  - Valproic acid
- Other
  - Melatonin
  - Cyproheptadine
    - Causes sedation, weight gain
    - Limited evidence

Treatment
Preventative

Tricyclic anti-depressants

Amitriptyline

- Open-label study of low-dose in 192 pediatric patients showed 80% responded with headache frequency reduction (Hershey et al, *Headache* 2000)
- Dangerous in overdose
- Sedation

- *Anti-hypertensives*

Propranolol

- Three trials with conflicting results, two showed no benefit (Forsythe et al, *Dev Med Child Neurol* 1984 and Olness et al, *Pediatrics* 1987).
- Randomized trial with 60-120 mg daily showed 71% had complete reduction (Ludvigsson *Acta Neurol* 1974).

Verapamil

- Multiple trials for flunarizine and nimodipine, but no quality pediatric trials with verapamil.

Treatment
Preventative

Anti-epileptics

Topiramate

- 25 – 100 mg daily div BID
- Retrospective study with limited follow-up showed reduction in headache, but 12% cognitive symptoms and 5% with weight loss, 3% paresthesias (Hershey et al, *Headache* 2002).

→ CHAMPS study is a placebo-controlled RTC comparing amitriptyline and topiramate, results pending.

Valproic acid

- 10 mg/kg – 1000 mg daily div BID
- Retrospective study showed 50% reduction in headaches at 4 months in 79% of pediatric patients (Caruso et al, *Headache* 2000)
- Side effects often limit therapy
- Avoid in post-pubertal women

Treatment
Preventative

Melatonin

- RTC shows 3 mg was superior to placebo and amitriptyline 25 mg (Goncalves et al, J Neurol Neurosurg Psych 2016)
- Smaller trial with lower dosing found no benefit (Alstadhaug et al, *Neurology* 2010).

Cyproheptadine

- Common expert recommendation: 2 mg QHS – 4 mg BID
- Single retrospective trial showed 83% response rate at 6 months (Hershey et al, Headache 2004).
- Sedation, weight gain

Treatment
Preventative

- **Riboflavin** (vitamin B2)
  - 25 to 400 mg daily
  - Small adult RTC (55 pts) showed riboflavin reduced headaches in 60% compared to 15% in the placebo group (Schoenen et al, Neurology 1998). No adequate pediatric trials.

- **Coenzyme Q10**
  - 100 mg Qday - TID
  - Small adult RTC (42 pts) showed CoQ10 reduced headaches in 50% compared to 14% in the placebo group (Sandor et al, *Neurology* 2005)

- **Magnesium**
  - Magnesium oxide 9 mg/kg/day div TID
  - Side effects: gastritis (5%) and diarrhea (19%)
  - Avoid with kidney dysfunction
  - Small RTC showed 45% reduction with magnesium at 3 months compared to 15% in placebo group (Piekert et al, *Cephalalgia* 1996)

- **Migralief Pediatric**
  - Riboflavin, feverfew, magnesium

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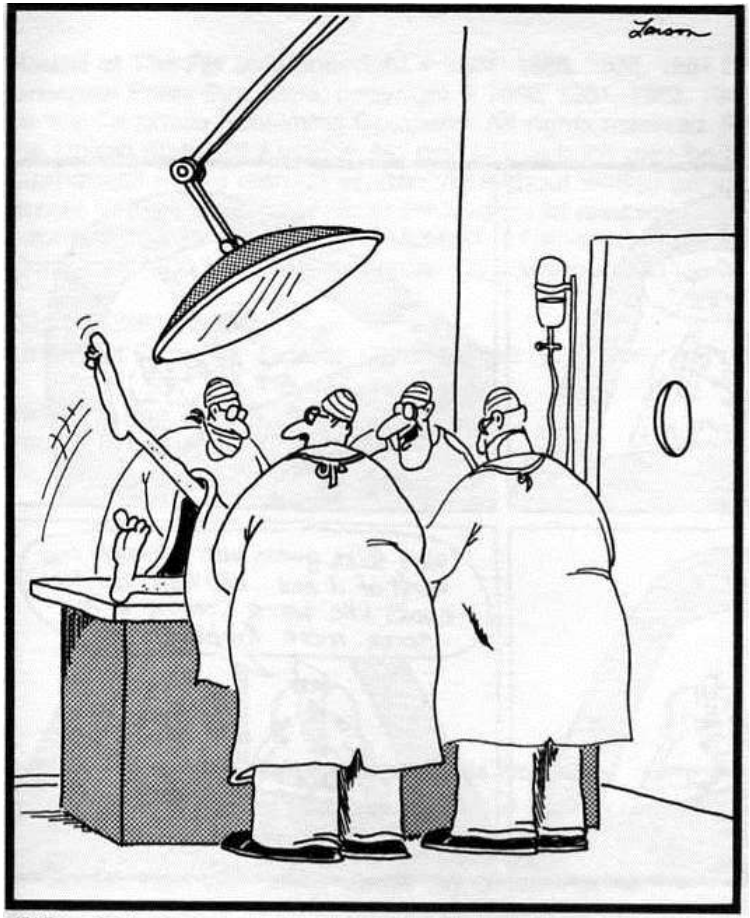
Thank you !



"Whoa! *That* was a good one! Try it, Hobbs — just poke his brain right where my finger is."

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