Clinical Diagnosis of Stroke and Stroke Subtypes

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1. Think
Don't let cook-book guidelines and protocols change your thoughtful systematic stepwise clinical approach

2. Stroke - evaluation
The most important investigations are:
- A thorough history
- A physical examination emphasizing the heart and blood vessels
- A competent neurological examination

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3. Clinical diagnosis- step 1
Begin to acquire information from the history about what and where

- What
  - Pathology
    - Is it a stroke?
    - What subtype?
- Where
  - Location of the brain lesion
  - Location of the vascular lesion

History - the what diagnosis (1)
Ecology (a priori odds)
- Past and present medical ills and risk factors
  - Hypertension
  - Diabetes
  - Coronary artery or other heart disease
  - Obesity
  - Claudication
  - Smoking
  - Illicit drugs
  - Family history of vascular disease

History - the what diagnosis (2)
- Past strokes and TIsAs (specific queries)
- Activity at onset
- Associated symptoms (headache, vomiting, loss of consciousness)
- Temporal course
  - Maximal at onset
  - Gradual progressive
  - Stepwise, fluctuating, stuttering
History - the *where* diagnosis

Neurological symptoms and their location

- For example:
  - weakness of one side of the body → visual symptoms?
  - double vision or striking vertigo?
- Query the patient about specific symptoms on which they may not spontaneously elaborate

4. After the history, make hypotheses about the *what* and *where* diagnoses

Order the diagnoses according to probability

Case example

- A 55 year old Chinese woman develops during hours a right hemiparesis
- Her family says that her speech is abnormal
- She has had hypertension and diabetes controlled with oral antihyperglycemic agents
- She is not known to have heart disease
- She has not reported headache before or during her neurological symptoms
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What diagnoses

- Thrombosis - MCA 30%
- Thrombosis - lacunar 25%
- Thrombosis - intracranial ICA - 15%
- Thrombosis or dissection neck ICA 10%
- Intracerebral hemorrhage - 10%
- Brain embolism 10%

Where diagnoses

- Left cerebral hemisphere
  - Deep - basal ganglia, internal capsule - 35%
  - Deep and cortical - 30%
  - Cortical - 15%
- Left brainstem - 20%
  - Pons, midbrain, or thalamus

5. Plan the general and neurological examinations to distinguish between the various what and where hypotheses

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Queries to test during the exam

- BP- is it very high?
- Any cardiac abnormality? any neck or cranial bruit?
- Is the speech abnormality aphasia or dysarthria?
- Is the motor weakness equal in face, arm, hand, thigh, and leg?
- Are there any sensory or visual field abnormalities?
- Are there any abnormalities of eye movement?

Case example - examination

- BP 140/75
- No heart abnormalities; no neck or cranial bruits
- Some paraphasic errors in speech
- Right face and hand weaker than right lower limb
- Difficulty localizing touch in the fingers of the right hand
- No visual field defect
- Slight asymmetry of conjugate gaze with slower saccades to the right

6. Revise the what and where diagnoses after the history and examination have been completed

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Modified what diagnoses
• Thrombosis - MCA 40%
• Thrombosis - intracranial ICA - 20%
• Thrombosis or dissection neck ICA 20%
• Intracerebral hemorrhage - 10%
• Brain embolism 10%

Modified where diagnoses
Left cerebral hemisphere
• Deep - basal ganglia, internal capsule - 30%
• Deep and cortical - 30%
• Cortical - 25%
• Thalamus - 15%

7. Plan the imaging and laboratory investigations in relation to the what and where hypotheses
8. Ask if the cause of the symptoms might be other than stroke
Could the patient have hypoglycemic hemiparesis or a subdural hematoma, or have bled into a brain tumor?

9. Routine blood tests
- Hematocrit, WBC, platelet count
- Prothrombin time (INR)
- Blood sugar
- BUN, Creatinine

10. Find out what is wrong with every patient as completely as you can
Precise detailed diagnosis has great intrinsic value even when there is no presently accepted treatment
Stroke is a cerebrovascular disease

- Patients with stroke have disease of the vasculature that supplies the brain
- We really need a vascular diagnosis

Data needed to logically treat stroke patients

- The nature, location and severity of the causative vascular-cardiac-hematological conditions
- The mechanism of ischemia-hypoperfusion or embolism
- The cellular and serological components of the blood
- The state of the brain-normal, "stunned", or infarcted

11. Obtain brain and vascular imaging

- CT and CTA (or rapid sequence cranial CT after dye); CT perfusion imaging
- MRI and MRA with diffusion & perfusion imaging
- CT or MRI with extracranial and transcranial ultrasound
12. MRI can be performed as the sole brain imaging procedure if a T2*-weighted sequence is performed.

T2*-weighted MRI images show recent and old brain and subarachnoid hemorrhages better than CT scans.

13. CT and MRI brain images can yield data re vascular lesions.

Examine the flow voids carefully.
In the Chinese woman described, CT scan showed a striato-capsular infarct.
14. Obtain vascular testing; This is critical for treatment decisions

- CTA (with CT perfusion if available)
- “Triphasic CT” after contrast
- MRA (with or without contrast)
- Neck ultrasound and TCD

Perfusion CT

Submitted by Walter Koroshetz, MD
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Triphasic CT perfusion

Patient scan at 3 hours

rt-PA given rescanned 18 hours after infusion
MRA and then cerebral angiography in this Chinese woman showed an occlusion of the left MCA at its origin; The ICA and other arteries were normal

Was this occlusion due to intrinsic MCA atherostenosis with occlusion or to embolism?
15. The heart and aorta are important to study as potential sources of embolism and for coexistent atherostenotic coronary artery disease.
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Left atrial thrombus

Left ventricle thrombus

Patent foramen ovale

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In this Chinese woman, transesophageal echocardiography with views of the heart and aorta were completely normal; I concluded that she most likely had intrinsic MCA disease.

16. Sometimes reviewing the history and/or the examination a second and even third time can yield very useful diagnostic information

- In this woman, on later questioning she recalled two transient attacks - each very brief, of numbness in her right hand and face that she had forgotten
- This made the likelihood of an intrinsic MCA lesion highly likely

17. Plan treatment depending on the anatomy, pathology, and pathophysiology of the brain and vascular lesions
18. Treatment considerations includes many items:

- Acute therapy especially to restore blood flow
- Prophylaxis to prevent the next stroke
- Management of risk factors
- Promoting recovery
- Education of patient and caregivers