**Neurology Review**

Gary M. Abrams, MD
Department of Neurology

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**Headache**

- **Primary headache**: 90%
- **Secondary headache**: 10%

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**1º Headache Disorders**

- **Migraine without aura** – 80%
  - At least 5 attacks lasting 4 – 72 hours
  - 2 of 4 characteristics
    - Unilateral
    - Pulsatile
    - Moderate or severe pain
    - Aggravated by routine physical activity
  - 1 of 2 - nausea/emesis or photophobia/phonophobia

- **Migraine with aura** - 15%
  - Recurrent disorder manifesting with reversible neurological deficits developing over 5 – 20 minutes lasting less than 60 minutes
  - Then similar criteria as migraine without aura
  - Less common - no headache or lacks migraine features
1º Headache Disorders

**Tension-type headache (TTH)**
Headache lasting 30 minutes to 7 days
With 2 of 4 characteristics
- Bilateral
- Pressing/tightening quality
- Mild-moderate intensity
- Not aggravated by physical activity

Both
- No nausea AND No more than one of photophobia or phonophobia

**Cluster Headache**
- At least 5 attacks,
- Unilateral, severe, 15-180 minutes, 1 q.o.d – 8/day, ipsilateral vasomotor symptoms
- At least 2 clusters (1 wk – 1 yr) separated by 1 month
- M:F ~5:1

2º Headaches

Due to associated illness: ~10% of HA

**Differential:**
- mass lesion or inflammatory disease in or around the brain
- trauma
- medications: use, overuse, withdrawal

**Red flags:**
- systemic illness
- onset after age 50
- abrupt, progressive
- worse when supine or with Valsalva
- associated with focal signs/syncope

Imaging
If symptoms are consistent with primary headache disorder - imaging can be deferred
MRI is preferable to CT for chronic headache

Treating 1º Headache Disorders

**Acute:** to abort a HA
- NSAIDs +/- antiemetics
- Combination analgesics
- Triptans (migraine)
- Beware of overuse! >2x/week or >75 tabs/month can lead to unremitting HA

**Prophylaxis:**
- frequency, severity, duration
- Categories
- tricyclic antidepressants
- antihypertensives: β-blockers, Ca<sup>2+</sup> blockers
- AEDs: valproate, topiramate
- NSAIDS – menstrual migraine
- Consider:
  - comorbidities, treatment hx
  - “Start low and titrate slow”
  - Allow adequate trial

UCSF
**Spine Pain**

**Clinical Approach**

“*My back hurts.*”

**Pain in the Neck**

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**Key questions:**

- Is there progressive neurological (especially motor or bowel & bladder) deficit?
- Is the underlying cause worrisome (tumor, infection, fracture)?

**History**

- age >50
- pain worse @ night
- progressive neurologic deficit
- hx malignancy
- chronic infection, IVDU
- trauma, chronic steroids

**Exam**

- fever, weight loss
- SLR +, spine tenderness
- abdominal, rectal, pelvic mass
- abnormal neuro exam

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**Back Pain**

**Remember!!**

Most common levels for disc herniation ----

L5- S1 > L4-5 > L3-4

If no : pain management, brief bedrest, PT
If pain for > 6 wks consider diagnostic imaging

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**Neck Pain**

**Clinical issues similar to LBP**

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**Table 1. Physical Findings Associated with Cervical Radiculopathy.**

<table>
<thead>
<tr>
<th>Disk Level</th>
<th>Root</th>
<th>Pain Distribution</th>
<th>Weakness</th>
<th>Sensory Loss</th>
<th>Reflex Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4-C5</td>
<td>C5</td>
<td>Medial scapular border, lateral upper arm to elbow</td>
<td>Deltoid, supraspinatus, infraspinatus</td>
<td>Lateral upper arm</td>
<td>Supinator reflex</td>
</tr>
<tr>
<td>C5-C6</td>
<td>C6</td>
<td>Lateral forearm, thumb and index finger</td>
<td>Biceps, brachioradialis, wrist extensors</td>
<td>Thumb and index finger</td>
<td>Biceps reflex</td>
</tr>
<tr>
<td>C6-C7</td>
<td>C7</td>
<td>Medial scalp, posterior or arm, dorsum of forearm, third finger</td>
<td>Triceps, wrist flexors, finger extensors</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>C7-T1</td>
<td>C8</td>
<td>Shoulder, inner side of forearm, fifth finger</td>
<td>Thumb flexors, abductors, intrinsic hand muscles</td>
<td>Fifth finger</td>
<td>—</td>
</tr>
</tbody>
</table>
**Epilepsy**

**Definitions**

**Seizure Classification**

**Epilepsy: Causes By Age**

**The 1st Seizure**

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**Seizures vs. Epilepsy**

**Seizure**
- paroxysmal derangement of cerebral dysfunction due to excessive, uncontrolled neuronal discharges
- ~10% of people experience at least 1 seizure.

**Epilepsy**
- tendency to have recurrent, unprovoked seizures
- ~3% cumulative lifetime incidence (highest early & late in life)

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**Seizure Classification**

**Primary generalized**
- Arise diffusely from cortex (or from deep structures)
- Types:
  - absence ("petit mal")
  - tonic-clonic ("grand mal")
  - others: atonic, myoclonic, tonic, clonic
- AEDs:
  - valproate, lamotrigine
topiramate
levetiracetam
absence only:
esthesuximide

**Partial (focal)**
- Begins in a particular part of the cortex
- Types:
  - simple ("focal") or complex symptoms ("temporal lobe epilepsy")
  - partial +/- 2nd generalization
- AEDs:
  - carbamazepine, lamotrigine
  - oxcarbazepine
  - levetiracetam
topiramate, valproate
gabapentin, phenytoin

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**Epilepsy in Children**

**Neonates:** <1 mo
- perinatal hypoxia & ischemia
- ICH & trauma
- CNS infection
- metabolic disturbances
  - glucose, Ca++, Mg++
- pyridoxine deficiency
- drug withdrawal
- developmental disorders
- genetic disorders

**Infants & children:** 1m–12 yrs
- febrile seizures
- genetic disorders (metabolic degenerative, 1st epilepsies)
- CNS infections
- trauma
- idiopathic

**Adolescents:** 12–18 yrs
- trauma
- genetic epilepsies
- infection
- tumor
- drug use
- idiopathic
Epilepsy in Adults

Younger: 18-35 yrs
- trauma
- alcohol withdrawal
- drug use
- tumor
- idiopathic

Older: >35 yrs
- stroke
- tumor
- alcohol withdrawal
- metabolic disturbances
- Alzheimer’s & other neurodegenerative disorders
- idiopathic

The 1st Seizure

W/U

- metabolic disturbance:
  - lytes, Ca²⁺ / Mg²⁺, LFTs, renal function
  - CBC, ESR
  - consider tox screen

- MRI in adults
- EEG (especially in children)

Should AEDs be started?

- probably no:
  - reversible cause found (sleep deprivation, EtOH withdrawal, etc)
  - entirely negative W/U

- probably yes:
  - no reversible cause
  - abnormal neuro exam, EEG or MRI
  - major consequence if recurrent seizure

Expect 50% to be sz free with first agent

Syncope & Vertigo

Definitions

- Syncope: transient loss of consciousness due to global (or brainstem) hypoperfusion
  - vision fades
  - sympathetic symptoms & weakness
  - myoclonus ok
  - Most common cause -- vasovagal

- Vertigo: sensation of movement (rotatory, translational, falling, see-saw) when none is present
### Syncope vs Seizure

<table>
<thead>
<tr>
<th></th>
<th>Syncope</th>
<th>Seizure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prodrome</td>
<td>Autonomic, Long</td>
<td>Short</td>
</tr>
<tr>
<td>Duration of LOC</td>
<td>Brief</td>
<td>Variable</td>
</tr>
<tr>
<td>Post-ictal Sxs</td>
<td>Never</td>
<td>Common</td>
</tr>
<tr>
<td>Urinary Incontinence</td>
<td>Rare</td>
<td>Varies</td>
</tr>
<tr>
<td>Related to posture</td>
<td>Frequent</td>
<td>Rare</td>
</tr>
<tr>
<td>Injury</td>
<td>Rare</td>
<td>Common</td>
</tr>
</tbody>
</table>

### Peripheral Vertigo

- **No associated brainstem dysfunction**
- **Evoked nystagmus**
  - present with vertigo (more intense symptoms)
  - 5-20 sec latency
  - fatigues & reduces with fixation
  - horizontal or rotatory (only); not vertical
- **Causes**
  - Viral neurolabyrinthitis; herpes zoster
  - Benign positional vertigo (50%)
  - Meniere’s syndrome
  - Migraine
  - Drug toxicity - gentamicin

### Benign Positional Vertigo

- **Etiol:**
  - Free-floating calcium carbonate crystals (canaliths) that inadvertently enter the long arm of the posterior semicircular canal.

- **Sx:**
  - Vertigo with paroxysmal positional nystagmus after a rapid change in head position.
  - No spontaneous nystagmus or hearing loss/tinnitus.
  - Very common in elderly

- **Tx:**
  - Remove crystals; rarely surgery

### Dix-Hallpike Test

Position patient with head extended over the end of the exam table.
Move patient rapidly backward into the head-hanging-down position.
Observe eyes for the development of nystagmus.
If no dizziness or nystagmus after 20 seconds, the patient is returned to the sitting position.
BENIGN POSITIONAL VERTIGO
Treatment – Epley Maneuver

Numbers in posterior semicircular canal (PSC) correspond to position of crystals as they move toward utricle (UT).
Each position change is performed rapidly to accelerate the particles.
Positions 2 & 3 are same except that therapist moves from front to back of patient to facilitate maneuvers
Entire sequence is repeated until no nystagmus is elicited.

Central Vertigo

Often associated brainstem features

Evoked nystagmus:
- may be absent
- if present:
  - no latency
  - does not fatigue
  - not reduced with fixation
  - may be vertical

Causes:
- drugs: EtOH & other CNS active drugs
- brainstem stroke or TIA (vertebrobasilar insufficiency)
- multiple sclerosis
- cerebellopontine angle tumors: acoustic neuroma, meningioma

Multiple Sclerosis

Chronic autoimmune disease of the CNS
- gradual destruction of myelin occurs in patches throughout the brain and/or spinal cord
- interference with nerve conduction pathways
- causing muscular weakness, loss of coordination, and speech and visual disturbances

Characteristics
- most common neuro disability (after trauma) in young adults
- typically starts early adult (age < 40)
- F:M - 2:1; familial preponderance

Clinical Types:

Diagnosis remains essentially clinical – patient must demonstrate multiple lesions separated in time and space.
Separation in time requires two attacks each lasting at least 24 hours; different parts of the CNS; separated by at least 1 month
Separation in space requires clinical evidence of distinct neurological deficits and/or MR imaging evidence of separate CNS lesions
Multiple Sclerosis

**Clinical signs – diverse!**

- Optic Neuritis (17% - initial symptom; 40% of all MS pts get ON)
- Transverse myelitis
  - Neurogenic bladder
- INO (Internuclear ophthalmoplegia)
- Paroxysmal symptoms (Pain)
- Fatigue is prominent; worsens with exercise

**MRI**
- Hypodense areas on T1
- Confluent periventricular high-intensity lesions on FLAIR or T2

**CSF**
- Presence of oligoclonal bands

**Treatment**
- Corticosteroids – decreases severity of acute exacerbation
- **Immunomodulatory drugs**
  - Interferon beta, glatiramer – reduce lesion load; reduce relapses; slow progression

**Amyotrophic lateral sclerosis (ALS)**

**ALS**
- Neurodegenerative disease of lower motor neurons + upper motor neurons
- Exam is mixed picture - loss of reflexes with atrophy and fasciculations + hyperreflexia and spasticity

**Spectrum**
- **Progressive muscular atrophy**
  - affects lower motor neurons - weakness, atrophy, hyporeflexia and fasciculations
- **Primary lateral sclerosis**
  - affects upper motor neurons – weakness, spasticity, increased reflexes

**ALS Clinical Features**

**Presentation:**
- asymmetrical limb weakness (80%); atrophic hand or foot drop
- bulbar muscles (onset in 20%) - dysphagia with choking; high risk of aspiration cramps are common

**If respiratory muscles affected – respiratory failure**

- Cognitive symptoms (usually mild) - ~ 15-50%; linked with frontotemporal dementia

**Sensation is preserved!**
**ALS Differential Diagnosis**

**Structural Lesions**
- tumors, cervical spondylosis, AV malformation of spinal cord

**Immune Mechanism Neuropathies**
- paraproteinemias, lymphoma

**Metabolic** - hyperthyroidism, diabetes

**Viral infections** – polio; herpes zoster; HIV

**Toxins** - Lead – motor neuropathy

**Paraneoplastic**

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**ALS Diagnosis/Treatment**

**Diagnostic studies** – Electromyography (EMG/NCS), MRI, laboratory evaluation

**Treatment** - riluzole - blocks glutamic acid release; may slow disease by disrupting glutamate-mediated neurotoxicity.
- Assistive and mobility devices
- Respiratory support (CPAP)
- Nutritional support (PEG)

Death in 3 – 5 yrs

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**Bell’s Palsy**

**Clinical**
- Affects 1 in 60-70 people in lifetime
- Pregnancy or diabetes increase risk
- Abrupt onset (over hours) with max deficit in < 3 weeks
- 60% with preceding viral illness
- Pain behind ear precedes paralysis (50%)
- Taste loss anterior 2/3 of tongue (25%)

**Etiology**
- Associated with a variety of viruses
  - HSV, VZV, EBV, CMV, others - histological studies show inflammation, edema

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**Bell’s Palsy**

**Laboratory**
- CSF – mild lymphocytosis
- MRI – swelling or enhancement of facial n.
- EMG – denervation after 2-3 weeks, then poorer prognosis
  - Incomplete paralysis in 1st week is favorable

**Differential Diagnosis**
- Ramsay-Hunt syndr. – H. Zoster - geniculate ganglion
- Lyme disease
- Brainstem infarcts, tumors or MS
- Meningeal infiltrative processes (e.g cancer)
- Bilateral Bell’s Palsy - Guillain-Barre; sarcoid
Bell’s Palsy

**Evaluation and Management**

**Clinical diagnosis**
1) typical presentation
2) no risk factor or preexisting conditions
3) no skin lesions (zoster)
4) normal exam except for VII n.

*If atypical:*
- Check ESR
- Check for diabetes mellitus; CXR; MRI

Bell’s Palsy Treatment

**Up-to-Date**

- Protect eye
- Short course (7 days) of prednisone 60-80 mg
- Prednisone + valacyclovir, if severe

**American Academy of Neurology**

- Corticosteroids (probably effective)
- Acyclovir (possibly effective)
- Surgical decompression (no proven benefit)

**Cochrane**

- No conclusion on treatments – need more data

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Stroke

**Classification**

**Risk Factors & 1º Prevention**

Ischemic Stroke
- acute therapy
- 2º prevention

**Ischemic:** 80%
- large vessel: embolic, thrombotic
- small vessel: thrombotic

**Hemorrhagic:** 20%
- parenchymal
- subarachnoid hemorrhage
- (subdural & epidural hematomas)
Common Stroke Syndromes

**Left (dominant) hemisphere – ICA/MCA**
right sensorimotor loss, right visual field cut, left gaze preference + **aphasia**

**Right (non-dominant) hemisphere – ICA/MCA**
left sensorimotor loss, left visual field cut, right gaze preference + **neglect of left side**

**Posterior cerebral hemisphere - PCA**
visual field deficits, amnesia

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**Brainstem/cerebellum**
- sensorimotor loss on both sides or **crossed signs**
- limb or gait ataxia
- dysconjugate gaze or nystagmus

**Small vessel subcortical or brainstem (lacunes)**
- pure motor
- pure sensory
- dysarthria/clumsy hand
- ataxia/hemiparesis

**Lacunar State**
multiple bilateral lacunes in BG and corticospinal tract; slow, stiff, clumsy pseudoparkinsonism

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**Risk Factors & 1º Prevention**

**Fixed**
gender
age
race
diabetes

**Modifiable**
- Hypertension
  - 160/95 – 4x > risk
- cardiac disease
- prior TIA or stroke
- smoking
- hyperlipidemia

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**Ischemic Stroke: Acute Therapy**

**Thrombolysis with IV tPA**
- <3 hrs, **significant** deficit (not TIA!!)
- BP <185/110
- coags/platelets & glucose ok, no blood on CT, no recent trauma or invasive procedure
- no age limit

11% more patients were normal or near normal at 3 months (NEJM 1995)

**Permissive hypertension** (ischemic stroke)
**Ischemic Stroke: 2º Prevention**

**Atrial fibrillation**
- ASA for lone AF < 65 y/o
- warfarin, INR 2-3 for everyone else
- warfarin reduces risk by 68%

**Endarterectomy:**
- >70% stenosis +/- symptoms, >50% with in men with symptoms
- 17% reduction in any stroke; 10% reduction in fatal strokes.

**Antiplatelet drugs:** ASA, ASA +/- persantine (Aggrenox), clopidogrel
- Platelet inhibitors reduce the risk of recurrent stroke by 25% after TIA, cardiac, and non-cardiac strokes.

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**Parkinson Disease**

**Cardinal features:** bradykinesia, rigidity, tremor, loss of postural reflexes

**Common presentations:** tremor, gait disorder

**Onset usually > age 50:**
- 1% of elderly, increasing with age
- 5% < age 40

**W/U:** clinical diagnosis - imaging if atypical features

**Treatment:**
- medical: levodopa (Sinemet), dopamine agonists, anticholinergics, MAO B Inhibitors
- PT/OT/SLP
- Deep brain stimulation in selected patients

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**Red Flag Features**

**Toxin exposure**
- Mn, drugs

**Early Onset**
- Wilson’s Disease

**Head trauma**
- Post-traumatic PD

**Early dementia**
- Alzheimer disease

**No resting tremor**
- PSP or MSA

**Action tremor**
- Essential tremor

**Mostly legs/spasticity**
- NPH or lacunar state

**No response - L-dopa**
- Not idiopathic PD

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**Substantia Nigra**

Normal

PD
**Pathophysiology of PD**

- Motor Cortex
- Caudate / Putamen
- GPe
- STN
- Thalamus
- GPi / SNr

- $D_2$
- $D_1$

$\uparrow =$ Inhibition
$\downarrow =$ Stimulation

**Subthalamic Nucleus DBS for PD**

- Pre-Op: Off Meds
- Post-Op: Off Meds, Bilateral STN DBS

**Parkinson vs. Essential Tremor**

<table>
<thead>
<tr>
<th>Parkinsons</th>
<th>Essential</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 - 6 Hz</td>
<td>6 - 9 Hz</td>
</tr>
<tr>
<td>Resting</td>
<td>Action/postural</td>
</tr>
<tr>
<td>Asymmetric/unilateral</td>
<td>Asymmetric/bilateral</td>
</tr>
<tr>
<td>Jaw tremor</td>
<td>Head tremor</td>
</tr>
</tbody>
</table>

- Improves with
  - levodopa
  - dopamine agonists

- Improves with
  - alcohol
  - beta blockers
  - primidone

**Restless Leg Syndrome (RLS)**

- Symptoms: Dysesthesias in legs – usually calves; urge to move legs – worse at rest or at night. Exam is negative. Sleep is disturbed; may have PLMS (periodic limb movements of sleep)

- 1° RLS: Family history is + (50-60%)
- 2° RLS: iron/folate deficiency, anemia, uremia, etc

- Etiology: Dopamine dysfunction; endorphins?

- DX: Lab helpful with 2°RLS; sleep studies

- RX: No large studies - Better sleep habits; exercise; vitamin supplements; Sinemet hs (augmentation) or dopamine agonists (ropinirole; pramipexole); benzodiazepines (clonazepam); gabapentin
**Alzheimer Disease**

*Features:* memory loss with parietal (visuospatial) & temporal (language) dysfunction

*60% of dementia:* 10% of all elderly (~50% >age 85)

*W/U:*

- **“typical” cases:** Head CT, labs (CBC, panel 20, B₁₂, TSH), depression screen
- **“atypical” cases:** rapid, younger, focal features, family history: MRI, more labs, consider LP & referral

*Rx:*

- **drugs:** cholinesterase inhibitors, memantine
- **symptomatic:** neuroleptics???
- **supportive care:** advance directives, respite, set routines