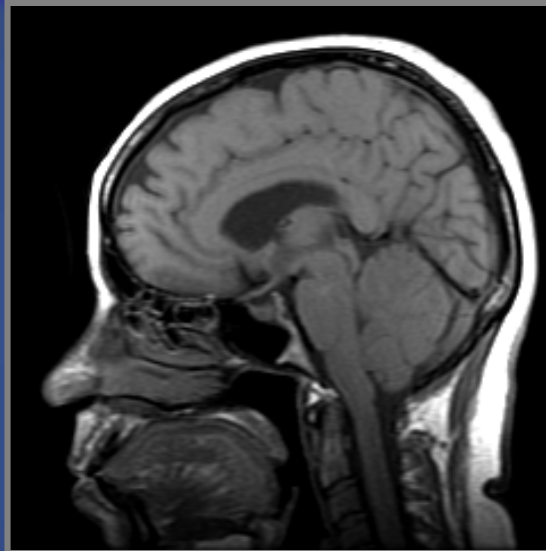


Neurological Emergencies



SAEM Undergraduate Medical Education Committee

Emergency Medicine Clerkship Lecture Series

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Lecture Objectives

- To review the presentation, diagnosis, and management of four distinct neurological emergencies

Case 1

- CC: confusion
- HPI: 78 year-old woman who lives alone and was last seen by her son 2 days prior. Found lying on the couch in her urine-stained nightgown mumbling incoherently.

What do you do first?

Assess A—B—C's

- The patient is sitting comfortably in the gurney, intermittently mumbling
- Her vital signs are:
 - HR 124
 - BP 105/72 mmHg
 - RR 22
 - Temp 95.8° F
 - SaO₂ 95% on room air
- What next???

IV—Oxygen—Monitor

- Apply to “ill patients”

Do the “DON’T”

- Dextrose => check the blood sugar
- Oxygen => check O₂ sat/give O₂
- Narcan => suspected narcotic OD
- Thiamine => consider if malnourished

Further History

- PMHx:
 - HTN
 - Type II DM
 - CAD s/p stent placement in 2004
 - UTI
- Meds: Norvasc, atenolol, aspirin, glipizide, metformin, vitamins, detrol
- Allergies: Penicillin
- Soc Hx: No tobacco, alcohol or drugs; lives alone

Physical Exam

- General: Obese female, alert, confused
- HEENT: No signs of trauma, pupils 4mm→2mm bilaterally, EOMI, oropharynx with dry mucous membranes
- Neck: Supple, full range of motion, no lymphadenopathy
- Chest: Clear to auscultation bilaterally
- CV: Tachycardic, regular, no murmurs

Physical Exam

- Abd: Soft, obese, non-tender, non-distended, guaiac neg brown stool
- Ext: No edema
- Skin: Cool, no rashes
- Neuro: Alert, oriented to name but not place or time, confused, not answering questions, but able to follow simple commands in all four extremities

What is your differential diagnosis at this point?

DDX: AEIOU TIPS

- Alcohol
- Endocrine
- Infection
- Oxygen
- Uremia
- Toxicology
- Inflammatory conditions
- Psychiatric problems
- Space occupying lesions, Sz, Stroke, SAH

DDX and Tests

- Alcohol
- Endocrine
- Infection
- Oxygen
- Uremia
- Tox
- Inflammation
- Psych
- Space Occupying lesions, SAH, Sz
- EtOH level
- BS, TSH

Back to Our Patient

- Labs: WBC 16 with 88% PMNs and bicarbonate of 18 with anion gap 16
- EKG: Sinus tachycardia, rate 120
- UA: >100 WBCs, +nitrite, many bacteria
- CXR: Cardiomegaly, otherwise normal

What's your diagnosis?

Urosepsis

- Common cause of altered mental status in the elderly
- Treatment:
 - Antibiotics
 - Aggressive IVF resuscitation according to Rivers protocol for Early Goal-Directed Therapy in Sepsis*
 - Admission

* Rivers E, et al. Early goal directed therapy in the treatment of severe sepsis and septic shock. N Engl J Med 2001; 345:1368-1377, Nov 8, 2001.

Key Points

- The differential diagnosis for a patient presenting with an altered mental status is comprehensive
- A systematic approach should be employed when evaluating this type of presentation
- Non-neurologic infectious etiologies or systemic illness can cause an altered mental status

Case 2

- CC: AMS
- HPI: 64 year old man with a sudden change in mental status. Patient was on the phone with his wife when he suddenly started slurring his words. She came home from work and found him lying on the floor, not moving his right side.

What do you do first?

Assess A—B—C's

- The patient is sitting comfortably in the gurney, alert, but not responding to initial questions.
- His vital signs are:
 - HR 78
 - BP 175/96 mmHg
 - RR 18
 - Temp 98.2° F
 - SaO₂ 98% on room air
- What next???

IV—Oxygen—Monitor

- ED Safety net

Do the “DON’T”

- Dextrose => check the blood sugar
- Oxygen => check O₂ sat/give O₂
- Narcan => suspected narcotic OD
- Thiamine => consider if malnourished

Further History

- PMH: HTN
- Meds: Atenolol
- NKDA
- Soc Hx: +1 ppd tobacco use
- Fam Hx: Dad had a CVA at age 58

Physical Exam

- General: lying on gurney, alert, non-verbal
- HEENT: No signs of trauma, pupils 3mm→2mm bilaterally, EOMI, oropharynx normal
- Neck: Supple, full range of motion, no lymphadenopathy
- Chest: Clear to auscultation bilaterally
- CV: Regular rate and rhythm, no murmurs

Physical Exam

- Abd: Soft, non-tender, non-distended
- Ext: No edema
- Skin: Cool, no rashes
- Neuro: Alert, non-verbal, right-facial droop, following simple commands in left upper and lower extremities, does not move right upper or lower extremity even in response to painful stimuli, Babinski upgoing on right, down on left, hyperreflexic on right

Diagnosis?

Acute Ischemic Stroke

- Third leading cause of death in the U.S.
- Leading cause of long-term disability in the U.S.
- Most commonly caused by an **EMBOLUS** (usually from the heart) or a **THROMBUS** (usually at the site of an atherosclerotic plaque)

What other conditions should be on your differential diagnosis?

Conditions that mimic acute stroke

- Hypoglycemia
- Bell's palsy
- Migraine associated with transient neurologic deficits
- Todd's paralysis (post-ictal transient paralysis)
- Hypertensive encephalopathy
- Labyrinthitis, Meniere's disease or other causes of acute peripheral vertigo (mimic posterior circulation strokes)

Can you localize our patient's embolus?

Left Middle Cerebral Artery (MCA) Stroke

- Classically presents with:
 - Aphasia (recall that Broca's and Wernicke's areas are on the left side of the brain in most individuals)
 - Right-sided hemiparesis and sensory loss, upper extremity and face usually more affected than lower extremity
 - Left hemianopsia, i.e. left visual field cut
 - Gaze preference is classically ***toward*** the stroke (i.e., to the left in a L MCA stroke)

ED Management of Acute Stroke

- Time is of the essence
- STAT head CT
- STAT Neurology consult
- Don't forget finger stick blood glucose, standard labs, INR, EKG, UA, CXR

Thrombolysis in Acute Ischemic Stroke

- Thrombolytics must be given within 3 hours of symptom onset for most patients. Up to 4.5 hours in some.
- Time of onset must be determined reliably; when time of onset is not known, determine the last time the patient was seen normal
- Numerous exclusion criteria

Tissue Plasminogen Activator (tPA)

- The only FDA-approved thrombolytic
- Dose: 0.9 mg/kg (max dose 90 mg); 10% of total dose given as IV bolus, remaining 90% infused over 60 minutes
- Complete NIHSS.
- Contraversial therapy

* Brott, T and Bogouslavsky, J. Drug therapy: treatment of acute ischemic stroke. N Engl J Med 2000; 343: 710-722.

**What are the contraindications
to thrombolysis?**

Contraindications to Thrombolysis

● Absolute*

- Prior hemorrhagic stroke
- Any stroke within past three months
- Known intracranial neoplasm, AVM, or aneurysm
- Active bleeding (except menses)
- Suspected aortic dissection
- Acute pericarditis
- Allergy

● Relative*

- Severe HTN (SBP>180)
- Known bleeding disorder
- Current use of anticoagulants
- Recent major surgery
- Recent internal bleeding
- Recent trauma
- Active peptic ulcer
- Age > 75
- Pregnancy
- Non-compressible vascular punctures
- Cardiogenic shock

*Note: some sources differ in agreement as to which are absolute and which are relative contraindications

Back to Our Patient

- Labs: Unremarkable
- EKG: Sinus rhythm 72
- CXR: Normal
- Head CT: normal (no hemorrhagic stroke)

Treatment

- In conjunction with Neurology services, our patient was administered tPA 2 hours after the onset of his symptoms
- He was admitted to the Neurology ICU for monitoring and repeat neuro checks(ICU admission is indicated for any patient treated with thrombolytics)

Case 3

- CC: AMS
- HPI: A 19 year old college student is brought to your ED by his roommate. Patient with a HA last noc and today he has been sleepy and not acting himself. Has vomited a few times.

What do you do first?

Assess A—B—C's

- The patient is lying on the gurney with his eyes closed, opens his eyes when you talk loudly to him, and appears ill
- His vital signs are:
 - HR 122
 - BP 95/66 mmHg
 - RR 22
 - Temp 102.2° F
 - SaO₂ 96% on room air
- What next???

IV—Oxygen—Monitor

- ED Safety Net

Do the DON'T

- Dextrose => check the blood sugar
- Oxygen => check O₂ sat/give O₂
- Narcan => suspected narcotic OD
- Thiamine => consider if malnourished

Further History

- Per roommate:
 - patient is healthy
 - drinks alcohol occasionally
 - has smoked marijuana a few times
 - does not do use intravenous drugs

Physical Exam

- General: Well-developed, somnolent, ill-appearing
- HEENT: No signs of trauma, pupils 5mm→3mm, oropharynx normal
- Neck: +nuchal rigidity
- Chest: Clear to auscultation bilaterally
- CV: Tachycardic
- Abd: Soft, NT, ND

Physical Exam

- Ext: No edema
- Skin: Warm, mildly diaphoretic, scattered petechiae over bilateral ankles
- Neuro: Somnolent, arouses to voice, answers some simple questions and is oriented to person but not place or time, follows simple commands in all four extremities
 - GCS 14

What is the most likely
diagnosis?

Acute Bacterial Meningitis

- Annual incidence of 4-6 per 100,000 adults
- *Streptococcus pneumoniae* and *Neisseria meningitidis* are the causative organisms in > 80% of cases
- *Listeria* species are causative organisms in one-quarter of patients > 60 years old
- Almost all patients present with at least 2 of the 4 classic symptoms: headache, neck stiffness, fever, altered mental status

* van de Beek, D et al. Current concepts: community-acquired bacterial meningitis in adults. N Engl J Med 2006; 354: 44-53.

Indications for Head CT Prior to Lumbar Puncture

- Seizure
- Focal neurologic deficit
- Head trauma
- Profoundly depressed mental status
- Immunocompromised state
- Papilledema***

Typical CSF Findings in Bacterial Meningitis

- Elevated opening pressure (often > 40 cm H₂O)
- WBC $> 5/\text{mm}^3$
- Elevated protein
- Low glucose
- Presence of organism on gram stain

Our Patient's LP Results

- Opening pressure: 42 cm water
- WBC: 1,200/mm³
- Glucose: 28 mg/dL
- Protein: 88 mg/dL
- Gram stain: + gram positive cocci in pairs

Treatment

- Time is of the essence—initiate antibiotics as soon as possible
 - ***In cases of suspected bacterial meningitis, administer ABX prior to CT / LP
- Stabilization and resuscitation
 - Airway management in obtunded patients
 - IV fluid resuscitation and vasopressors for septic shock

Antimicrobial Therapy

- Vancomycin and a third-generation cephalosporin for adults < 50
- Vancomycin plus a third-generation cephalosporin plus ampicillin (to cover *Listeria*) for adults < 50

Role of Dexamethasone

- Dose: 10 mg IV q 6 hrs for 4 days
- Should be started before or with the first dose of antibiotics
- Benefit is greatest in those with pneumococcal meningitis
- Shows slight benefit in hearing and neurologic deficits

Indications for Prophylaxis

- Meningococcal meningitis:
 - Household member should receive rifampin every 12 hours for 4 doses
 - Healthcare providers only require prophylaxis if they participate in mouth-to-mouth resuscitation, endotracheal intubation, or suctioning of secretions
- Exposure to a patient with Pneumococcal meningitis does *not* require prophylaxis

Back to Our Patient

- He received dexamethasone 10 mg IV, ceftriaxone 2 gm IV, and vancomycin 1 gm IV
- He was resuscitated with 2L normal saline with improvement in his vital signs
- He was admitted to the ICU

Case 4

- CC: HA
- HPI: A 42 year old woman presents with the worst headache of her life. It started suddenly about 1 hour ago while she was lifting some heavy boxes. Has vomited twice and has never felt this horrible in her life.

What do you do first?

Assess A—B—C's

- The patient is sitting on the stretcher, appears uncomfortable, but is alert and interactive
- Her vital signs are:
 - HR 86
 - BP 165/92 mmHg
 - RR 18
 - Temp 97.8° F
 - SaO₂ 98% on room air
- What next???

IV—Oxygen—Monitor

Further History

- Has had two migraines before, but this headache is much more severe than either of her migraines. The light bothers her eyes, and she requests an emesis basin.

Further History

- PMH: Migraine x 2, HTN
- Meds: Metoprolol
- NKDA
- Soc Hx: 1 ppd tobacco x 30 years, no alcohol or drugs
- Fam Hx: Father died of “kidney problems” at age 56

Physical Exam

- General: Alert, uncomfortable, holding her head
- HEENT: no signs of trauma, pupils 4mm→2mm bilaterally, EOMI, oropharynx normal
- Neck: Patient resists flexion
- Chest: Clear to auscultation bilaterally
- CV: RRR, no murmurs
- Abd: Soft, non-tender, non-distended

Physical Exam

- Ext: No edema
- Skin: Cool, no rashes
- Neuro: Alert and oriented x 3, CN II-XII intact, motor 5/5, sensation intact to light touch, neg pronator drift, normal finger-to-nose bilaterally, normal gait

What life-threatening diagnosis are you most concerned about?

Subarachnoid Hemorrhage (SAH)

- Caused by ruptured intracranial aneurysm in > 80% of cases
- High morbidity and mortality
- Misdiagnosed in up to 50% of patients who do not present with classic symptoms
- Major risk factors include tobacco, alcohol, cocaine, hypertension
- Family history (polycystic kidney disease, Ehlers-Danlos, etc.)

* Suarez, J et al. Current concepts: aneurysmal subarachnoid hemorrhage. N Engl J Med 2006; 354: 387-396.

What additional diagnoses are
on your differential?

Differential Diagnosis

- Migraine
- Vertebral or carotid dissection
- Pseudotumor cerebrii (idiopathic intracranial hypertension)
- Meningitis or other intracranial infection
- Acute angle closure glaucoma (normal pupillary exam makes this unlikely)
- Brain tumor

How do you proceed with work-up?

Work-up of Possible SAH

- Standard labs including Chem 7, CBC, PT/PTT
- EKG
- CT head without IV contrast

Back to our Patient

- Labs are unremarkable
- Head CT shows:



- CTA shows a ruptured posterior communicating artery aneurysm

Treatment of SAH

- Emergent Neurosurgical consultation
- Blood pressure control (goal SBP < 140)
- Analgesia with reversible agents
- Nimodipine to decrease likelihood of stroke in aneurysmal SAH
- Correct hyperglycemia and hyperthermia
- ICU admission

Summary Points

- Altered mental status: The differential diagnosis is broad and requires a thorough history, physical, and work-up
- Acute ischemic stroke: Time is of the essence in initiating treatment
- Bacterial meningitis: Time is of the essence in initiating antibiotic therapy
- SAH: Have a high index of suspicion in any patient with headache as the morbidity and mortality of SAH are tremendous

Thank you

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