



Acute Stroke for the Generalist

Early management fundamentals when resources are low

Preston Seaberg, M.D.

Learning Objectives

- Evaluate a person with suspected stroke
- List ideal management steps for acute stroke
- Create a stroke management plan based on available resources
- Identify strategies to reduce risk of recurrent stroke

Acute Stroke: Definition

Sudden focal or global neurologic deficit

due to

dysfunction in brain, retina or spinal cord

caused by

vascular disruption, resulting in infarction

What is a “Focal” Neurologic Deficit?

- “Focal” = one area of central nervous system
 - e.g. retina → monocular blindness
 - e.g. dominant temporal lobe → aphasia
- The challenge? One area of the central nervous system can do quite a lot
 - e.g. lateral medullary syndrome
 - Ipsilateral facial sensory loss
 - Contralateral torso sensory loss
 - Dysphagia, dysphonia, absent gag reflex
 - Vertigo, nystagmus, nausea
 - Ataxia, dysmetria, dysdiadochokinesia

What Does Stroke Look Like?

- Weakness
- Numbness
- “Clumsiness”
- Imbalance
- Vision loss
- Dysphagia
- Dysarthria
- Aphasia
- Hoarseness
- Headache
- Loss of hearing
- Inattention
- Change in behavior
- Amnesia
- Facial droop
- Headache
- Vertigo
- Nausea
- Decreased level of consciousness

Can Stroke Type be Predicted without Imaging?

- In short, no
- Certain things may be suggestive in the right context
- The more common the problem, the more predictive
 - Should be noted that the coming numbers weren't necessarily derived from patients in your population

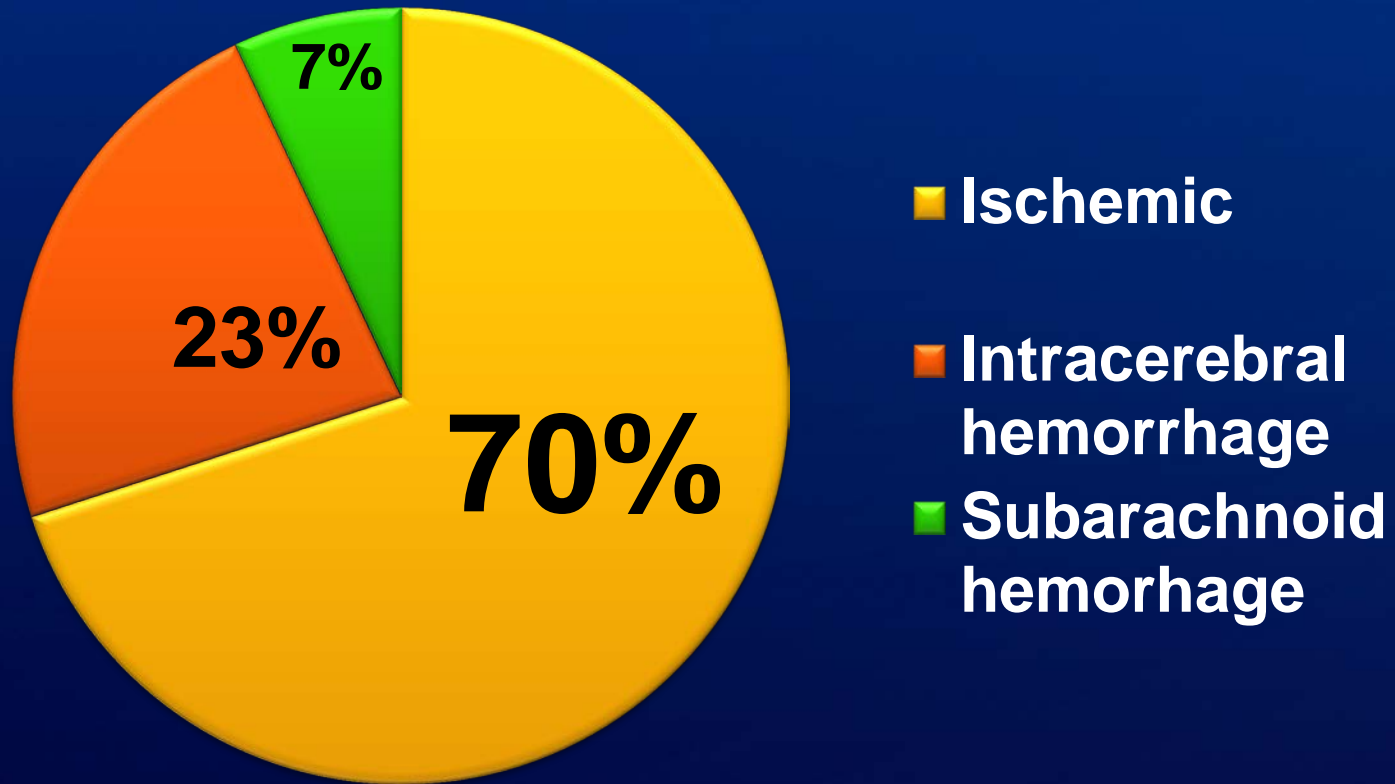
It's 2016, and a patient is diagnosed with stroke. If the patient is in a coma...

History/Exam Item	Pooled LR+	Pooled LR-
Prior transient ischemic attack	0.34	1.2
Seizures	4.7	0.93
Vomiting	3	0.73
Headache	2.9	0.66
Coma	6.2	
Drowsy	2.0	
Alert	0.35	
Neck stiffness	5.0	0.83

LR+ of 6.2 → 31% chance of hemorrhagic stroke if in US, 53% chance of hemorrhagic stroke if in China

Key point: even in countries with high baseline risk of hemorrhagic stroke, history/exam cannot predict stroke type

Types of Acute Stroke, Globally



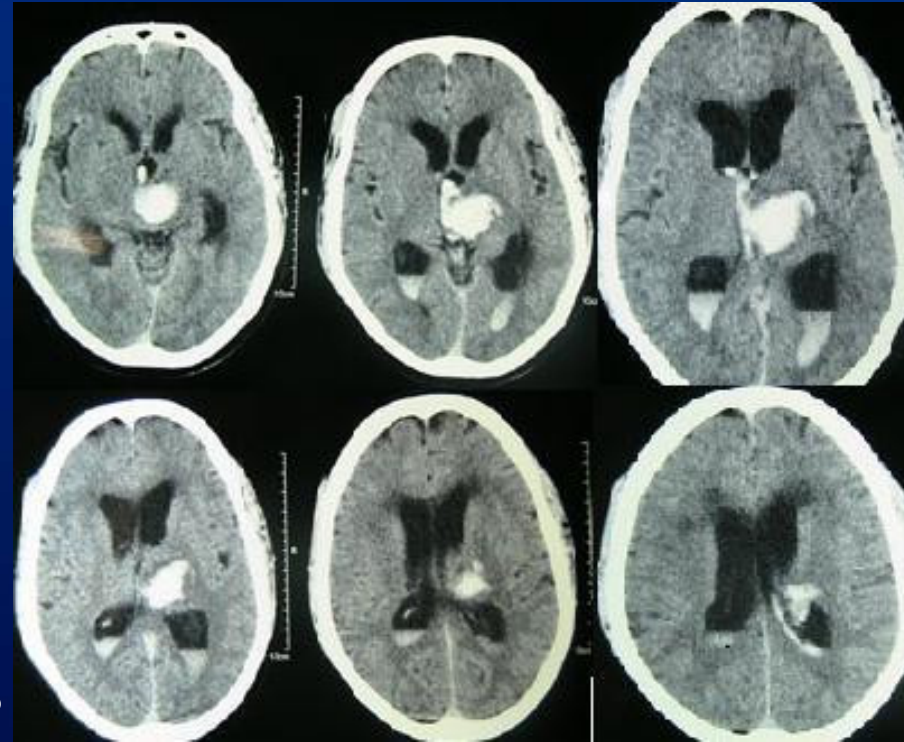
Acute Ischemic Stroke: Causes

- **Large artery atherosclerosis**
 - **Infarct only in territory of diseased artery**
- **Cardioembolism**
 - **Known source > simultaneous infarcts in multiple vascular territories**
- **Small vessel occlusion (lacune)**
- **Stroke of other determined etiology**
 - **E.g. hypercoagulable state, dissection**
- **Stroke of undetermined etiology**

Intracerebral Hemorrhage

Causes

- Hypertension
- Trauma
- Bleeding disorder
- Amyloid angiopathy
- Vascular malformations



Suggestive symptoms

- Headache, depressed level of consciousness

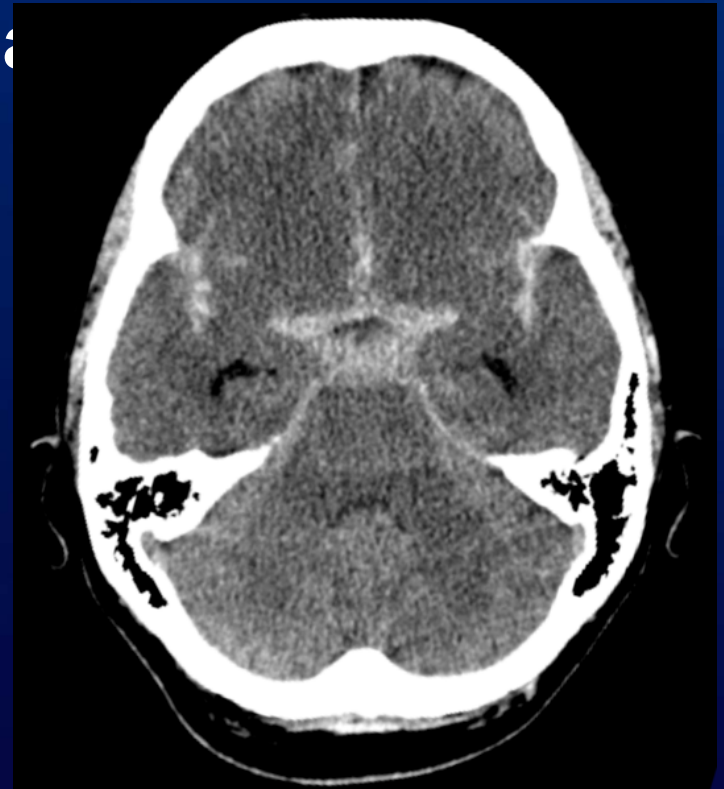
Subarachnoid Hemorrhage

Causes

- Rupture of arterial aneurysm
- Bleeding vascular malformation
- Trauma

Suggestive symptoms

- “Thunderclap” headache
- Depressed level of consciousness



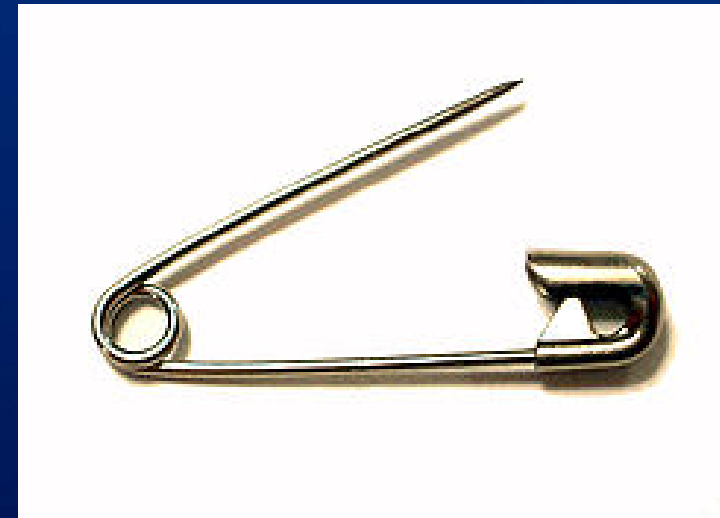
Shared Risk Factors

- Hypertension
- Cigarette smoking
- High alcohol intake



Diabetes, hyperlipidemia linked to ischemic stroke but not to hemorrhagic stroke

Physical Exam in Suspected Stroke



Standardized Stroke Assessment

- **National Institutes of Health Stroke Scale (NIHSS)**
- **11 items (plus some sub-items)**
 - **Level of consciousness**
 - **Eye movements**
 - **Visual fields**
 - **Strength of face, arms and legs**
 - **Limb coordination (absence of ataxia)**
 - **Sensation to pinprick**
 - **Speech and articulation**

NIHSS In Action

<https://www.youtube.com/watch?v=wzjWAJgGjTw>

See separate PDF for copy of NIHSS

Where does the NIHSS Fall Down?

- **Posterior circulation**
 - **Possible symptoms: headache, nausea, vertigo**
 - **Signs: truncal ataxia**
- **Speech testing not necessarily standard in other languages**
- **If patient cannot read, articulation domain must be tested differently**

Key Principles in Stroke Management

- **First things first**
 - **Airway**
 - **Breathing**
 - **Circulation**
- **Then systematic assessment**
 - **History**
 - **Structured physical exam**
 - **Exclusion of mimics (e.g. hypoglycemia)**
- **Then optimal management**
 - **Cause-dependent and -independent**

Ideal Acute Stroke Management

Patient taken by ambulance to nearby facility with

- CT scanner, MRI and experienced radiologist
- Neurologist and vascular neurosurgeon
- Cerebral reperfusion capability
- Dedicated stroke unit/team

In much of the world,
not widely available



Acute Ischemic Stroke: Ideal Management

- Step 1: optimize airway, breathing, circulation
- Step 2: standardized assessment
- Step 3: noncontrast CT head, capillary glucose
- Step 4: systemic fibrinolytic agent, if candidate
- Step 5: endovascular therapy, if candidate
- Step 6: aspirin within 48 hr (+ 21 d clopidogrel if not cardioembolic)
 - Initially 160-300 mg (per rectum if needed), then less
- Step 7: confirmation, cause evaluation
- Step 8: cause-specific management in stroke unit
 - Plus swallowing evaluation, rehab, enteral nutrition, secondary prevention, BP targets

Acute Ischemic Stroke Causal Evaluation

- Large artery atherosclerosis
 - Glycated hemoglobin, total/HDL/LDL cholesterol, head/neck vascular imaging
- Cardioembolism
 - Cardiac rhythm monitoring, ?echocardiogram
- Stroke of other determined etiology
 - Suspect in persons < 55 years of age
 - Coagulation testing? Syphilis testing? Sickle cell anemia?

Intracerebral Hemorrhage: Ideal Management

- Step 1: optimize airway, breathing, circulation
- Step 2: noncontrast CT head, capillary glucose
- Step 3: reverse coagulopathy, if applicable
- Step 4: treat systolic BP > 150 mm Hg targeting 140 mm Hg; not with nitroprusside
- Step 5: assess severity in standardized way
- Step 6: surgical treatment for a few
- Step 7: cause-specific manage in stroke unit
 - Plus rehabilitation, swallow evaluation, enteral nutrition, secondary prevention, BP targets

Overview: Subarachnoid Hemorrhage

- Step 1: optimize airway, breathing, circulation
- Step 2: noncontrast CT head, capillary glucose
 - CT unrevealing but SAH suspected → lumbar puncture
- Step 3: reverse coagulopathy, if applicable
- Step 4: treat systolic BP > 160 mm Hg, not w/ nitroprusside
- Step 5: angiography; severity assessment
- Step 6: surgical clipping or endovascular coiling if aneurysmal, with confirmatory imaging
- Step 7: nimodipine, if patient not hypotensive
- Step 8: cause-specific management in stroke unit
 - Plus rehabilitation, swallow evaluation, enteral nutrition, secondary prevention, BP targets

Basic Principles of Rehabilitation

- Examination of physical functioning
- Setting of goals for function
- Selection of interventions
- Intervention for specific impairments impeding ability to perform desired function
- Task-specific training
 - May initially require equipment to learn or relearn movement patterns
 - May initially require external feedback or cues from therapist

Now we get practical

Key Questions for Suspected Stroke

- Question 1: is this patient unstable now?
- Airway?
- Breathing?
- Circulation?
- If “yes,” stabilize, then move to question 2
- If “no,” move to question 2

Key Questions for Suspected Stroke

- Question 2a: fibrinolysis available in facility?
 - 2b. Ideal care available in facility?
 - 2c. Is another place better and reachable within 1-2 hours (or at least within window for reperfusion)?
 - 2d. Is medical transportation available?
- 2a-2b “yes” → proceed with ideal care
- 2a “yes,” 2b “no ” 2b-2d “yes,” → consider fibrinolysis and transfer
- 2a-2b “no,” 2c “yes,” 2d “no” → consider transfer if risks/benefits favorable
- If 2a-2d “no” → provide “best available” care

Disclaimer: not a guideline-based decision tree

Key Questions for Suspected Stroke

- Question 3: is noncontrast CT head feasible?
- If “yes,” obtain images to guide treatment per prior slides
- If “no,” minimize risk of harm by focusing on points of guideline/evidence overlap

Points of Friction When Stroke Type Unknown

- Blood pressure target different for each of
 - Ischemic stroke, pending fibrinolytic
 - Ischemic stroke, not given fibrinolytic
 - Ischemic stroke, given fibrinolytic
 - Intracerebral hemorrhage
 - Subarachnoid hemorrhage
- Antiplatelet therapy different for each of
 - Ischemic stroke due to cardioembolism
 - Ischemic stroke not due to cardioembolism
 - Hemorrhagic stroke
- Anticoagulant considerations different for each of
 - Ischemic stroke from atrial fibrillation
 - Ischemic stroke from atheroembolism
 - Hemorrhagic stroke

Overlapping Strategies with Evidence

- Use standardized risk-stratification instruments
- Reduce risk of venous thromboembolism
 - Intermittent pneumatic compression or pharmacologic prophylaxis preferred
- Evaluate swallow before feeding
- Physical rehabilitation early
- Treat some hypertension now and all of it later
 - If BP > 220/120 mm Hg, reduce by 15% in first 24 h
 - 72 hours after onset, target long-term BP < 130/80
- Advise cessation of smoking, use of stimulants
- Later, advise alcohol only in safe amounts
- Low-dose aspirin (≤ 160 mg daily) if strong indication and reasonably sure no worsening bleeding in brain

Strong Indications for Aspirin

- Presence of vascular stents*
- Existing atherosclerotic vascular disease
- High risk of ischemic stroke or ischemic heart disease, with multiple of
 - Hypertension
 - Diabetes
 - Cigarette smoking
 - Chronic kidney disease
 - Obesity
 - Siblings or parents with premature ischemia
 - Men < 55 years[†]
 - Women < 65 years[†]

Less Robust Stroke Recommendations

- Check baseline troponin
- Supplemental oxygen only for SpO₂ < 94%
- Correct hypotension and hypovolemia
- Treat fever and its cause(s)
- Treat hypo- and hyperglycemia
- Regular skin checks for hospitalized patients
- Check for post-stroke depression
 - If known hemorrhagic stroke, caution with selective serotonin reuptake inhibitors

Summary

Treating Stroke When Type is Unknown

- Use standardized risk-stratification instruments
- Reduce risk of venous thromboembolism
 - Intermittent pneumatic compression or pharmacologic prophylaxis preferred
- Evaluate swallow before feeding
- Physical rehabilitation early
- Treat some hypertension now and all of it later
 - If BP > 220/120 mm Hg, reduce by 15% in first 24 h
 - 72 hours after onset, target long-term BP < 130/80
- Advise cessation of smoking, use of stimulants
- Advise alcohol only in safe amounts
- Low-dose aspirin (≤ 160 mg daily) if strong indication and reasonably sure no worsening bleeding in brain
 - Example: no clinical worsening for two weeks

Strong Indications for Long-Term Aspirin, Even if Prior Hemorrhagic Stroke

- Presence of vascular stents*
- Existing atherosclerotic vascular disease
- High risk of ischemic stroke or ischemic heart disease, with multiple of
 - Hypertension
 - Diabetes
 - Cigarette smoking
 - Chronic kidney disease
 - Obesity
 - Siblings or parents with premature ischemia
 - Men < 55 years[†]
 - Women < 65 years[†]

References (part 1)

- “break-time-out-workers-hand-beer-drinking-beer-smoking-unhealthy-way-of-life.jpg” by unknown creator on Pikist.com is licensed under CC BY 2.0.
- “[SAB bei Aneurysma.png](#).” by Hellerhoff on wikipedia.org is licensed under CC BY 3.0.
- “[Intracerebral hemorrhage.jpg](#)” by Yadav YR et al on wikipedia.org is licensed under CC BY 2.0.
- Martin-Schild S, Albright KC, Tanksley J et al. Zero on the NIHSS does not equal the absence of stroke. *Ann Emerg Med*. 2011;57(1):42. Epub 2010 Sep 15.
- “[The Holy Grail of Valencia](#)” by Jmjriz on wikipedia.org is licensed under CC BY 4.0.
- Berkowitz AL, Westover MB, Bianchi MT, Chou SH. Aspirin for acute stroke of unknown etiology in resource-limited settings: a decision analysis. *Neurology*. 2014;83(9):787-793. doi:10.1212/WNL.0000000000000730
- Krishnamurthi RV et al. Global and regional burden of first-ever ischaemic and haemorrhagic stroke during 1990-2010: findings from the Global Burden of Disease Study 2010. *Lancet Glob Health*. 2013;1(5):e259. Epub 2013 Oct 24.
- Virani SS et al. Heart Disease and Stroke Statistics-2020 Update: A Report From the American Heart Association. *Circulation*. 2020;141(9):e139. Epub 2020 Jan 29.
- Feigin VL et al. Global, Regional, and Country-Specific Lifetime Risks of Stroke, 1990 and 2016. *N Engl J Med*. 2018;379(25):2429.
- Koton S et al. Stroke incidence and mortality trends in US communities, 1987 to 2011. *JAMA*. 2014 Jul;312(3):259-68.
- Feigin VL et al. Global and regional burden of stroke during 1990-2010: findings from the Global Burden of Disease Study 2010. *Lancet*. 2014;383(9913):245.

References (part 2)

- J. Claude Hemphill. Stroke. The ICH Score , Volume: 32, Issue: 4, Pages: 891-897, DOI: (10.1161/01.STR.32.4.891)
- Stroke, Hemorrhagic. In: Simel DL, Rennie D. Simel D.L., & Rennie D(Eds.),Eds. David L. Simel, and Drummond Rennie.eds. *The Rational Clinical Examination: Evidence-Based Clinical Diagnosis*. McGraw-Hill; Accessed September 01, 2020.
<https://jamaevidence.mhmedical.com/content.aspx?bookid=845§ionid=61357667>
- Adams HP Jr et al. Classification of subtype of acute ischemic stroke. Definitions for use in a multicenter clinical trial. TOAST. Trial of Org 10172 in Acute Stroke Treatment. Stroke. 1993;24(1):35.
- Powers WJ et al. **Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association.** Stroke. 2019;50:e344–e418
- Hemphill JC III et al. Guidelines for the Management of Spontaneous Intracerebral Hemorrhage: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2015;46:2032–2060.
- **Connolly SE Jr et al. Guidelines for the Management of Aneurysmal Subarachnoid Hemorrhage: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association.** Stroke. 2012;43:1711–1737