Stroke

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Scope of Problem

- Major cause of disability
- Third leading cause of death in the western world (30/20/10)

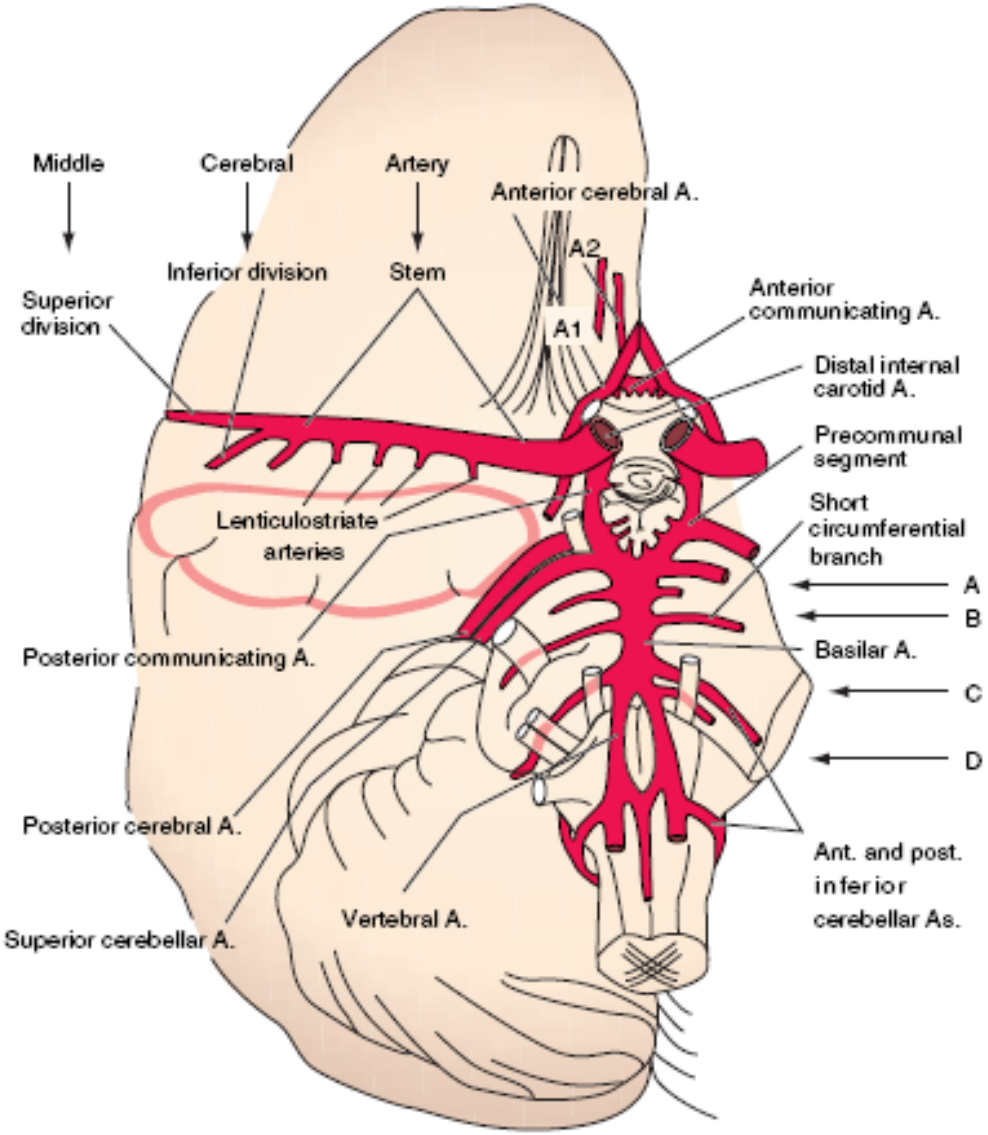
Definition

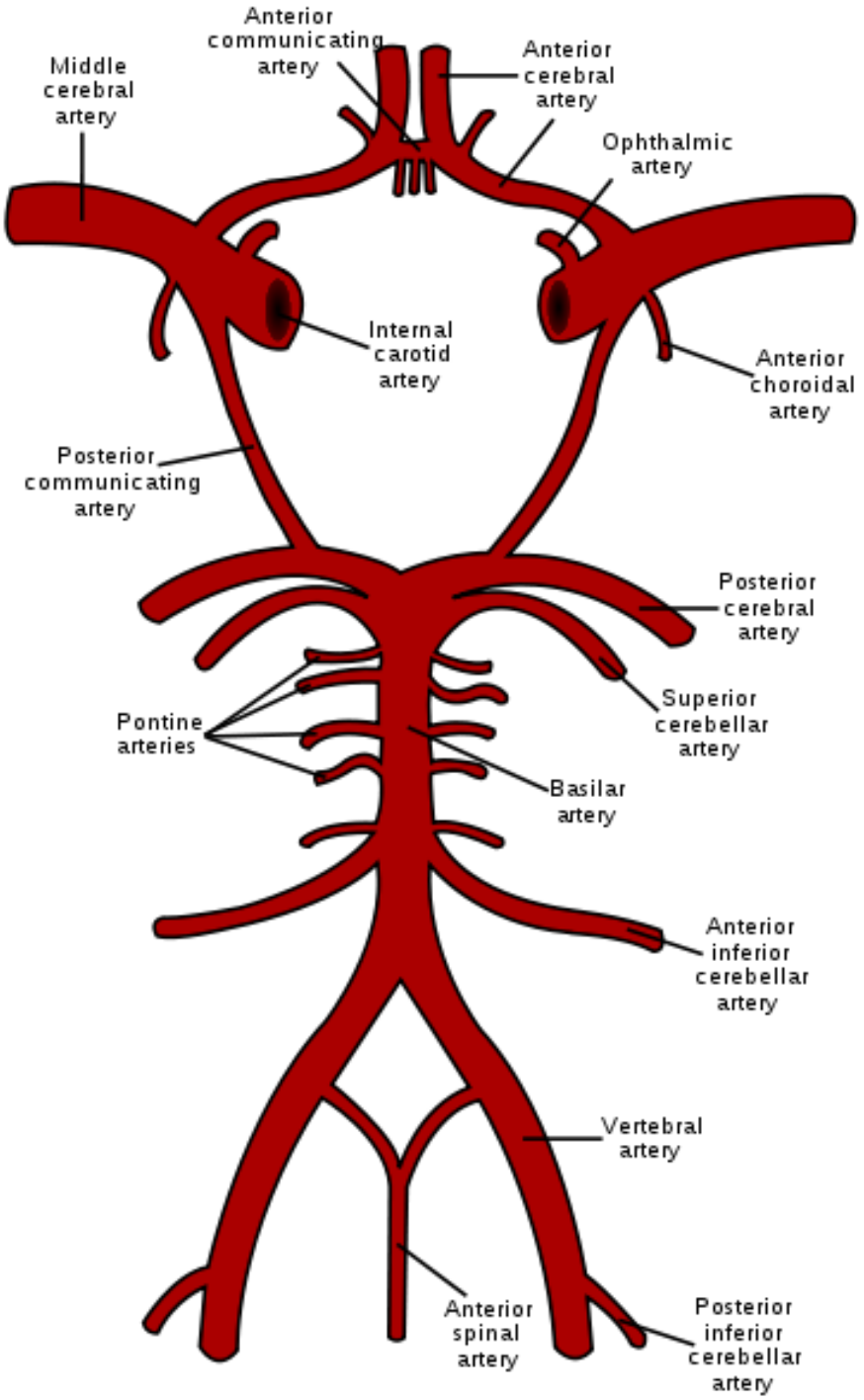
- Stroke
  - A sudden focal neurological deficit or acute neurological impairment caused by the interruption of blood flow to a specific region of the brain
  - Ischemic or Hemorrhagic

Definitions

- Transient Ischemic Attack (TIA)
  - Any focal deficit that resolves completely and spontaneously within 24 hours
- Many patients with TIA have definite evidence of brain infarction

Anatomy


Middle
Cerebral
Artery
Anterior cerebral A.
A2
A1
Inferior division
Stem
Superior division
Anterior communicating A.
Distal internal carotid A.
Precommunal segment
Lenticulostriate arteries
Short circumferential branch
A
B
Basilar A.
C
D
Posterior communicating A.
Posterior cerebral A.
Ant. and post. inferior cerebellar As.
Vertebral A.
Superior cerebellar A.

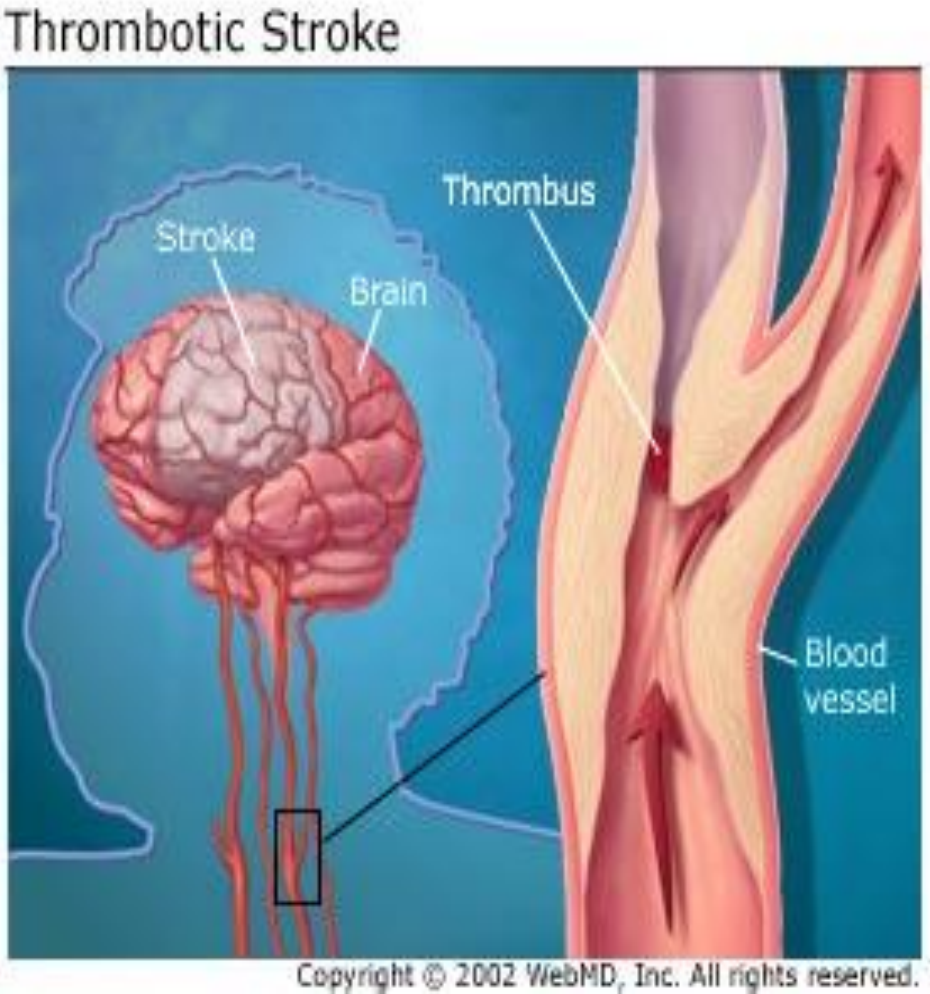

Anterior communicating artery
Middle cerebral artery
Anterior cerebral artery
Ophthalmic artery
Internal carotid artery
Anterior choroidal artery
Posterior communicating artery
Posterior cerebral artery
Pontine arteries
Superior cerebellar artery
Basilar artery
Anterior inferior cerebellar artery
Vertebral artery
Anterior spinal artery
Posterior inferior cerebellar artery

Ischemic Stroke

- 85% of all strokes
- Caused by occlusion of an artery to a specific region of the brain
  - Thrombotic
  - Embolic
  - Hypoperfusion
    - Global pattern
    - Low blood flow or intermittent periods of no flow

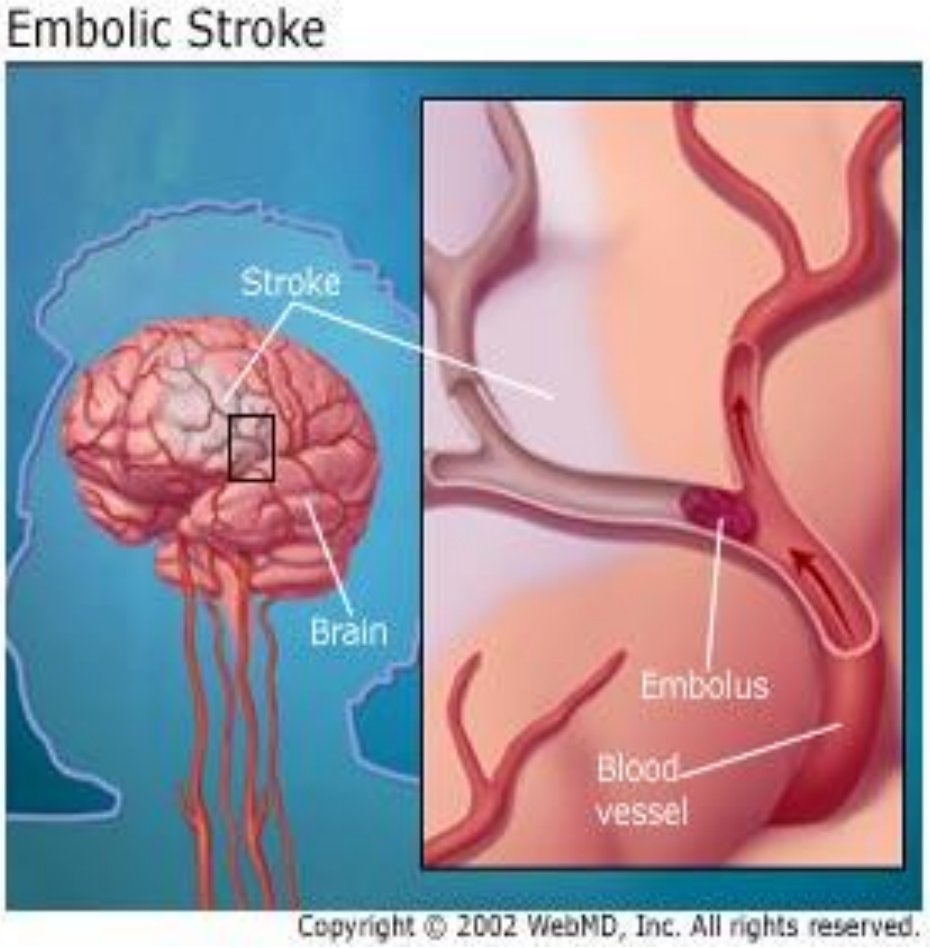
Ischemic Stroke

- Thrombotic
  - Acute occluding clo
  - Superimposed on chronic narrowing



Ischemic Stroke

- Embolic
  - Intravascular material, most often a clot, separates proximally
  - Flows through arterial system until it occludes distally
  - Atrial fibrillation



Hemorrhagic Stroke

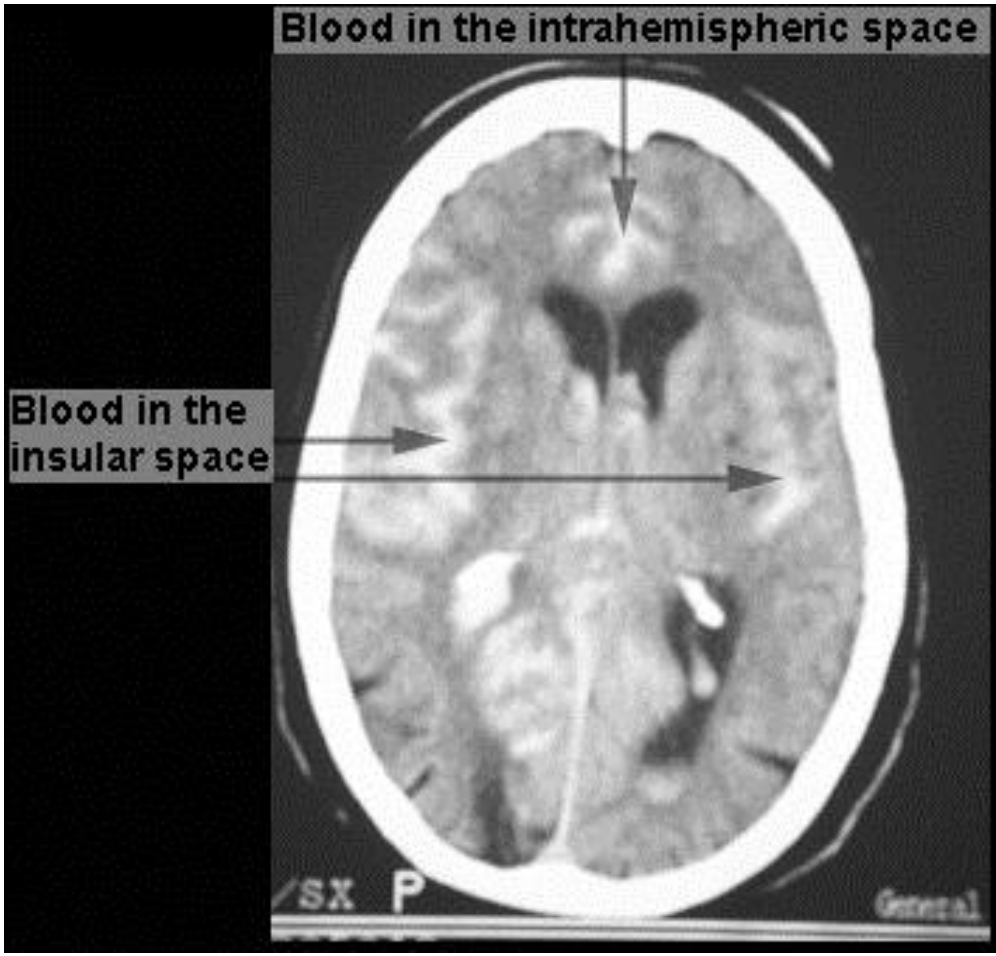
- 15% of all strokes
- Blood vessel in brain ruptures
- Hemorrhage into surrounding tissue
- Damage from direct trauma to brain cells, expanding mass effects, elevated intracranial pressure, damaging mediators released, vascular spasm, loss of blood supply distally

Hemorrhagic Stroke

- Intracerebral
  - Blood leaks directly into brain parenchyma
  - HTN most common cause

Hemorrhagic Stroke

- Subarachnoid
  - Blood leaks from cerebral vessel into subarachnoid space
  - If arterial, sudden and painful
  - Aneurysms and AVMs



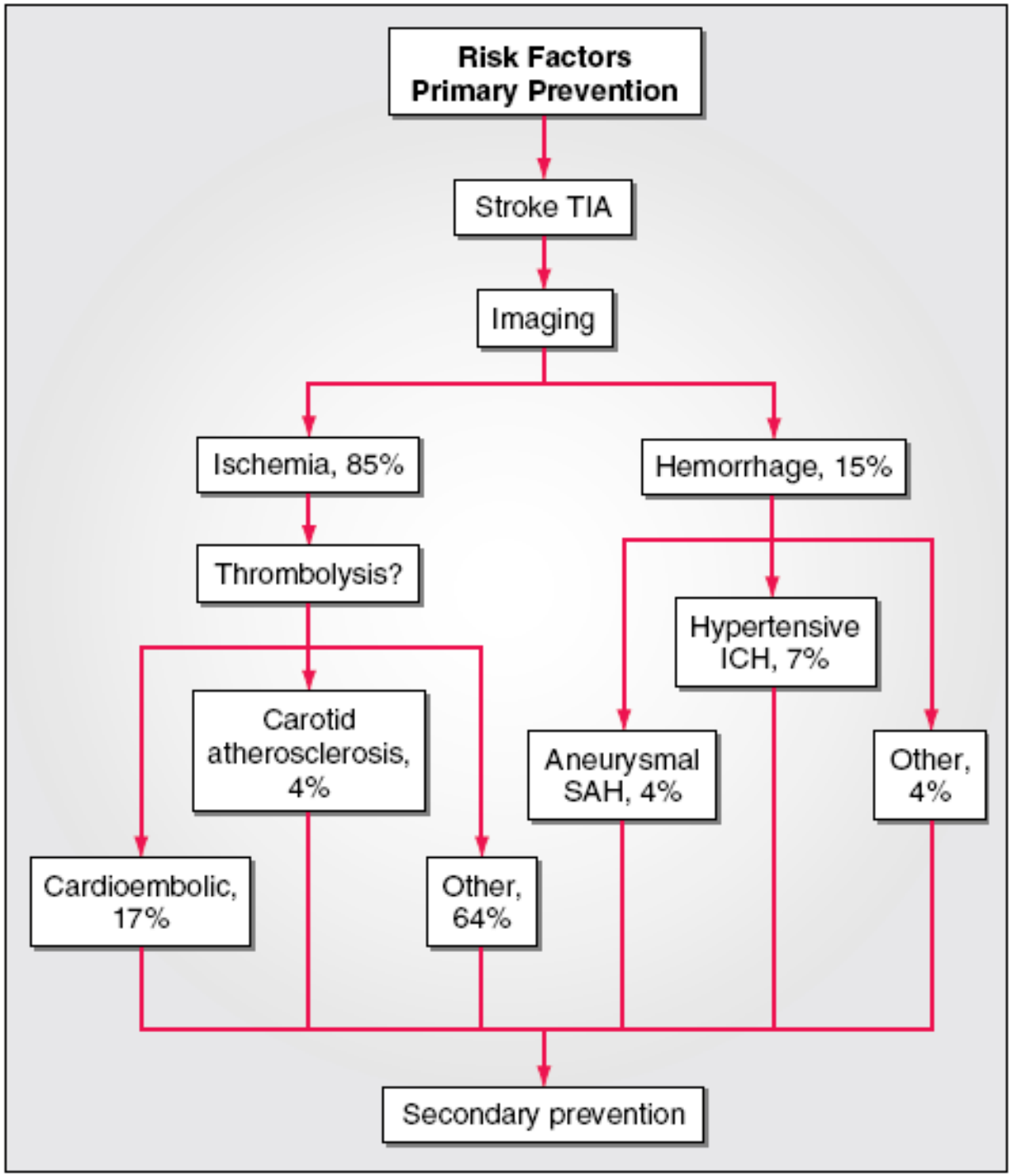
Risk Factors

- Hypertension
- Smoking
- Diabetes mellitus
- Dyslipidemia
- H/O TIAs
- Heart Disease
- Hypercoagulopathy
- Increased RBC count/Sickle Cell
- Carotid Bruit

Signs/Symptoms

- Hemiplegia/ hemiparesis
- Hemianesthesia
- Homoymous hemianopia
- Dominant hemisphere: (Left in 90% R & 60% L)
  - Aphasia
    - Fluent=Sensory=Wernike
    - Nonfluent=Motor=Broka

    } global
- Nondominant hemisphere
  - Anosognosia
  - Constructional apraxia
  - neglect


Risk Factors
Primary Prevention
Stroke TIA
Imaging
Ischemia, 85%
Hemorrhage, 15%
Thrombolysis?
Hypertensive ICH, 7%
Carotid atherosclerosis, 4%
Aneurysmal SAH, 4%
Other, 4%
Cardioembolic, 17%
Other, 64%
Secondary prevention

Stroke Management

- Patient with a suspected stroke
  - Get patient to ED
  - Always ABCs first with vitals
  - Oxygen if hypoxemic
  - IV access/Labs/Glucose
  - Neurologic screening assessment
  - Get CT scan of brain ordered
  - Get 12 lead ECG
- Within 10 minutes of arrival to ED

Stroke Management

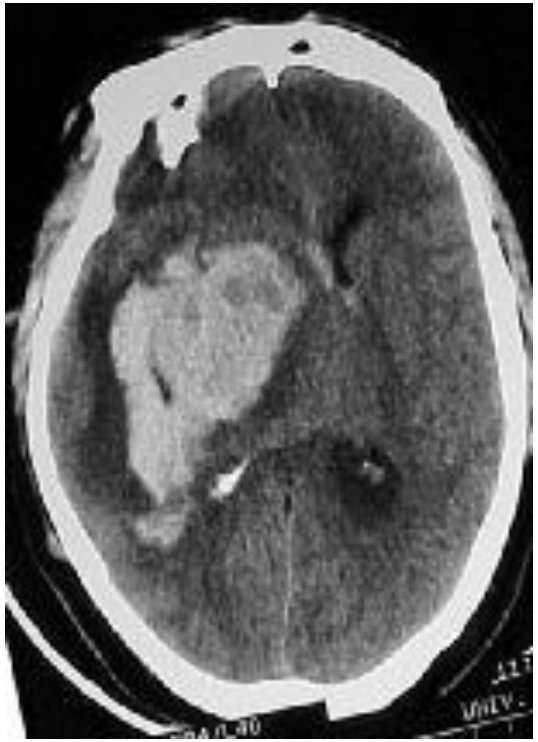
- Immediate Neurologic Assessment
  - Review History
  - Onset of symptoms
  - Neurologic examination
    - NIH Stroke Scale
    - Canadian Neurologic Scale
- Within 25 minutes of arrival to ED

Stroke Management

- CT scan—noncontrast
  - Complete scan within 25 minutes of arrival to ED
  - Have scan read within 45 minutes of arrival to ED

Stroke Management

Is hemorrhage present?



Stroke Management

- Hemorrhage seen on CT
  - Need neurology/neurosurgery
  - Mannitol to lower ICP
  - Nimodipine for SAH
  - BP mgmt
    - May need higher than normal systemic BP to maintain cerebral perfusion
  - Supportive measures

Stroke Management

- No Hemorrhage on CT
  - Probable acute ischemic stroke
  - Consider fibrinolytic therapy
  - Inclusions—need all YES answers
    - Age18 or older **AND**
    - Clinical diagnosis of ischemic stroke with a measurable neurologic deficit **AND**
    - Time of symptom onset well established as less than 3 hours before infusion would begin

TABLE 349-2 Administration of Intravenous Recombinant Tissue Plasminogen Activator (rtPA) for Acute Ischemic Stroke[a]

Indication

- Clinical diagnosis of stroke
- Onset of symptoms to time of drug administration ≤3 h
- CT scan showing no hemorrhage or edema of $>\frac{1}{3}$ of the MCA territory
- Age ≥18 years
- Consent by patient or surrogate

Contraindication

- Sustained BP > 185/110 despite treatment
- Platelets < 100,000; HCT < 25%; glucose < 50 or > 400 mg/dL
- Use of heparin within 48 h and prolonged PTT, or elevated INR
- Rapidly improving symptoms
- Prior stroke or head injury within 3 months; prior intracranial hemorrhage
- Major surgery in preceding 14 days
- Minor stroke symptoms
- Gastrointestinal bleeding in preceding 21 days
- Recent myocardial infarction
- Coma or stupor

Administration of rtPA

- Intravenous access with two peripheral IV lines (avoid arterial or central line placement)
- Review eligibility for rtPA
- Administer 0.9 mg/kg intravenously (maximum 90 mg) IV as 10% of total dose by bolus, followed by remainder of total dose over 1 h
- Frequent cuff blood pressure monitoring
- No other antithrombotic treatment for 24 h
- For decline in neurologic status or uncontrolled blood pressure, stop infusion, give cryoprecipitate, and reimage brain emergently
- Avoid urethral catheterization for ≥2 h

Stroke Management

- No hemorrhage on CT
  - Meets inclusion/exclusion criteria
  - Deficits not rapidly improving or normal
    - Candidate for fibrinolytic therapy
    - Review risks/benefits with family
    - Give tPA
    - No anticoagulants/antiplatelets for 24 hours
  - If not a candidate
    - Give aspirin

Stroke Management

- All Stroke Patients
  - Admit to monitored bed
  - Monitor and treat BP if indicated
  - Monitor neurologic status and emergent CT if deterioration
  - Monitor blood glucose and treat if needed
  - Initiate supportive therapy and treat comorbidities

Stroke Management

- Blood Pressure Management
- Not eligible for fibrinolytic therapy
  - SBP $\leq$ 220 OR DBP $\leq$ 120
    - Observe unless other end organ involvement, treat other stroke symptoms/complications
  - SBP $\geq$ 220 OR DBP 121-140
    - Labetalol 10-20mg IV for 1 to 2 minutes
    - May repeat or double every 10 minutes (max 300mg) OR Nicardipine infusion
    - Aim for 10-15% BP reduction
  - DBP > 140
    - Nitroprusside infusion

Stroke Management

- Blood Pressure Management
- Eligible for fibrinolytic therapy
  - Pretreatment
    - SBP > 185 OR DBP > 110
      - Labetalol, Nitropaste
  - During/After treatment
    - DBP > 140
      - Nitroprusside infusion
    - SBP > 230 OR DBP 121-140
      - Labetalol, Nicardipine
    - SBP 180-230 OR DBP 105-120
      - Labetalol

Prevention

- Stop Smoking
- Manage Comorbidities
  - HTN
  - HLP
  - DM
  - CAD

Prevention

- Bruits/Carotid Stenosis
  - Symptomatic
    - Stenosis ≥ 70%
      - Surgery offers significant benefit
    - Stenosis 50-69%
      - Surgery offers modest benefit; especially those with hemispheric ischemia or no h/o DM
    - Stenosis < 50%
      - No surgical benefit

Prevention

- Bruits/Carotid Stenosis
  - Asymptomatic
    - Stenosis > 80%
      - May consider surgery
    - Stenosis 60-79%
      - Surgery only in select cases

Prevention

- Atrial Fibrillation
  - Aspirin vs Warfarin
  - Need to risk stratify patient
- High Risk Patients
  - WARFARIN
    - Previous stroke, TIA, or systemic embolis
    - H/O HTN
    - Poor LV systolic fxn
    - Age > 75 years
    - Rheumatic/Prosthetic Valve disorder

Prevention

- Atrial Fibrillation
- Moderate Risk Patients
  - If one risk factor WARFARIN OR ASPIRIN
  - If more than one risk factor WARFARIN
    - 65-75 years
    - DM
    - CAD with preserved LV systolic fxn
- Low Risk Patients
  - ASPIRIN
    - < 65
    - No CAD

Prevention

- TIAs
  - Evaluate for embolic source
  - Evaluate for carotid stenosis
  - Start with aspirin in most patients
  - If symptoms/progression despite aspirin may consider clopidogrel or aspirin/dipyridamole
  - If aspirin not tolerated may consider clopidogrel