STROKE Rehabilitation

Definition of Stroke

- Sudden focal neurological deficit secondary to occlusion or rupture of blood vessels supplying the brain.
- TIA (transient ischemic attack) = stroke symptoms that resolve without any residual deficits.

Non-modifiable Risk Factors

- **Age**: after age 55, incidence increases for both males and females.
- **Sex** (male > female)
- **Race** (AA 2x > Caucasians > Asians)
- **Family History** of stroke

Modifiable Risk Factors

- **HTN**: increases risk by 7x.
- **History of prior stroke/TIA**: 5% of TIA patients go on to develop stroke within one month.
- **CAD/CHF**: increases risk by 2x.
- **A.fib**: increases risk of embolic stroke by 5x.
- **Diabetes**: risk increases by 2x (tight glucose control has not been shown to alter the risk of stroke)

Modifiable Risk Factors cont..

- **Cigarette Smoking**
- **Carotid Stenosis**: risk of stroke decreases with CEA
- **Cocaine/ETOH Abuse**
- **Estrogen (BCP)**
- **Hypercoagulable States**
- **Hyperlipidemia**: 30% reduction in risk of stroke with use of statins.
- **Migraine HA/ PFO**
- **OSA**

Blood Vessels involved in Stroke
Types of Stroke

- **Ischemic Strokes**: (85%) Thrombotic, Embolic, Lacunar
  - **Hemorrhagic Strokes**: (15%)
    - Intracerebral Hemorrhage (ICH) and Subarachnoid Hemorrhage (SAH)

Ischemic Strokes: Thrombotic

- Severe stenosis or occlusion of major vessels.
- Presents more gradually with progressive deficit.
- 50% have a preceding TIA, usually in the same territory.

Ischemic Strokes: Embolic

- Cardiac source
- Sudden, immediate deficit
- 11% with preceding TIA (TIA uncommon → no micro-emboli)
- Can manifest as "watershed infarct" or hemorrhagic infarction (30% of pts with embolism)

Watershed Infarct: Embolic
Ischemic Strokes: Lacunar

- Small lesions (<15mm) of the putamen, pons, thalamus, caudate, internal capsule, and corona radiata.
- Abrupt or gradual onset
- 23% have preceding TIA
- Strong correlation with HTN, but also seen in DM
- CT shows the lesion 2/3 times but MRI is more sensitive

Neuroanatomy: Homunculus

Stroke Territories

Anterior Cerebral Artery Infarct

- Foot/leg > thigh > upper extremities
- Weakness usually does not involve the face.
**MCA Territories**

**Middle Cerebral Artery Infarction: M1 Mainstem**

- **Dominant Hemisphere** (left-side): damage to the language network. Broca’s (frontal) and Wernicke’s (temporal) areas can be affected.

- **Non-dominant Hemisphere** (right-side): severe visual and perceptual deficits with disrupted spatial body orientation $\rightarrow$ apraxia. Also severe left hemi-neglect syndrome as well as anosognosia and asomatognosia.

**Middle Cerebral Artery Infarction: M2 Superior Division**

- **Dominant Hemisphere**: Broca’s aphasia, bilateral limb apraxia from damage to frontal lobe language network.

- **Non-dominant Hemisphere**: Hemi-neglect syndrome, deficits with visual-spatial perception, aprosodia (frontal lobe).

**Definitions**

- **Apraxia**: disorders of skilled movement in the absence of motor, sensory, or cognitive impairment.

- **Anosognosia**: patients denying they even have a stroke or stroke-related impairments.

- **Asomatognosia**: loss of awareness of one’s body schema and its relation to extrapersonal space (parietal lobe).

- **Aprosodia**: loss of prosody in one’s speech $\rightarrow$ lacking the normal inflections that emphasize a meaning of a sentence.

**Anatomy**

**Middle Cerebral Artery Infarction: M1 Mainstem**

- **ARM>LEG**

- Complete contralateral hemiplegia of UE, LE and lower face equally because of lenticulostriate arteries

- Hemisensory loss

- Homonymous hemianopsia contralaterally

- Head and eyes deviate toward the side of infarct

- Can have both expressive and receptive aphasia
Anatomy

Middle Cerebral Artery Infarction: M2 Inferior Division

- Affecting the lateral parietal, temporal and occipital lobes.
- **Dominant Hemisphere**: Wernicke’s aphasia and contralateral hemionopsia.
- **Non-dominant Hemisphere**: left hemi-neglect syndrome and sensory apropia in which the individual has a difficult time comprehending the prosody in another’s speech.

Aphasia

- **Broca**: impaired fluency, mildly impaired comprehension, impaired repetition, impaired naming.
- **Wernicke**: normal fluency, impaired comprehension, impaired repetition.
- **Transcortical Motor**: impaired fluency, normal comprehension, normal repetition.
- **Transcortical Sensory**: normal fluency, mildly impaired comprehension, normal repetition.

Posterior Cerebral Artery Infarct

- PCA supplies the upper brainstem, inferior part of the temporal lobe and medial parts of the occipital lobe.
- **Clinical manifestations**:
  1. Visual field cuts (homonymous hemianopsia)
  2. Prospagnosia (can’t read faces)
  3. Dyschromatopsia (altered color discrimination)
  4. Palinopsia (abnormal recurring visual imagery)
  5. Alexia (can’t read) without agraphia due to lesion in angular gyrus
  6. Transcortical sensory aphasia: repetition intact but pt can’t comprehend written or spoken word.
Brain Stem Syndromes

- Brainstem (midbrain, pons and medulla) supplied by verteobasilar system.
- In general, infarcts in the verteobasilar system will cause:
  - vertigo
  - nystagmus
  - ipsilateral CN dysfunction
  - bilateral motor involvement
  - absence of cortical signs (aphasia or cognitive deficits)

Brain Stem Syndromes: Midbrain

- **Weber Syndrome**: CN III Palsy and contralateral hemiplegia.

Brain Stem Syndromes: Pons

- **Millard-Gubler Syndrome**: CN 6 and 7 palsy resulting in ipsilateral facial weakness with contralateral hemiplegia.
- **“Locked In” Syndrome**: tetraparesis with patients only able to move eyes vertically or blink; patients are fully awake because of sparing of reticular activating system. Caused by basilar artery occlusion.

Brain Stem Syndromes: Medulla

- **Wallenberg (Lateral Medullary) Syndrome**: Ipsilateral → Horner’s Syndrome, decrease pain/temp on face, ataxia of extremities. Contralateral → decreased pain/temp body. Also has dysphagia, dysarthria, hiccups, nystagmus and diplopia. Vertigo/dizziness from lesion in vestibular nuclei.
- **Medial Medullary Syndrome**: Ipsilateral CN 12 palsy, contralateral hemiplegia, contralateral lemniscal sensory loss (proprioception).

Brain Stem Syndromes: In General

- Midbrain = PCA = CN 3 = Weber Syndrome
- Pons = Basilar = CN 6,7 = Millard-Gubler
- Medulla = Vertebral = CN 12 = Medial Medullary

Hemorrhagic Strokes: ICH

- In general, linked to chronic HTN.
- Sudden onset HA and/or LOC.
- Vomiting at onset in 22-44%.
- Seizures in 10%
- Nuchal rigidity common.
- Preceded by formation of “false” aneurysms of Charcot/Bouchard (also called pseudo-aneurysms) = arterial wall dilations secondary to chronic HTN.
Hemorrhagic Strokes: ICH

- **Putamen**: most common, hemiplegia because of the hit to the internal capsule, vomiting in 50%, headache.
- **Thalamus**: Hemiplegia, contralateral sensory deficits, mild aphasia with dominant lesions; contralateral hemineglect with non-dominant lesions.
- **Pontine**: Deep coma in minutes, total paralysis, small reactive pupils, decerebrate rigidity → death! Usually only survive if its smaller than 1cm.
- **Cerebellum**: LOC, occipital HA, vertigo, inability to sit, stand or walk (loss of balance).

Hemorrhagic Strokes: SAH

- **Saccular aneurysms = Berry aneurysms (90-95% occur in anterior part of circle of willis)**
- Rupture occurs when patient is straining
- Peak age of rupture = 50's-60's
- Mortality = 25% during first 24 hours.

Stoke Rehabilitation: Recovery from Impairments

1. Immediately after = **loss or decrease of DTR**.
2. Within 48h = **increased DTR (tone returns → spasticity)**.
3. 6-33 days later, **first intentional movements** appears usually proximal → distal
4. **Flexion synergy pattern** develops (UE= shoulder, elbow, wrist and finger flexion) followed by extension synergy patterns.
5. **Increased voluntary movement** = decreased spasticity
6. Tendon reflexes remains hyper despite full motor recovery.

Hemorrhagic Strokes: ICH

- **Lobar Hemorrhages**: HA and vomiting!
  - Occipital → dense homonymous hemianopsia and pain ipsilateral eye.
  - Temporal → partial hemianopsia/ fluent aphasia/pain ear.
  - Frontal → contralateral hemiplegia and frontal HA.
  - Parietal → contralateral hemisensory deficit/ anterior temporal HA.

Hemorrhagic Strokes: SAH

- “Worst headache of my life”
- **CN 3 palsy, CN 6 palsy**.
- Hemiplegia, aphasia (dominant hemisphere), memory loss
- **Transient LOC** in 20-45%
- Seizures: 4% at onset/ 25% overall
- Vasospasm is a common complication

Flexion Synergy
Stroke Rehabilitation: Predictors of motor recovery

1. Severity of arm weakness
2. Timing of return of hand movement (4 weeks)
3. Poor prognosis associated with:
   - severe proximal spasticity
   - prolonged flaccid period
   - late return of proprioceptive facilitation (tapping) response > 9 days
   - late return of proximal traction response (shoulder flexors/adductors) > 13 days

Why is this important?

- FUNCTION: ADLs (activities of daily living)
  - toileting/bathing
  - dressing
- FUNCTION: Mobility
  - how do they get around safely
  - cane, walker, wheelchair
- FUNCTION: Cognition
  - can they live by themselves? Can they go back to work?
- FUNCTION: Swallowing
  - risk of aspiration, do they need a peg tube.

Common Post-stroke Complications

- Post-stroke Shoulder Pain
- Falls (22% of patients fall on rehab)
- CPRS (complex regional pain syndrome)
- DVT (incidence = 45% in acute stroke)
- Spasticity
- Dysphagia/Aspiration
- Aphasia
- Post-stroke Depression
- Bladder Dysfunction (incidence = 37-79%)
- Sexual Dysfunction

Causes of Post-stroke Shoulder Pain

- CRPS (RSD), also known as “shoulder-hand syndrome”
- Adhesive Capsulitis (Frozen Shoulder)
- Shoulder Subluxation
- Biceps Tendonitis
- Rotator Cuff Tear
- Impingement Syndrome

Spasticity

- “Velocity dependent increase in tonic stretch reflexes with exaggerated reflexes” (UMN sign).
- Modified Ashworth Scale (MAS)

- Why is spasticity such a problem?

- Tx includes oral medicaions (baclofen, dantrolene, tizanidine), Botox, and/or ITB.

Bladder Dysfunction

- Incidence of urinary incontinence after stroke is 50-70% during the first month.

- Why do stroke patients have urinary incontinence?

- Management includes treating the UTI, regulate fluid intake, removing indwelling catheter and perform post void residuals, timed voids, medications.
Dysphagia (difficulty swallowing) Aspiration

- Incidence is 51-55% in clinical tests and 64-78% on video fluoroscopy.
- Dysphagia is associated with 3x increase in chest infections; 11x increase in chest infections with definite aspiration.
- Tx: direct swallowing therapy techniques (diet modification and behavioral compensation) and indirect swallowing therapy techniques (exercises)...Peg tube may be needed!

Post-stroke Depression

- 1/3 of stroke patients.
- Major depression peaks within 3-6 months post-stroke, and declines after ~2 years.
- Minor depression which remains mostly stable or increases over time.
- Tx includes serotonergic and noradrenergic modulators (i.e. SSRIs, SNRIs, TCA)

Questions?