

Acute Ischemic Stroke Pathophysiology and Core Measures Critical Care Consortium

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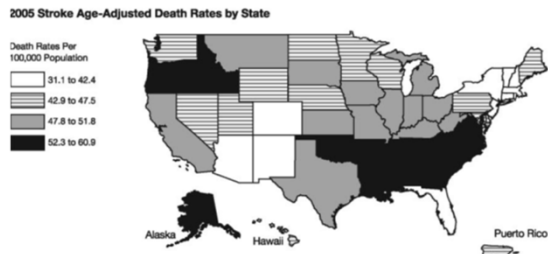


Disclosures:
Consultant for the
National Stroke
Association

Off Label Usage may
be discussed.



National Demographics



www.aha.health.state.ok.us/

Thank goodness for Mississippi....

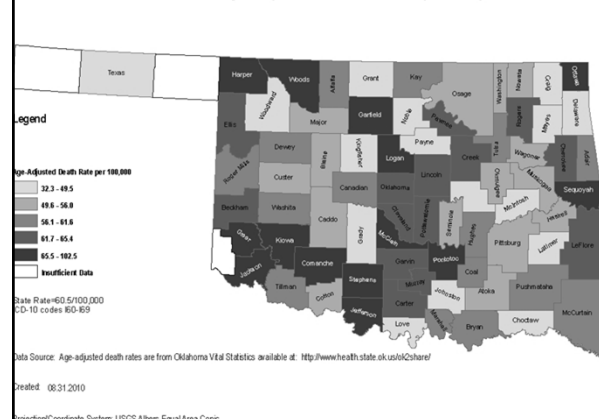
- Oklahoma has the second WORST stroke mortality and morbidity in the entire United States.....coming in dead last in the US is Mississippi
- One stroke every 18 minutes in Oklahoma

Stroke in Oklahoma

- Fourth leading cause of death
 - Six people die per day
 - 800 strokes /month in Oklahoma (2005)
- Prevalence of stroke in Oklahoma is 3.4%
 - Second only to Mississippi (4.3%)
- 57% of adult Oklahomans are unaware of stroke symptoms

Source: AHA 2009, OK State Health Dept

Oklahoma Stroke Age-Adjusted Death Rates by County, 2002-2006



Challenges for Oklahoma

- Limited access to neurological expertise for stroke care
- Oklahoma State Department of Health
New Classifications of Emergency Stroke Facilities
- Primary Stroke Center
 - If the facility does not have a board certified neurologist on staff to provide immediate consultative services for emergent stroke patients 24 hours a day, the facility shall have a written agreement with a hospital or a group of neurologist to provide such services for emergent stroke patients on a 24 hour a day basis.
 - The Neurologist shall be available for consultation on site or immediately available by telephone or other electronic means 24 hours a day.

Secondary Stroke Facility

- The hospital shall have written policies defining the patients they will keep and those that require stabilizing treatment and transfer.....aka transfer agreements

Major Risk Factors For Stroke

Risk Factor	Relative Risk for Stroke Occurrence
Hypertension	6x
Heart Disease	2-6x
Previous Stroke, TIA	10x
Carotid Bruit	3x
Diabetes Mellitus	2-4x
Smoking	2x

HYPERTENSION TREATMENT

Diastolic BP

- (5-6 mm decrease) - 30-40% stroke reduction

- 14% reduction in CAD

Systolic BP

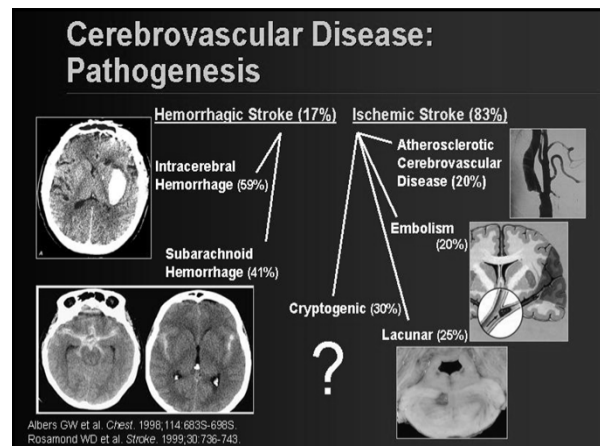
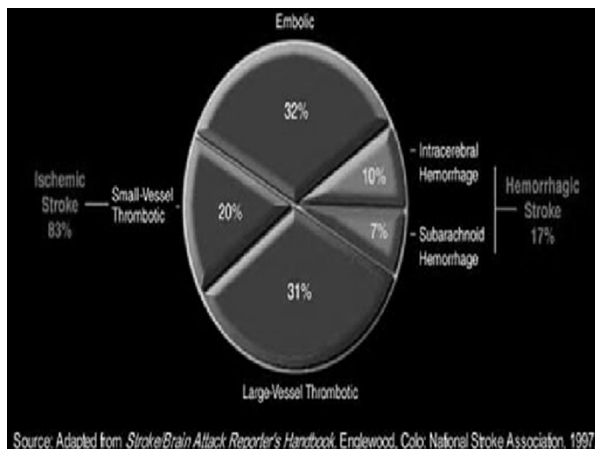
- (8 mm decrease) - 36% stroke reduction

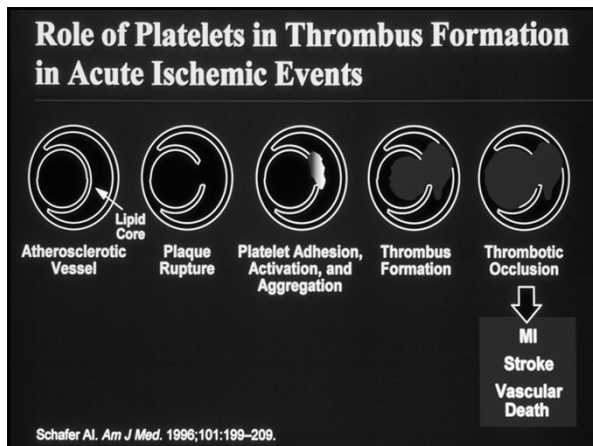
- 27% reduction in CAD

Collins, et al, LANCET 2990;486:837
Shep, JAMA 2992; 265:3255

Reduction of Stroke Risk Factors

Non-Modifiable Risk Factors	Modifiable Risk Factors
Age	Hypertension
Sex	Cardiac disease
Race	Atrial fibrillation
Prior Stroke	Diabetes mellitus
Heredity	Smoking
	Carotid stenosis
	Hypercholesterolemia
	Heavy alcohol use
	Sedentary lifestyle



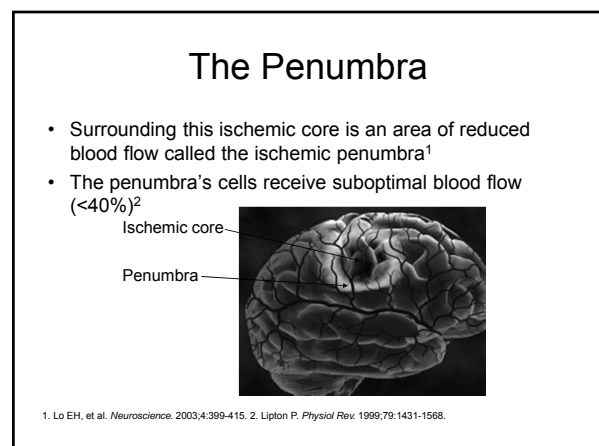


- ### How Are Strokes Treated?
- Hemorrhagic Stroke
 - Surgical Intervention
 - Endovascular Procedures, e.g., “coils”
 - Ischemic Stroke (84%)
 - Anticoagulants – Warfarin, aspirin
 - Carotid Endarterectomy
 - Angioplasty/Stents
 - Clot-busters e.g., t-PA

- ### Medications Used to Treat Ischemic Stroke
- Current treatments attempt to restore blood flow to the stroke region
 - Intravenous Activase (rTPA) is currently the only drug therapy approved by the FDA to treat ischemic stroke
- Albers GW, et al. *Chest.* 2004;126 (suppl 3):483S-512S.

- ### Acute Ischemic Stroke:
- National Institute of Neurological Disorders and Stroke (NINDS) and Stroke rt-PA Stroke Study Group.
 - Multi-center study
 - January 1991 through October 1994 with 624 patients randomized.
 - If given within 3 hours of symptom onset, at least 30% were found to have minimal or no disability at three months!

- ### FDA approved Activase in 1996!
- Activase administered IV within 3 hours of stroke onset is the only currently approved medication to reverse the effects of an acute ischemic stroke!
 - Must determine time last seen normal
 - Clinical trials initially did not recommend r-tpa administration after 3 hours window of opportunity.....increased risk of hemorrhage! This changed in 2009.
 - Strict adherence to NINDS protocol recommendations



Stroke Nurses are Penumbra Savers!

- After a stroke, cells in the penumbra are in danger of cell death but are not immediately irreversibly damaged



Lo EH, et al. *Neuroscience*. 2003;4:399-415.

Activase Eligibility and Exclusionary Criteria: (partial list only)

Eligibility for IV treatment with r-tpa:

- Age 18 or older
- Clinical diagnosis of AIS causing measurable neuro deficit
- Time of onset well-established to be less than 180 minutes before treatment

Exclusionary criteria:

- Stroke, head trauma, intra spinal/intracranial surgery within 3 months
- Any prior history of intracranial neoplasm, hemorrhage, AV malformation or aneurysm
- Major surgery or serious trauma within 14 days
- Active internal bleeding within 21 days
- Lumbar puncture within 7 days
- Recent AMI in the past 3 months
- Only minor stroke symptoms or rapidly improving neurological signs
- Seizure at onset of stroke***
- Clinical presentation suggests subarachnoid hemorrhage, even if initial CT is normal

Exclusionary Criteria - (cont)

- Clinical presentation consistent with AMI, pericarditis, subacute endocarditis
- Known bleeding diathesis, including but not limited to:
 - Platelet count less than 100,000/mm³
 - Pt has received heparin within 48 hours and has an elevated PTT (greater than upper limit of normal for lab) or
 - Pt has received recent oral anticoagulant (e.g., Coumadin) and has INR 1.7 or greater
- Evidence of intracranial hemorrhage on non-contrast head CT scan
- Hypodensity or mass effect suggestive of evolving infarction on CT scan
- On repeated measurements, SBP greater than 185 or DBP greater than 110 at the time treatment is to begin, and patient requires aggressive treatment to reduce blood pressure to within these limits.
- Blood glucose of less than 50mg/dL or greater than 400 mg/dL (results required before treatment, chemstrip ok)

Adams, HP et al. Guidelines for the Early management of Adults with Ischemic Stroke: A guideline from the AHA/ASA. *Stroke*; 38(5) 2007.

DETERMINING TIME LAST SEEN NORMAL

- Only have 3 hours from onset of symptoms to give the drug
- History is absolute critical
- Validate and question again and again
- Ask "What about that spell yesterday"
- Case Examples: "Lady at Church" and "those found asleep"

If patient meets criteria for treatment with r-tpa (Activase):

- Give 0.9 mg/kg (maximum dose of 90 mg) infused over 60 minutes with 10% of the total dose administered as an initial intravenous bolus over 1 minute.

See Genentech video for competencies

- Do not leave this patient alone in the ER while Activase is infusing
- 2 good IV lines in before bolus
- Any other tube in prior to bolus, prn
- Mock patient experiences for practice

Adams et al (2007)

Nursing care of the Activase patient

- Admit to ICU
- Frequent VS (NINDS protocol q15 min x 2 hrs; then q30min x 6 hrs; then q1h x 16 hrs).
- Serial neuro checks to include LOC, motor sensory and pupil checks: NIHSS Q Shift.
- NOTIFY PHYSICIAN FOR ANY CHANGES IN NEURO STATUS: Assume any decrease in LOC in the first 36 hours following Activase is due to intracranial hemorrhage.
- IF change in neuro status, LOC...DC infusion and prep for STAT non-contrast head CT and refer to the "oh crum" orders

Adams et al. Guidelines for the Early management of Adults with Ischemic Stroke: A guideline from the AHA/ASA. *Stroke*; 38(5) 2007.

Post Activase patient care (cont).....

- Assess for signs of internal bleeding: tachycardia, hypotension, pallor or restlessness, complaints of low back pain, muscle weakness, or numbness in the lower extremities.
- Monitor for sign of external bleeding: IV sites, gums
- Check all gastric secretions, urine and stool for occult blood
- Blood pressure parameters: Maintain SBP less than or equal to 185 mmHg and DBP less than or equal to 110 mmHg.
- Monitor hematological status: hgb, hct, and mean corpuscular volumes

Adams et al (2007)

Post Activase care (cont)

- Evaluate baseline coagulation values & compare with ongoing studies.
- Cardiac monitoring and rhythm analysis per unit routine
- Accurate I & O
- NO Heparin, Coumadin, Ticlid or aspirin x 24 hours after thrombolytic infusion
- Avoid invasive catheters: Bladder cath>30 minutes, nasogastric tube and venipuncture>24 hours post tpa
- Bedrest

Adams et al (2007)

Post Activase Care (cont)

- Apply continuous pressure to any site of bleeding
- Maintain adequate oxygenation
- If patient is stable, anticipate transfer out of ICU to stroke unit after first 24 hours of ICU care. We also get non-contrast CT of head prior to transfer to stroke unit.....or per your hospitals' protocols, if you have them.

Adams et al (2007)

National Standard for Stroke Response Times:

- ED door to stroke eval - - - 10 minutes
- Stroke team notified - - - 15 minutes
- ED door to CT scan - - 25 minutes of arrival
- CT interpreted - - 45 minutes of arrival
- Door-to-drug time - - 60 minutes from arrival

**Trained ED staff, code stroke teams, and protocols are keys to success
Do you have a code stroke team?**

Adams et al (2007). Stroke 38, 1655-1711.

Protect the Penumbra

- Optimize cerebral perfusion
 - Avoid normotension
- Avoid increasing metabolic demands
 - Temperature and glucose monitoring

Adams et al (2007)

Nondrug Treatments for Ischemic Stroke

- Acute treatment
 - Penumbra Device FDA approved 2008
 - Mechanical clot removal devices
- <http://concentric-medical.com/Animations>

1. Becker K, et al. Stroke 2005;36:400-403. What is carotid endarterectomy? American Heart Association. Available at: www.americanheart.org/downloadable/heart/110065676921546%20WhatsCarotidEndArterect.pdf. Accessed December 9, 2005.

NIHSS Overview

- 11 items on the tool
- NIH score can be 0-42
- Acute measurement of Left or Right hemisphere
- Performed in 5-8 minutes
- With training, a high degree of inter-rater reliability

Using NIHSS to Prevent Secondary Complications

NIHSS ITEMS	Physical/Cognitive impairment	Complications
Facial Palsy(4) Dysarthria (10)	Impaired swallowing	Aspiration pneumonia
Visual (3) Sensory (8) Extinction and Inattention (10) Limb Ataxia (7)	Impaired Sensation Impaired Judgments	Falls/Burns
Motor Leg (6a&b) Limb Ataxia (7)	Impaired Mobility	DVTs Pulmonary Embolisms

Acute Stroke Nursing Goals

- **Protect the Penumbra**
- **Prevent complications**
- **Secondary stroke prevention**
 - Includes evaluation of current event
- **Stroke Education**

Prevention of Complications

- Falls----- Close monitoring of all patients, esp. those w/ neglect, fall precautions
- UTI-----Avoid catheters, eval for urinary retention
- Aspiration--HOB>30°, NPO, FT, swallow screen/eval, remember liquids more difficult than solids
- Pressure Ulcers-- Frequent turning if on BR, early mobilization, good skin care
- DVT--- Lovenox or SCDs

Prevention of Complications

- Dehydration-----IV NS, FT, Modified diet
- Depression-----SSRI's (↓ long term mortality)
- Constipation-----stool softeners, avoid dehydration, mobility
- UGI bleed-----H2 Blockers or PPIs
- Shoulder injury--Avoid pulling affected arm, early rehab, proper positioning

What this means.....

- Stroke is preventable!
- Disability from stroke can be reduced
- Patients who received Activase during clinical trials showed a 30% reduction in their disability at 3 months
- Complications from stroke can be reduced via stroke units and organized process.

Late-Breaking Science from the AHA International Stroke Conference February 2010

Thrombolysis with Alteplase 3 to 4.5 Hours after Acute Ischemic Stroke

- The standard of care is still to treat with IV r-tpa Alteplase in 3 hours of symptom onset.
- Same dosage for 3 hour window
- Those inclusionary/exclusionary criteria still stand in addition to the following exclusions for the extended window.....

Additional Exclusions for 3-4.5 hour window for Alteplase for AIS

Exclusions:

- Age greater than 80 years
- Oral anticoagulants regardless of INR
- Baseline NIHSS >25
- Combination of both previous stroke and diabetes

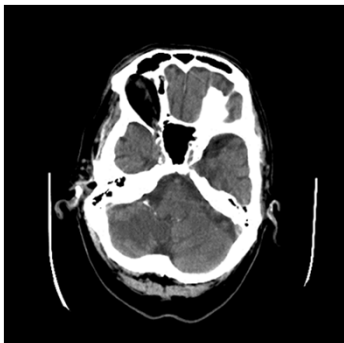
Del Zoppo et al (2009) Expansion of the time window for treatment of acute ischemic stroke with intravenous tissue plasminogen activator. A scientific advisory from the AHA/ASA. *Stroke*(40) 1-4 retrieved from <http://www.americanheart.org/presenter.jhtml?identifier=3004586>

Of special note:

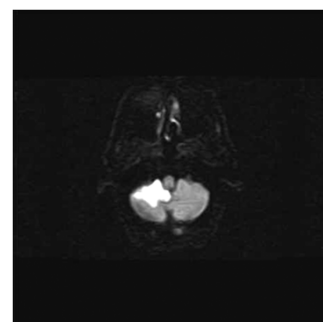


- This is currently considered “off-label” use of Activase/Alteplase.
- Should obtain appropriate “off-label” consent is you chose to use this extended therapy
- AHA has written scientific statement published
 - May 2009 in *Stroke* journal
- Genentech may approach the FDA in 2010

Cerebellar Ischemic Infarct - CT



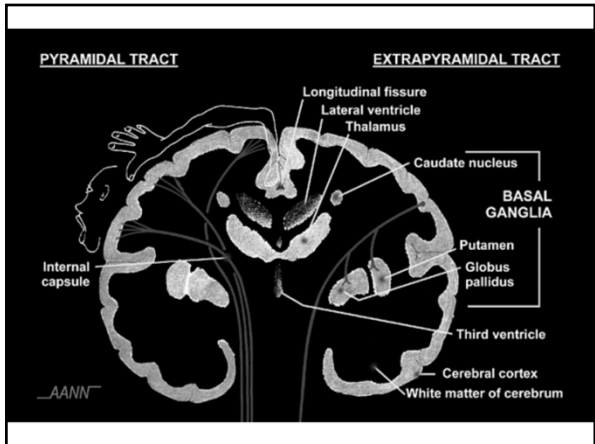
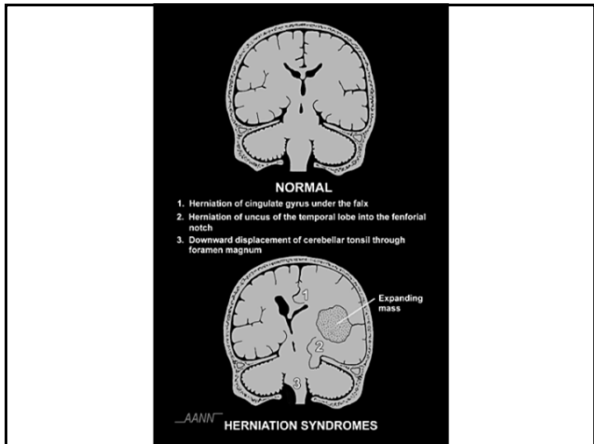
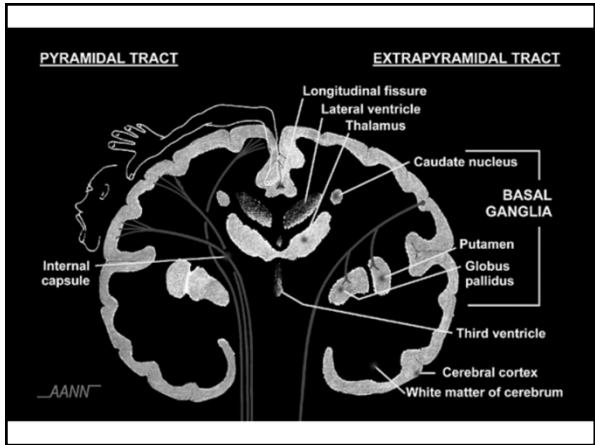
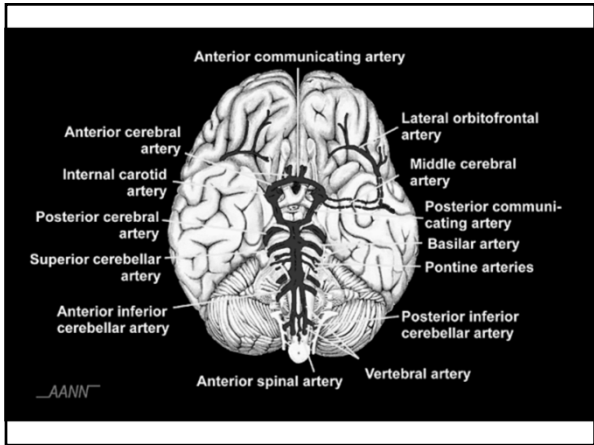
Cerebellar Ischemic Infarct -MRI

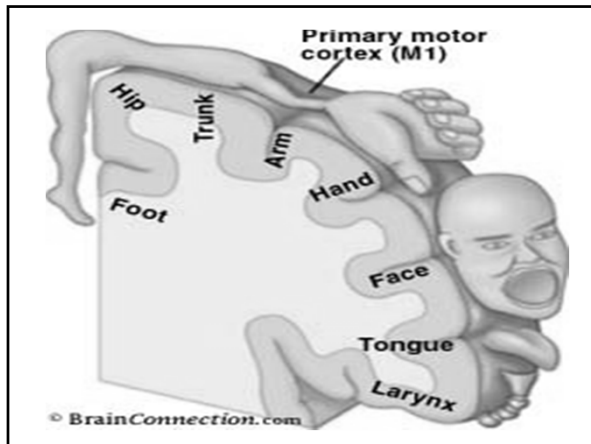


Anterior and Posterior Circulation
and Stroke Pathophysiology:
Putting it all together

<http://www.umassmed.edu/strokestop/>

- ### Vascular Supply to the Brain
- **Internal Carotid Arteries**
Divide Into:
 - Anterior cerebral artery (ACA)
 - Middle cerebral artery (MCA)
 - ◆ **Arterial distribution for the anterior aspects of the brain**
 - ACA supplies medial structures
 - MCA supplies lateral structures
 - **Vertebral Arteries**
 - Arterial distribution for the posterior aspects of the brain
 - umassmed
- <http://www.umassmed.edu/strokestop/>





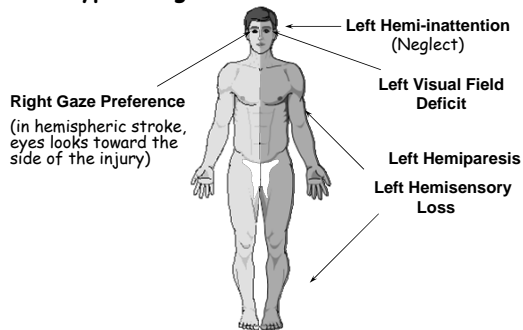
Major Stroke Syndromes

1. Left Hemisphere
2. Right Hemisphere
3. Brainstem
4. Cerebellum
5. Hemorrhagic

Stroke syndromes are named for the location of the injured area of the brain. HEMORRHAGIC stroke is separated out because it can occur in any area of the brain.

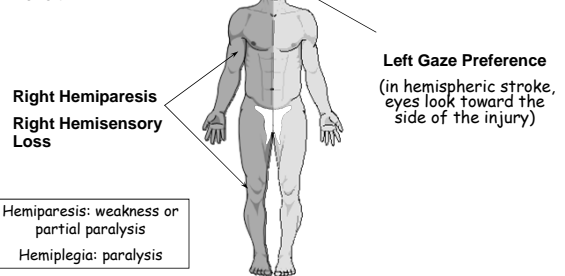
RIGHT HEMISPHERE (NON-DOMINANT)

Typical Signs: Left Side Weakness



LEFT HEMISPHERE (DOMINANT)

Typical Signs: Right Side Weakness and Aphasia



Right and Left Hemispheric Strokes

- Motor and sensory deficits are found on the side **OPPOSITE** to the affected side of the brain
- Visual field deficits are also found on the side **OPPOSITE** to the affected side of the brain

Aphasia

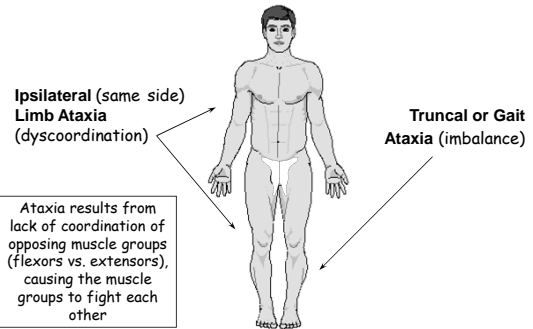
- In right handed people, the speech center of the brain is found in the left hemisphere
- So left hemispheric stroke is the most likely cause of aphasia in most people

Hemi-inattention or "Neglect"

- Patients with neglect tend not to acknowledge (i.e., they "neglect") anything about the affected side of their body
- The most common form is neglect of the left side of their body due to a right hemispheric lesion

CEREBELLAR STROKE

Typical Signs: Lack of Coordination



Brainstem Typical Signs: Bilateral Abnormalities

Dysarthria,
Dysphagia,
Diplopia
Dysequilibrium,
Dizziness

Other signs:
Nystagmus
Contralateral Gaze
Deviation

Crossed Signs
(ipsilateral face
and contralateral
body)

Hemiparesis
Hemisensory Loss



HEMORRHAGIC STROKE

Both Subarachnoid
and Intracerebral
Hemorrhage:
Headache
Nausea, Vomiting
Decreased LOC
(not always present)

None of these signs are
DIAGNOSTIC of
hemorrhage; hemorrhagic
strokes may be totally
indistinguishable from
ischemic stroke without
imaging studies

**SUBARCHNOID
HEMORRHAGE:**

Intolerance to Light
Neck Stiffness / Pain

**INTRACEREBRAL
HEMORRHAGE:**

Focal Signs such as
Hemiparesis



Major Syndrome Deficits

1 LEFT HEMISPHERE

- Speech-Aphasia
- Right Body-Visual Motor, Sensory

2 RIGHT HEMISPHERE

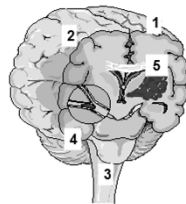
- Left Body-Neglect, Visual, Motor, Sensory

3 BRAINSTEM

- Right and/or Left Motor, Sensory
- Eye Movements
- Speech/Swallowing
- Dizziness/Nausea
- ↓ Consciousness

4 CEREBELLUM

- Imbalance
- Dyscoordination



5 POSSIBLE HEMORRHAGE

- Headache
- Neck Pain/Stiffness
- Light Intolerance
- Nausea/Vomiting
- ↓ Consciousness
- ± Focal Findings

QUESTIONS?

