Cerebrovascular diseases

Didactic Session 1-Summary

Daniel L. Menkes, M.D.

University of Connecticut Health Center

Concept: Stroke = dead brain

- All living tissue requires blood and oxygen
- Decreased oxygen supply = hypoxia
- Decreased blood supply = ischemia
  - This may be reversible
  - Time is brain
- No blood flow = infarction
  - This is not reversible
  - This is what needs to be prevented

Stroke mechanisms:

- Hemorrhage from leaky blood vessels
- Chronic arterial obstruction
  - Atherosclerosis [Large vessel]
    - Same as for cardiac disease
  - Lipohyalinosis [Small vessel]
    - Chronic hypertension
    - Diabetes mellitus
- Acute arterial obstruction
  - Blood vessel structural defects
  - Clots tossed from the heart
- Venous thrombosis [hypercoaguable states]

Hemorrhagic stroke

- Hypertensive hemorrhage (5 main locations)
  - Caudate/putamen
  - Thalamus
  - Deep lobar white matter
  - Cerebellum
  - Pons
- Treatment
  - Gently lower blood pressure
  - Watch for signs of herniation
  - Neurosurgical consultation

Large vessel atherosclerosis

- Similar risk factors to coronary artery disease
  - Coronary arteries usually diseased before carotids
  - Primary prevention is most effective
- Two main vascular territories:
  - Posterior circulation: Vertebrobasilar (VB)
    - Occipital lobes
    - Brainstem
  - Anterior circulation: Internal carotid and branches
    - Anterior cerebral = contra leg motor and sensory
    - Middle cerebral = everything else not ACA or VB

Small vessel disease

- Different pathophysiology-lipohyalinosis
  - Deposition of “silty material” in small vessels
  - Very specific syndromes result
- 4 main syndromes
  - Clumsy hand dysarthria [motor to face and arm]
  - Crural ataxia [motor to leg]
  - Pure motor stroke [entire corticospinal tract]
  - Pure sensory stroke [thalamus]
- Treatment
  - Control blood pressure
  - Control blood sugar
  - Anti-platelet agents

Chronic vascular diseases may allow for intervention

- Transient Ischemic Attack
  - "Warning" of impending stroke
  - Definition to follow
- Collateral circulation may minimize deficit
- Cerebrovascular symptoms often imply significant coronary artery disease
- Risk reduction may be initiated
  - Cholesterol lowering agents
  - Antiplatelets
  - Lifestyle modifcation

Embolic strokes- 2 sources

- Cardiac source- consider anticoagulation
  - Atrial fibrillation (paroxysmal has higher risk)
  - Anatomical abnormalities (LV dysfunction)
  - Right to left shunt (Patent foramen ovale/VSD)
- Vessel to vessel- antiplatelet agents
  - Aortic arch
  - Carotid arteries
- Most commonly affected vessel- middle cerebral
  - Highest blood flow and straight shot from below

Transient Ischemic Attack (Thrombotic or embolic)

- FOCAL and reversible neurological deficit
  - Most last minutes
  - Nearly all resolve within one hour
  - May last up to 24 hours
  - Do NOT result in loss of consciousness
- Stroke versus TIA
  - TIAs are reversible and show no MRI abnormalities
  - Strokes are permanent and are visible on MRI
- Some TIAs progress to stroke – use ABCD2 score to determine who is at risk

ABCD2 Score for TIA and future stroke risk [low 0-3, mod 4-5, high 6+]

- Age ≥ 60? Yes +1
- BP ≥ 140/90 mmHg at 1st evaluation? Yes +1
- Clinical Features of the TIA:
  - Unilateral Weakness +2
  - Speech Disturbance without Weakness +1
- Duration of Symptoms?
  - 10-59 minutes +1
    ≥ 60 minutes +2
- Diabetes Mellitus in Patient's History? Yes +1

Other (rarer) causes of stroke

- Blood vessel structural abnormalities
  - Fibromuscular dysplasia
  - Aneurysm rupture followed by vasospasm
  - Connective tissue diseases
- Carotid dissection
  - Tearing of intima to create false lumen
  - Actual lumen is occluded
- Venoocclusive disease (hypercoaguable states)
- Vasculitis (blood vessel inflammation)

Stroke work-up should be more extensive in…

- Patients less than age 60
  - This is especially true in children
- Patients with fewer risk factors

Approach to stroke

- TIMING IS EVERYTHING
- LOCALIZE the LESION
- Find the underlying cause
- Reverse the underlying cause if possible
- Risk factor reduction
- Secondary prevention

TIMING for TPA

- TPA most effective when given early as possible or TIME = BRAIN
- Exact time of symptom onset is important
  - Waking up with a deficit = time unknown
  - Based on LAST KNOWN TO BE NORMAL
- Risk to benefit favorable for first 4.5 hours
  - Benefit most favorable at 1 minute
  - No benefit after 4 hours and 31 minutes
- TPA criteria MUST be met (carry a card)

Localization-Cortical signs? [Note: findings are contralateral]

- Apraxia (inability to initiate an action)
- Broca's aphasia
- Wernicke's aphasia
- Agraphesthesia or Astereognosis
- Visual field cut
  - Spares macula
  - Affects macula
- Pre-frontal cortex/frontal cortex
- Left frontal lobe
- Left parietal lobe
- Parietal lobe contralaterally
- Depends
  - Temporal or parietal
  - Occipital

Main types of aphasia [This is a language problem]

- Expressive = Broca's = Motor
  - Unable to express oneself in speech OR writing
  - Deaf persons cannot sign to others
- Receptive = Wernicke's = Sensory
  - Unable to understand language
  - Deaf persons cannot interpret signs
- Transcortical motor = Broca's but able to repeat
- Transcortical sensory = Wernicke's but able to repeat
- Conduction = Repetition is the only deficit
- Global = Total language loss

No cortical signs…is it lacunar?

- Clumsy hand dysarthria
  - Posterior limb of internal capsule
  - Affects face and arm pyramidal tract fibers
- Crural ataxia
  - Posterior limb of internal capsule
  - Affects leg pyramidal tract fibers
- Pure motor stroke
  - Posterior limb of internal capsule
  - Affects all corticospinal fibers
- Pure sensory stroke - thalamus

Emergent stroke work-up

- Head CT WITHOUT contrast ASAP
  - MUST EXCLUDE BLEED
  - Contrast looks like blood
  - If bleed- admit to ICU for observation
- NO BLEED- Is patient TPA candidate?
- If not TPA candidate- admit for routine work-up

Routine stroke work-up

- MRI of brain (Diffusion weighted)
  - Evaluate size and location of stroke
  - If MRI is contraindicated – head CT 1 week later
- Rule out MI
- Cardiac echo
- Evaluate carotid arteries
  - Surgery helpful with > 70% symptomatic stenosis
  - Other indications are controversial
- Evaluate risk factors and treat them

Secondary prevention

- Embolic strokes
  - Coumadin
  - Pradaxa
  - Consider correction of anatomical defects
- Thrombotic strokes
  - Statin therapy
  - Antiplatelet agents
  - Blood pressure control

Summary

- Is it a stroke or TIA?
  - Should have a focal deficit
  - URGENT Head CT to exclude a bleed
- Use NIH stroke scale for scoring
- Consider TPA if patient is a candidate
- Subsequent treatment
  - Anti-platelets
  - Coumadin for Atrial fibrillation or cardiac thrombus
  - Lipid lowering agents for all
  - Risk factor reduction