

Case Study 43: Stroke

Time lost is brain lost. —American Stroke Association

Time is muscle; time is kidney; time is brain; time is everything in case of emergency

—Badar M Zaheer

CASE HISTORY

A 60-year-old white female is brought to the emergency department (ED) by her husband with sudden onset of right upper extremity weakness that began while she was preparing breakfast in the morning. The husband became concerned when the patient could not talk in response to questions. Screening tools were used and patient seems to understand what is being said but cannot respond (Figs 3 and 4). Patient has history of medication-controlled hypertension. The patient's father died of a stroke at the age of 70 years after living his whole life with hypertension, but her mother lived to the age of 80 years completely healthy.

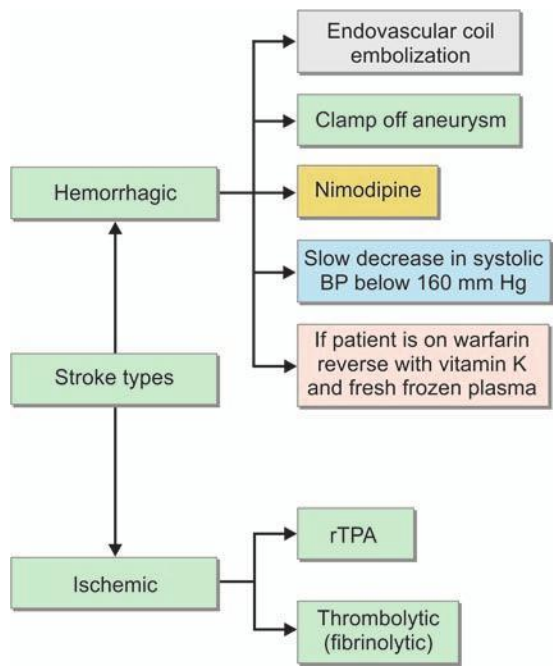
PHYSICAL EXAMINATION

- *Neurologic examination:* Cranial nerves (CN) II-VI, VIII-XII are intact with right facial nerve palsy. She can wrinkle her forehead. Droop noted on the right side of the mouth. No lid weakness noticed.
 - *Motor:* Flaccid hemiparesis noted onto the right side.
 - *Sensory:* No light touch of right upper extremities (RUE).
 - *Reflexes:* No deep tendon reflexes (DTR) of right lower extremities (RLE). Babinski's reflex is present on the right big toe. Corneal and gag reflexes are normal.
 - *Cerebellar:* Slight truncal ataxia to the right side and gait disturbance.
 - *Visual/Neglect:* Lost vision and neglect on the right side of the eye.
 - *Language:* Dysarthria, expressive aphasia and no receptive aphasia.
 - *Level of consciousness:* Slightly somnolent and responds to verbal stimuli.
 - Rest of the physical examination is normal.

DIAGNOSTIC WORKUP

- Initial (most sensitive) test available to detect blood in the brain: Noncontrast head computed tomography (CT) scan. See Flow chart 1 for hemorrhagic versus ischemic stroke.
 - Negative for ischemia within first 48 hours after onset of symptoms.
- *Accurate test for ischemia:* Available
- Diffusion-weighted magnetic resonance imaging (MRI) is done for cerebral ischemia detection.

Flow chart 1: Types of stroke



- Search for embolic source by doing an echocardiogram, carotid duplex scan and 24-hour Holter monitoring.
- Initial blood test is done to check for inherited hypercoagulability.
- Electrocardiogram (ECG) may help to show ischemia or inverted T-waves.
- Bubble study on echocardiogram to detect cardiac defect and function. The bubble echocardiogram shows better results than a conventional echocardiogram. Watch on Youtube <http://www.youtube.com/watch?v=3dssbDeow50>

MANAGEMENT

A diagnosis of acute ischemic stroke and acute onset of focal neurologic deficit is made. The course of treatment suggested for this patient was tissue plasminogen activator (tPA) since there were no hemorrhages found and it was within 2 hours of the onset of symptoms. The patient was administered tPA: 0.9 mg/kg body weight. Follow the guide-lines from: <http://www2.massgeneral.org/stopstroke/tpaDoseCalc.aspx>. A repeat neurologic examination was performed 90 minutes following treatment and showed increased speech and use of the right arm. The patient was

discharged to a rehabilitation hospital on Day 7 and scheduled for a follow-up examination in 3 months.

Acute Ischemic Stroke

- Acute onset from a focal neurological deficit
- *CT*: No low density areas of bleeding
- No contraindications (CI) to tPA, blood pressure (BP) is less than 185/110 mm Hg.
- No family to defer tPA use. tPA is administered, with no complication.
 - Consent for tPA is necessary.
 - Explain and elaborate on the risks and benefits of tPA use.
 - Received verbal consent and signature with left hand.
 - tPA administered in less than 2 hours after cerebrovascular accident (CVA) symptoms onset.
 - *Initial bolus*: 5 mg slow IVP over 2 minutes.
 - *Follow-up infusion*: 40 mg infusion over 60 minutes.
 - Repeat neurological examination at 90 minutes.
 - *Repeat examination*: Increased speech and use of right arm.
 - Decreased mouth droop and visual neglect.
- *Hospital course*: No hemorrhage, and improved neurological function.
 - *Disposition*: Rehabilitation in hospital on Day 7. Follow-up examination in 3 months. Near complete use of RUE. Speech and vision improved. Slight residual gait deficit. Her husband is at home to assist.
 - POEMs: Patient Oriented Evidence that Matters.

Question: Does adding endovascular procedures to intravenous tissue plasminogen activator (t-PA) improve outcomes for patients with stroke?

Answer: Local delivery of t-PA extracting the thrombus or stenting (endovascular therapies) showed no benefit in a randomized clinical study and in other two clinical trials which reaffirmed the ineffectiveness of this procedures (Figs 1 and 2). (N Engl J Med. 2013;368(10):904-914) (Kidwell CS, Jahan R, Gornbein J, et al. A Trial of Imaging Selection and Endovascular Treatment for Ischemic Stroke. N Engl J Med. 2013; 368(10):914-923).

None of the above procedures are as effective as intravenous t-PA which provides modest benefit, if the patients are rightly selected.

DIFFERENTIAL DIAGNOSIS

It includes epileptic seizures and postictal subdural hematoma, tumor, hyponatremia, hypocalcemia, hepatic encephalopathy, Wernicke Korsakoff syndrome, hypoglycemia, hyperglycemia, alcohol, illicit drugs, head



Fig. 1: Mechanical thrombectomy

Courtesy of Wikipedia: http://en.wikipedia.org/wiki/File:Merci_L5.jpg

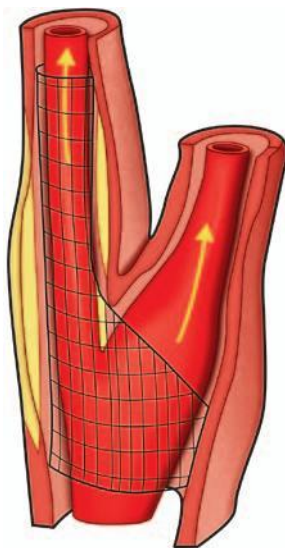


Fig. 2: Stents and angioplasty

Courtesy of Wikipedia: http://en.wikipedia.org/wiki/File:Merci_L5.jpg

injury, encephalitis, cerebral abscess, hypertensive encephalopathy, peripheral nerve lesion, multiple sclerosis, Creutzfeldt-Jakob disease, and subarachnoid hemorrhage.

TREATMENT

Golden Hour of Acute Ischemic Stroke (Fig. 5)

Acute ischemic stroke is an extremely serious medical emergency. In a typical large-vessel acute ischemic stroke, 1.9 million neurons may be lost each minute without medical management. Rapid intervention is crucial in the management of acute ischemic stroke. Door to treatment in less than or equal to 60 minutes is the standard of care recognized by professional medical associations involved in the treatment of acute ischemic stroke (Fig. 5).

- *Tissue plasminogen activator*: Administered in less than 3 hours from onset of symptoms, better neurologic function in 3 months post-CVA.
- *Contraindication to tPA*: Stroke or serious head trauma less than 3 months ago.
 - *Hemorrhage*: Gastrointestinal/genitourinary (GI/GU) less than 3 weeks ago.
 - Surgery less than 2 weeks ago
 - History of intracranial hemorrhage
 - Arterial puncture less than 1 week ago
 - Lumbar puncture less than 1 week ago
 - Blood pressure more than 185/110 mm Hg



Fig. 3: Screening Tool; Patients must be able to identify the problems in the situation

Source: www.ninds.nih.gov/doctors/NIH_Stroke_Scale.pdf.



Fig. 4: Screening Tool; Patients are asked to identify the objects in the picture
Source: www.ninds.nih.gov/doctors/NIH_Stroke_Scale.pdf.

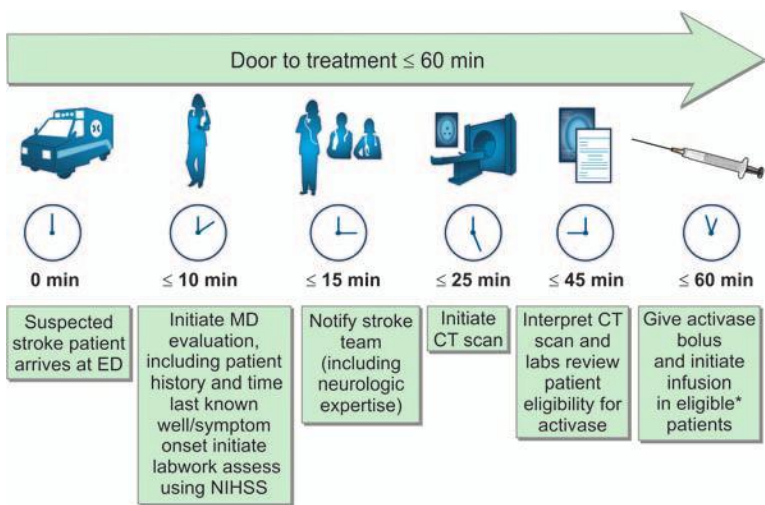


Fig. 5: Golden Hour for Thombolytic Therapy

Source: Adapted from http://www.ninds.nih.gov/news_and_events/proceedings/stroke_proceedings/recs-emerg.htm#emergency; and Jauch EC. American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation. 2010;122(18 suppl 3):S818-S828.

Checklist before Starting tPA Therapy

1. Check the indications below that apply:

- ☐ Patient is 18 years of age or older
- ☐ Time of symptoms onset can be identified accurately
- ☐ Thrombolytic therapy can be started within 3 hours of symptom onset.

2. If all the boxes in Step 1 are checked, then review the absolute contraindications below and check the ones that apply:

- ☐ Head CT scan today showing intracranial bleeding
- ☐ Head CT scan today shows no intracranial bleeding but the clinical presentation is suspicious for subarachnoid hemorrhage
- ☐ Head CT scan today shows multilobar infarction (hypodense area greater than one-third the area of the cerebral hemisphere)
- ☐ Any of the following within the past 3 months; intracranial or intraspinal surgery, serious head trauma, or a witnessed seizure
- ☐ Witnessed seizure since the onset of symptoms
- ☐ Blood pressure higher than 185 mm Hg (systolic) or higher than 110 mm Hg (diastolic)
- ☐ Arterial puncture at noncompressible site within past 7 days.

Risk of hemorrhage:

- ☐ Evidence of active internal bleeding
- ☐ Patient has an arteriovenous malformation, aneurysm, or neoplasm
- ☐ Prior history of intracranial bleeding
- ☐ Laboratory evidence of a coagulopathy (e.g. platelet count < 100,000/ μ L)
- ☐ Patient on coumadin and INR greater than or equal to 1.7, or patient received heparin in past 48 hours and aPTT above normal range.

3. If none of the boxes in Step 2 are checked, review the relative contraindications below and check any that are considered an unacceptable risk:

- ☐ Major surgery or serious trauma in past 14 days
- ☐ Gastrointestinal or urinary tract bleeding within past 21 days
- ☐ Acute MI in past 3 months or post-MI pericarditis
- ☐ Blood glucose less than 50 mg/dL or more than 400 mg/dL.

If all boxes in Step 1 are checked, and no boxes in Step 2 and 3 are checked, then give thrombolytic therapy.

Source: Adapted from American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Part 9: Adult Stroke. Circulation. 2005;112:IV111-20.

- *Current use of anticoagulants:* Platelets less than 100,000/mm³ coagulopathy, prothrombin time (PT) is more than 15 seconds.
 - *Heparin:* It is given but no clear benefit
 - Increased risk of bleeding.
 - *Strongest indication:* Acute thrombosis
 - *Used only with higher risk of recurrent stroke:* Risk from side effects offsets benefit of treatment.
- Atrial fibrillation, basilar artery thrombosis, stroke in evolution

Antiplatelet Therapy

- *Aspirin:* It is a first line drug most useful in secondary prevention of ischemic stroke.
- 24 hours post-tPA, dipyridamole, if continue to have recurrent CVA on aspirin alone
- *Clopidogrel:* Known allergy to aspirin

Surgical Interventions

- *Carotid endarterectomy:* Occlusion of less than 70% of arterial lumen and symptomatic lesion. Mechanical Thrombectomy (see Fig. 1).
- *Alternative:* Carotid stenting (see Fig. 2).

Practice Pearl

The Emergency MD needs to be able to diagnose accurately and acts upon certain CT findings without specialist (e.g. radiologist) assistance, because many disease processes are time-dependent and require immediate life-saving action. Don't forget the mnemonic while reading the CT

B	Blood	Blood
C	Can	Cisterns
B	Be	Brain
V	Very	Ventricles
B	Bad	Bone

head—"Blood Can Be Very Bad," where blood = blood, can = cisterns, be = brain, very = ventricles, and bad = bone.

Blood

- Presence of blood, its location, and spread (Figs 6 to 8).
- Acute bleeding absorbs X-rays and they become white (Hyperdense).

Cisterns

Examine the cisterns which are collections of CSF protecting the brain. Look for asymmetry, presence of blood, and effacement.