Headache in the Emergency Room: Non-vascular headache

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Disclosures:

- Dr. Marmura has royalty payments from Cambridge, Devos Medical and Medlink Neurology. He receives salary support from Teva for work as a principal investigator in clinical trials and has received compensation for consultations from Teva and Supernus.
Objectives:

- Distinguish the presentation of acute headache secondary to brain tumor in the emergency department from more typical presentations to an outpatient clinic.
- Evaluate the relationship between hypertensive emergency and acute headache.
- Evaluate potential infectious causes of headache such as brain abscess.
- Review the presentation and evaluation of facial pain in the emergency department.
How common is headache in the ED?

• More common than you think (and not just migraine)
• Depends on if a symptom or the chief compliant
• In children: viral and respiratory illnesses, concussion/post-traumatic, ventriculoperitoneal shunt malfunctions are not rare.
• But SERIOUS life-threatening causes (aseptic meningitis, subdural oe epidural hematoma, proven VP shunt malfunction, brain abscess, pseudotumor cerebri) are uncommon (< 10% total).
• In adults < 50 life-threatening causes are rare

Final diagnosis documented for headache in US emergency departments

<table>
<thead>
<tr>
<th>Any physician diagnosis</th>
<th>n</th>
<th>Proportion of headache patients (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Migraine/vascular</td>
<td>3208</td>
<td>63.5% (60.9, 66.1)</td>
</tr>
<tr>
<td>Tension</td>
<td>180</td>
<td>3.4% (2.1, 4.6)</td>
</tr>
<tr>
<td>Viral syndrome</td>
<td>126</td>
<td>2.4% (1.6, 3.1)</td>
</tr>
<tr>
<td>Anxiety/psych</td>
<td>60</td>
<td>1.1% (0.5, 1.7)</td>
</tr>
<tr>
<td>CVA (stroke, TIA)</td>
<td>43</td>
<td>0.8% (0.2, 1.8)</td>
</tr>
<tr>
<td>Bleeds (ICH, SAH, aneurysm)</td>
<td>33</td>
<td>0.6% (0.1, 1.1)</td>
</tr>
<tr>
<td>CNS infection (meningitis, encephalitis)</td>
<td>28</td>
<td>0.5% (nc)</td>
</tr>
<tr>
<td>Other pathological diagnosis</td>
<td>13</td>
<td>0.2% (nc)</td>
</tr>
<tr>
<td>Other benign diagnosis</td>
<td>1016</td>
<td>19.9% (18.0, 21.9)</td>
</tr>
<tr>
<td>Benign diagnosis</td>
<td>5083</td>
<td>98.0% (97.6, 98.4)</td>
</tr>
<tr>
<td>Pathological diagnosis</td>
<td>115</td>
<td>2.0% (0.5, 3.4)</td>
</tr>
</tbody>
</table>
Headache in United States Emergency Departments: demographics, work-up and frequency of pathological diagnoses

Cephalalgia
Case 1: I have a headache and I’m blind!

- 23 year old woman
- Developed a severe headache while watching July 4th fireworks
- Now says she can’t see anything
Further history...

- Sudden onset headache
- Exam: blind
- “I have a craniopharyngioma... could this have something to do with this?”
Pituitary Apoplexy

Call neurosurgery!
High dose corticosteroids may be needed
Pituitary Apoplexy

Pathologic Change :
Destruction of pituitary:

Optic chiasm:
Cavernous sinus
CN III
CN IV
CN V
CN VI
Sympathetic chain
Internal carotid and branches
Hypothalamus
Leakage blood/necrotic tissue

Clinical Sequelae
Hypopituitarism, spontaneous resolution of preexisting endocrinopathy
Visual field defects, visual acuity
Proptosis, eyelid edema
Ptosis, diplopia, mydriasis, poor medial + down gaze
Superior oblique palsy
Facial paresthesias, loss of corneal reflex
Lateral rectus muscle palsy
Ptosis, miosis, anhidrosis restricted to forehead
Focal hemispheric dysfunction or hemiplegia, altered consciousness, seizures
Hyperpyrexia, diabetes insipidus, or inappropriate secretion of vasopressin
Features of subarachnoid hemorrhage or aseptic meningitis: headache, nausea, vomiting
Case 2: ED follow-up for pseudotumor

- Obese 43 yo school cafeteria worker w progressive headache + papilledema. CT/MRI without gad wnl.
- Opening pressure = 26 cm, headache improved in ED with LP and medications
- Headache right sided only, ocular, constant w fluctuations, pressure > throbbing
- Follow-up with me, improved with topiramate but papilledema did not resolve and OP still high on repeat LP
- Developed worsening headache, now with right ptosis...
Pituitary adenoma

- Insulin-like growth factor 1 (IGF1) elevated
- Improved with tumor resection (headache and physical appearance)
Headache in pituitary tumors:

- “Deep” > neuropathic pain
- Rarely shift sides
- Episodic > constant > constant with exacerbations
- ? Prolactinoma – Acromegalic causing headache > Null cell or Cushing’s disease
- Microadenoma = macroadenoma in terms of headache frequency/severity
- Cavernous sinus invasion - > Cluster / TAC phenotype
- Consider re-imaging patients with unusual TACs if deteriorating or refractory

Brain Tumor and Headache

- Often presents with seizure, abnormal exam
- Metastatic and primary. Usually progressive
- Headache correlates with edema > size
- Headache does not usually lateralize
- Worse with bending over in 1/3
- “Morning headache” not especially common

Case 3: Papilledema and headache

- Referral from optho clinic for unexplained papilledema, mild headache
- 68 yo man with mild headache, bilateral papilledema
- Exam: obese, uncomfortable, dyspnic
- Blood gas: pH 7.33 PCO2 68 PO2 58
# Secondary Intracranial Hypertension

<table>
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<tr>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tumor, brain abscess, large infarct or hemorrhage</td>
</tr>
<tr>
<td>Hydrocephalus, shunt failure</td>
</tr>
<tr>
<td>Venous obstruction including high flow AVM, dural sinus thrombosis</td>
</tr>
<tr>
<td>Systemic diseases: COPD, severe renal disease or anemia, hepatorenal syndrome</td>
</tr>
<tr>
<td>Meningitis, encephalitis (may not resolve immediately after infection)</td>
</tr>
<tr>
<td>Drugs: growth hormone, vitamin A, cyclosporine, corticosteroid withdrawal, amiodarone, minocycline</td>
</tr>
</tbody>
</table>
Carcinomatous meningitis

- Presentation typically consists of headache/neck pain, encephalopathy, cranial nerve palsies
- Occurs in 5% of those with cancer
- Leukemia/lymphoma, breast, lung, melanoma
- Increased opening pressure, CSF protein common
- + CSF cytology in > 50%, almost always after 3 LPs.
Case 4: Catastrophic headache

- 26 yo healthy medical resident
- Presents with headache worsening over 2-3 days
- Bilateral headache/pressure
- Exam: Ill-appearing, BP 206/142, HR 141, otherwise wnl
- Is the high blood pressure the cause of headache?
Hypertension and Headache

- About 5% of patients in ED presenting with headache have hypertensive-related headache (mean >170 SBP, > 100 DBP)
- Essential hypertension and migraine link?: conflicting results
- Mild-moderate changes in BP do not cause headache
- Eclampsia/preeclampsia more strongly linked to migraine during pregnancy
- Treatment with antihypertensives may treat migraine
- Hypertensive encephalopathy is part of the spectrum of Reversible posterior leukoencephalopathy syndrome (also called PRES)
- High BP WITHOUT acute end-organ dysfunction ≠ hypertensive emergency

Dhopesh et al Headache 1979; Adeney and Williams Headache 2006
## Hypertensive Emergency: Clinical Features

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Pressure</td>
<td>Usually &gt;220/140 mm Hg</td>
</tr>
<tr>
<td>Funduscopic findings</td>
<td>Hemorrhages, exudates, papilledema</td>
</tr>
<tr>
<td>Neurologic status</td>
<td>Headache, confusion, somnolence, stupor, visual loss, seizures, focal neurologic deficits, coma</td>
</tr>
<tr>
<td>Cardiac findings</td>
<td>Prominent apical pulsation, cardiac enlargement, congestive heart failure</td>
</tr>
<tr>
<td>Renal symptoms</td>
<td>Azotemia, proteinuria, oliguria</td>
</tr>
<tr>
<td>Gastrointestinal symptoms</td>
<td>Nausea, vomiting</td>
</tr>
</tbody>
</table>

Vidt The Journal of Clinical Hypertension 2001
Radiologic Findings:
- Edema: Subcortical white matter > Cortex
- Parieto-occipital > Frontal, Cerebellar, Pons
- Sparing of calcarine and paramedian occipital lobes
- Endothelial dysfunction?
- May cause vasoconstriction, perfusion deficits or CVA


Figure 3. Axial magnetic resonance images of a patient with hypertensive encephalopathy. A, B: T1-weighted images, before and after gadolinium; no remarkable features are present. C, D: T2-weighted (C) and proton-density (D) images show occipital hyperintensity.

Vaughan CJ, Delanty N Lancet 2000
Treatment Guidelines for Hypertensive Emergencies

- Goal: Lower Diastolic BP to approximately 100-105 over 2-6 hours; max initial fall not to exceed 25%
- Do not lower BP ≥ 20% over the first 1 to 2 hours unless necessary to protect other organs
- More aggressive decrease can lead to ischemic stroke and myocardial ischemia
- Further reductions should be very gradual (days)
- Hypertensive urgency ≠ emergency

Thiruchelvam Chest 2015
## Parenteral drugs for treatment of hypertensive emergencies

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Onset of action</th>
<th>Duration of action</th>
<th>Adverse effects</th>
<th>Special indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium nitroprusside</td>
<td>0.25-10 μg/kg/min as IV infusionΔ</td>
<td>Immediate</td>
<td>1-2 min</td>
<td>Nausea, vomiting, muscle twitching, sweating, thiocyanate and cyanide intoxication</td>
<td>Most hypertensive emergencies; caution with high intracranial pressure or azotemia</td>
</tr>
<tr>
<td>Nicardipine hydrochloride</td>
<td>5-15 mg/h IV</td>
<td>5-10 min</td>
<td>15-30 min, may exceed 4 h</td>
<td>Tachycardia, headache, flushing, local phlebitis</td>
<td>Most hypertensive emergencies except acute heart failure; caution with coronary ischemia</td>
</tr>
<tr>
<td>Clevidipine</td>
<td>1-2 mg/h IV with rapid titration to max of 16 mg/h</td>
<td>1-2 min</td>
<td>5-15 min</td>
<td>Atrial fibrillation, nausea</td>
<td>All hypertensive emergencies</td>
</tr>
<tr>
<td>Fenoldopam mesylate</td>
<td>0.1-0.3 μg/kg per min IV infusion</td>
<td>&lt;5 min</td>
<td>30 min</td>
<td>Tachycardia, headache, nausea, flushing</td>
<td>Most hypertensive emergencies; caution with glaucoma</td>
</tr>
<tr>
<td>Nitroglycerin</td>
<td>5-100 μg/min as IV infusion</td>
<td>2-5 min</td>
<td>5-10 min</td>
<td>Headache, vomiting, methemoglobinemia, tolerance with prolonged use</td>
<td>Coronary ischemia</td>
</tr>
<tr>
<td>Enalapril</td>
<td>1.25-5 mg every 9 h IV</td>
<td>15-30 min</td>
<td>6-12 h</td>
<td>Precipitous fall in pressure in high-renin states; variable response</td>
<td>Acute left ventricular failure; avoid in acute myocardial infarction</td>
</tr>
<tr>
<td>Hydralazine hydrochloride</td>
<td>10-20 mg IV</td>
<td>10-20 min</td>
<td>1-4 h IV</td>
<td>Tachycardia, flushing, headache, vomiting, aggravation of angina</td>
<td>Edampsia</td>
</tr>
<tr>
<td></td>
<td>10-40 mg IM</td>
<td>20-30 min</td>
<td>4-6 h IM</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* These doses may vary from those in the Physicians' Desk Reference (64th edition).
• Hypotension may occur with all agents.
Δ Requires special delivery system.
## Parenteral drugs for treatment of hypertensive emergencies, continued*

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Onset of action</th>
<th>Duration of action</th>
<th>Adverse effects*</th>
<th>Special indications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Andrenergic inhibitors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labetalol hydrochloride</td>
<td>20-80 mg IV bolus every 10 min</td>
<td>5-10 min</td>
<td>3-6 h</td>
<td>Vomiting, scalp tingling, bronchoconstriction, dizziness, nausea, heart block, orthostatic hypotension</td>
<td>Most hypertensive emergencies except acute heart failure</td>
</tr>
<tr>
<td></td>
<td>0.5-2.0 mg/min IV infusion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esmolol hydrochloride$\Delta$</td>
<td>250-500 µg/kg/min by infusion; may repeat bolus after 5 min or increase infusion to 300 µg/min</td>
<td>1-2 min</td>
<td>10-30 min</td>
<td>Hypotension, nausea, asthma, first-degree heart block, HF</td>
<td>Aortic dissection, perioperative</td>
</tr>
<tr>
<td>Phentolamine</td>
<td>5-15 mg IV bolus</td>
<td>1-2 min</td>
<td>10-30 min</td>
<td>Tachycardia, flushing, headache</td>
<td>Catecholamine excess</td>
</tr>
</tbody>
</table>

* These doses may vary from those in the Physicians’ Desk Reference (64th edition).
- Hypotension may occur with all agents.
- $\Delta$ Requires special delivery system.

Case 4: (cont.) cardiac arrest

Cystic degeneration (arrows) of the right adrenal mass on CT scan.

Jan Pesek et al. Circulation. 2005;112:e327-e328
Headache attributed to pheochromocytoma

Headache attacks, usually severe and of short duration less than 1 hour) and accompanied by sweating, palpitations, pallor and/or anxiety, caused by phaeochromocytoma.

- Evidence of causation demonstrated by at least two of the following:
  - 1. Headache episodes have commenced in temporal relation to development of the pheochromocytoma, or led to its discovery
  - 2. Either or both of the following: a) individual headache episodes develop in temporal relation to abrupt rises in blood pressure, b) individual headache episodes remit in temporal relation to normalization of blood pressure
  - 3. Headache is accompanied by 1+ of the following: a) sweating b) palpitations c) anxiety d) pallor
  - 4. Headache episodes remit entirely after removal of the pheochromocytoma

- Headaches **paroxysmal** 51–80% of patients: less than 15 minutes in 50% and less than 1 hour in 70% of patients.
- Often severe, frontal or occipital and usually described as either pulsating or constant in quality.
- Associated features include apprehension/anxiety, often with a sense of impending death, tremor, visual disturbances, abdominal or chest pain, nausea, vomiting and occasionally paresthesia.
- The face can blanch or flush during the attack.
- Diagnosis established by the demonstration of increased excretion of catecholamines or catecholamine metabolites, and can usually be secured by analysis of a single 24-hour urine sample collected when the patient is hypertensive or symptomatic.
Case 5: Seizure and confusion

- 46 yo man with hx of IV drug abuse, Hep C
- Reportedly confused prior to generalized seizure, now comatose
Brain Abscess:

- Organisms: streptococcus, staphylococcus aureus, bacteroides species, enterobacter. Fungal causes include Candida species, aspergillosis and blastomycosis.
- Risk factors: Contiguous area of infection (sinusitis, ears, dental), immunosupression
- MRI diffusion /ADC (abscess has higher DWI intensity, lower ADC) and MR spectroscopy can help distinguish from tumor
- Multiple abscesses in > 10%, Capsular appearance > cerebritis
- Surgical treatment is usually necessary in most cases