# Spot a Stroke FAST

https://www.youtube.com/watch?v=YUN0KnRfiJU


*If everything seems under control, you're not going fast enough – Mario Andretti*

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# Acute Stroke

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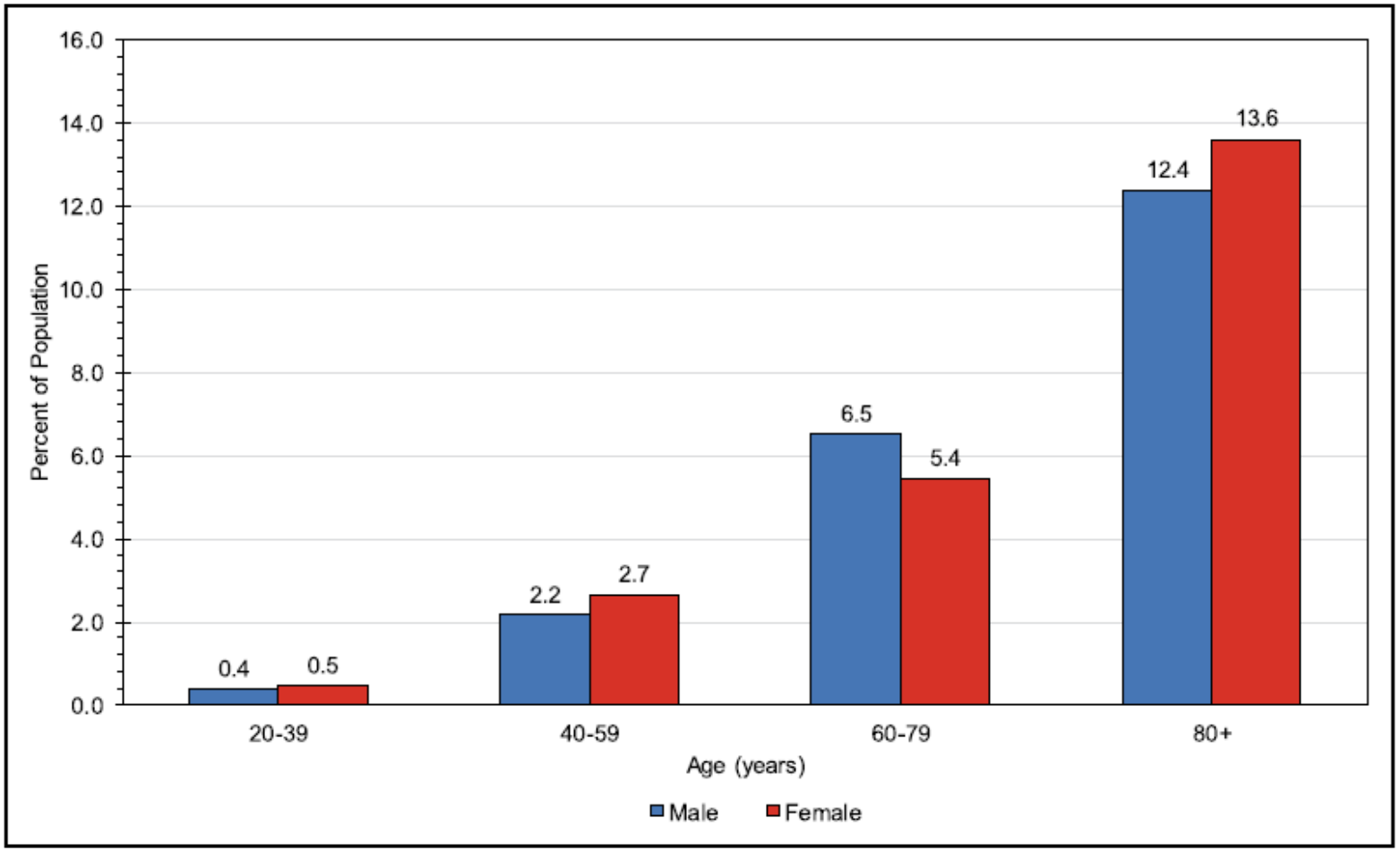
# Objectives

- List key elements in the presentation, pathogenesis, and risk factors for stroke and TIA
- Create a treatment plan for a patient with acute stroke who qualifies for alteplase and for a patient who does NOT qualify for alteplase
- Describe the type of stroke or TIA patient for whom you would recommend the following medications for secondary prevention: aspirin; anticoagulation; aspirin plus dipyridamole; clopidogrel
- Describe other secondary treatment strategies for the patient who has suffered a stroke or TIA
- Explain the use of the ABCD2 stroke risk tool in patients diagnosed with TIA

# Prevalence of stroke by age and sex

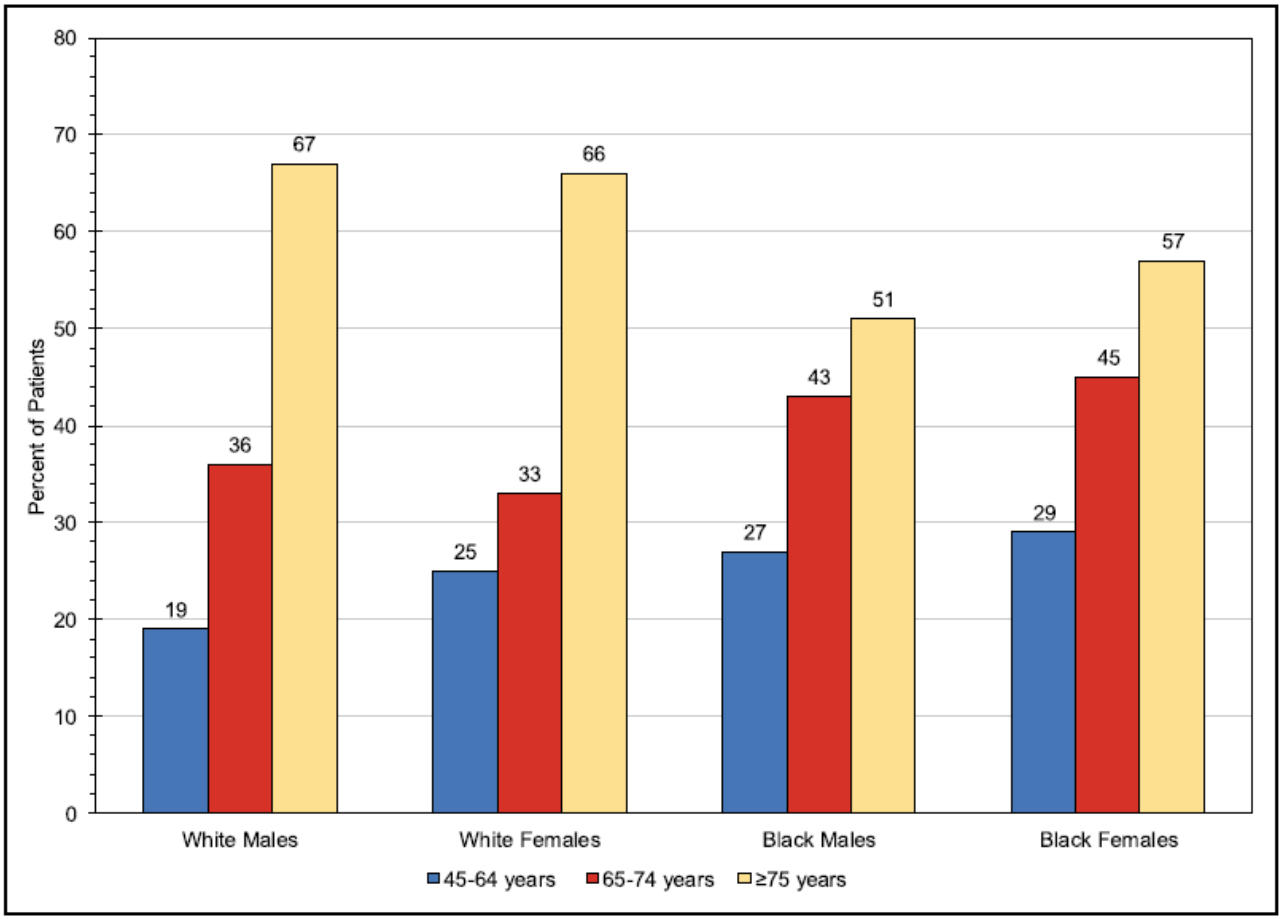
## (NHANES: 2015–2018)




Virani S et al. Heart Disease and Stroke Statistics—2021 Update.

American Heart Association.

# Probability of death within 5 years after first stroke




Virani S et al. Heart Disease and Stroke Statistics—2021 Update.

# Definition of Stroke

- Disruption of blood supply to any part of the brain that causes neurological impairment
- Sudden onset focal neurological deficit

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# Common S/Sx of Stroke

- Unilateral paralysis (hemiplegia)
  - Weakness, clumsiness, or heaviness, usually involving 1 side of the body
  - Facial droop
- Unilateral numbness (hemiparesis)
- Language disturbance
- Change in mental status
- Visuospatial neglect
- Monocular blindness
- Blurred or double vision
- Vertigo
- Ataxia

# Morbidity Associated with Stroke

A population based 6 month follow up study of people age 65 years or older who had experienced a stroke found that:

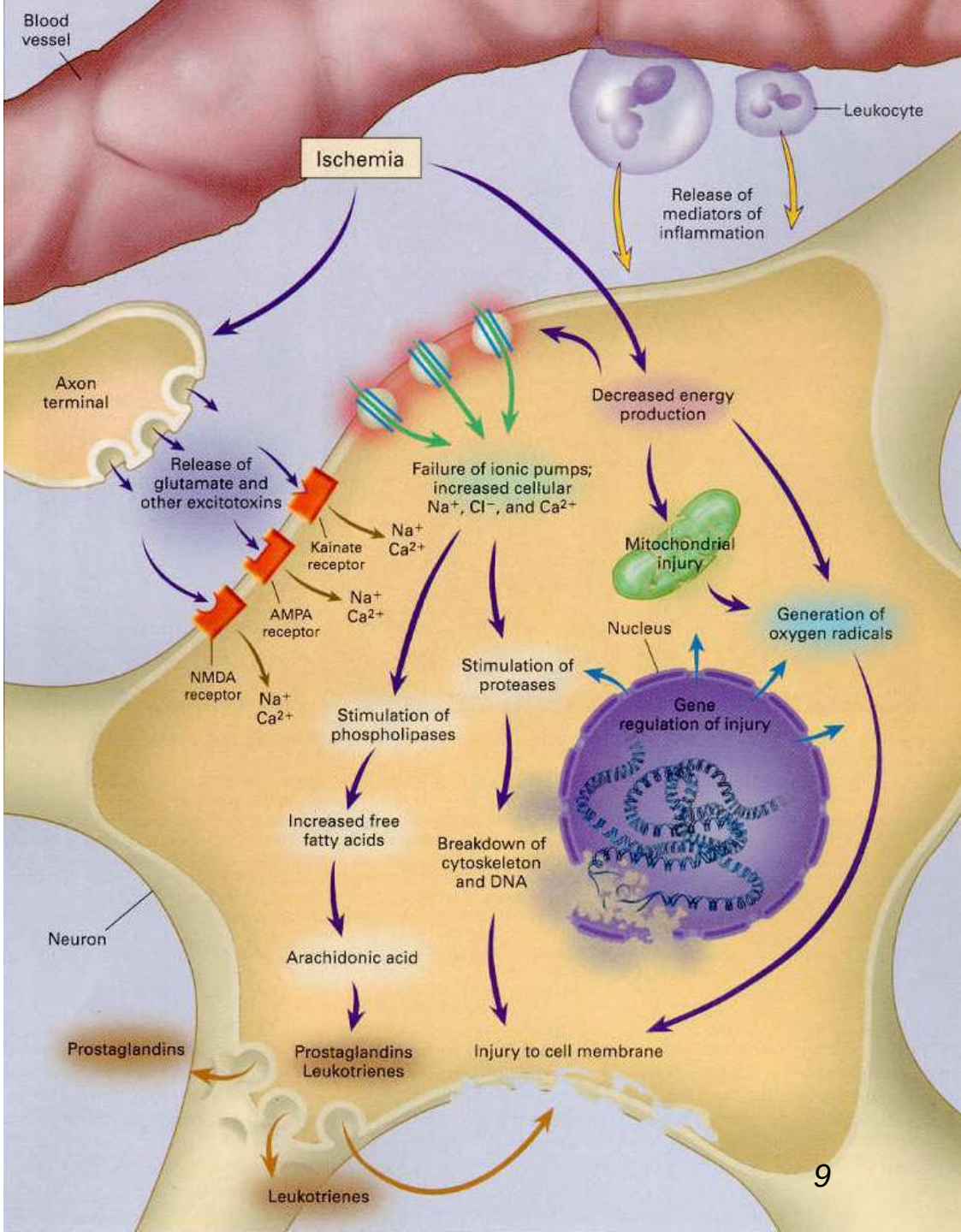
- 50% had some hemiparesis on one side of the body
- 46% had cognitive deficits
- 35% had symptoms of depression
- 30% were unable to walk without assistance
- 26% were dependent in ADLs
- 26% lived in long term care
- 19% had aphasia

***Stroke is the leading cause of serious long-term disabilities in the US***

# Stroke Pathogenesis

- Results from a cascade of events from energy depletion to cell death
- Excess of extracellular excitatory amino acids
- Free-radical formation
- Inflammation

Brott, T. NEJM. 2000;343:710-722

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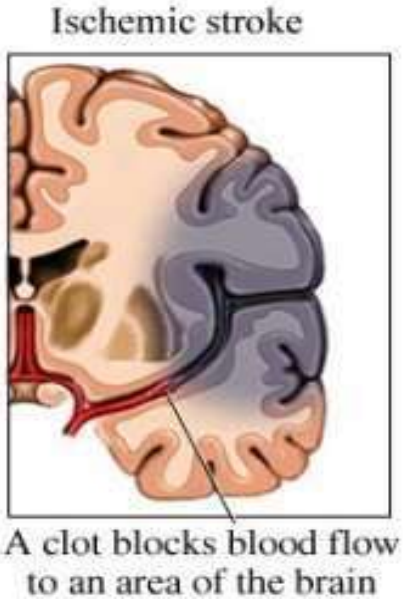
# Stroke Pathogenesis - Vascular (95%)

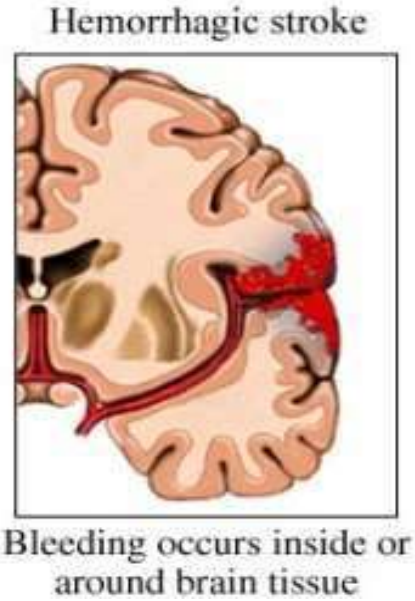
## Ischemic (87%)

- Cardioembolic
  - Atrial fibrillation
  - Cardiomyopathy
  - Post-MI
- Artery-to-artery emboli
- In situ thrombosis
- Other
  - Vasculitis
  - Coagulation Abnormality
  - Cocaine

## Hemorrhagic (13%)

- SAH (3%)
- ICH (10%)




*Benjamin EJ et al. Circ. 2019;139:e56-e528*

# Stroke Risk Factors

- **HTN***
- **DM**
- **Atrial fibrillation**
- Hyperlipidemia
- Tobacco use
- Physical inactivity
- Nutrition
- CKD
- Age
- Family history
- H/O CVD or CHD

- Obstructive sleep apnea
- Sleep duration- 6-7 hrs
- Psychosocial factors
  - Depression
  - stress

***~90% of stroke risk is attributed to modifiable RF like HTN, obesity, DM, hyperlipidemia, and renal dysfunction.***

***~74% attributable to behavioral RF like smoking, sedentary lifestyle, and poor diet.***

*Benjamin EJ et al. Circ. 2019;139:e56-e528*

# Stroke Risk Factors Continued

**Specific to women:**

- Early (≤ 10 yr of age) or late (≥ 17 yr of age) menarche
- Menopause before 45 years of age
- Postmenopausal use of estrogen and/or progestin
- Migraine w/aura (particularly if they smoke & use OC)
- Pregnancy and postpartum
  - 2 days before to 1 day after delivery
  - Lesser extent up to 6 weeks postpartum
  - RF include preeclampsia, infections, prothrombotic states, coagulopathies, chronic HTN, not breastfeeding for at least 1 month postpartum

*Virani S et al. Heart Disease and Stroke Statistics—2021 Update.*

# Patient Case

- RN is a 72 yo female
- PMH:  HTN, DM, HLD, tobacco use
- HPI:
  - Eating lunch & suddenly drops her fork
  - Cannot pick it up with her R hand
  - Hard to stand up because R leg is weak

***Is she experiencing a stroke?***
***What are her risk factors?***
***Which side of the brain is likely affected?***

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# Time is Brain!

1.9 million neurons lost each minute in which a stroke is untreated.

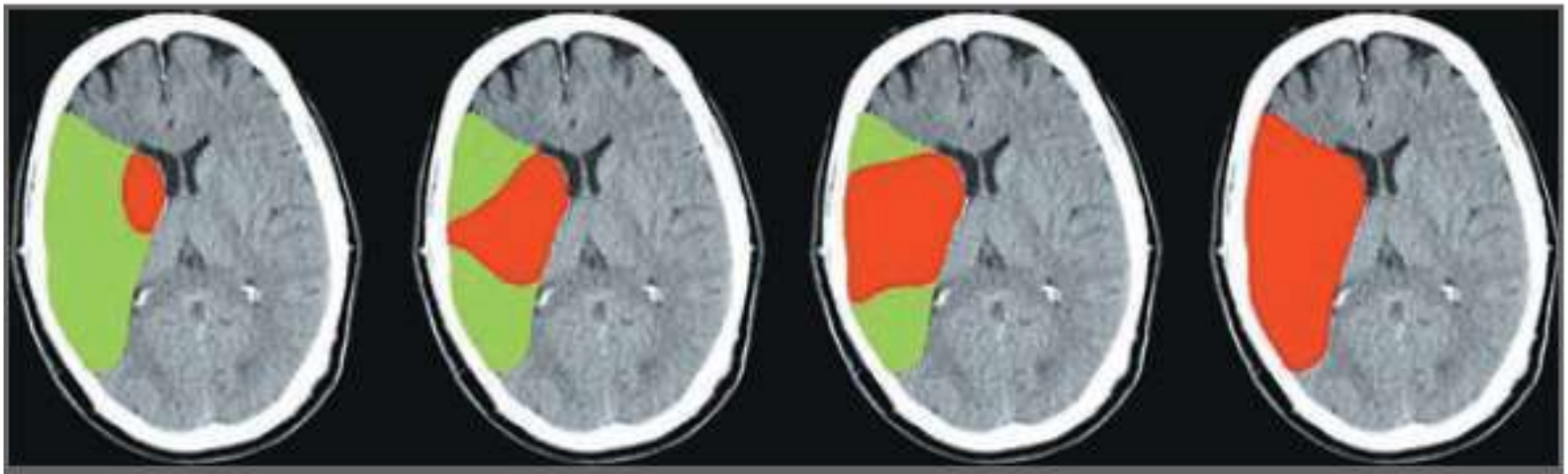

Figure 1. Progression over Time (Left to Right) of the Infarct Core (Red), with Irreversible Damage at the Expense of the Ischemic Penumbra (Green).

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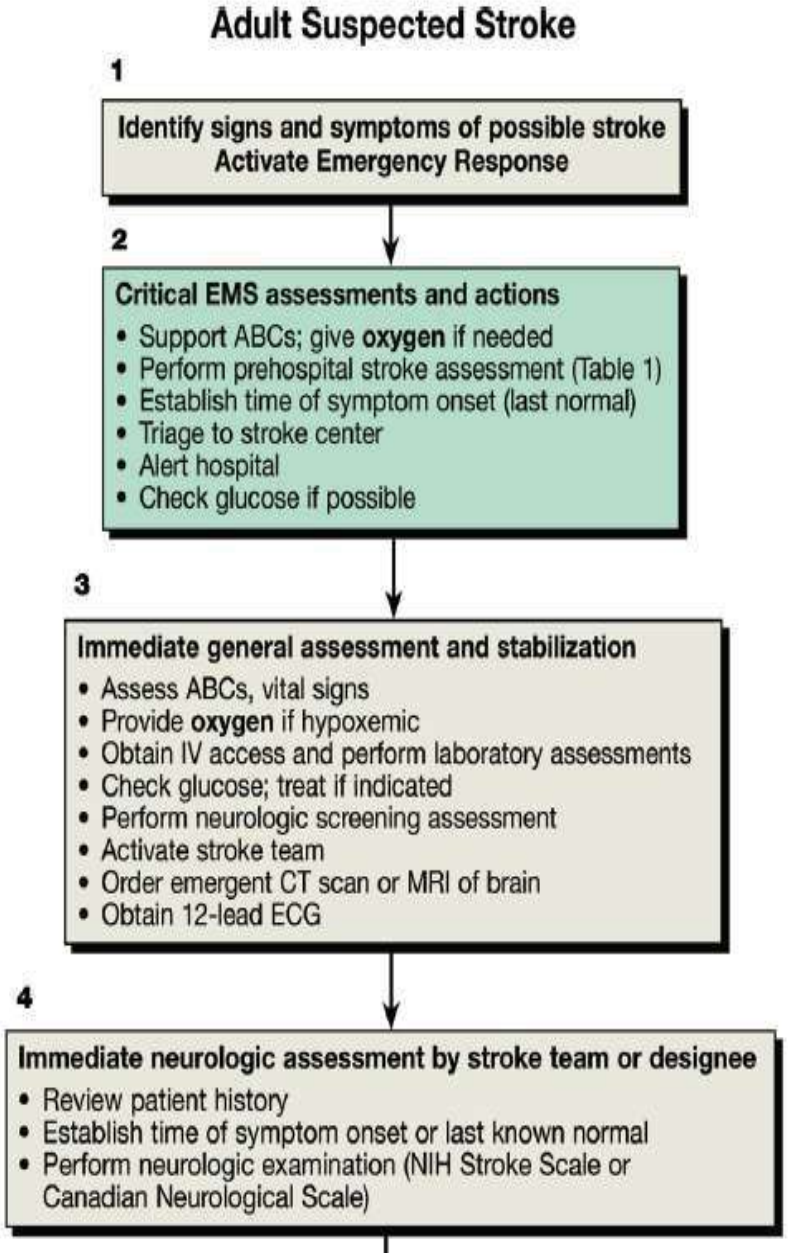
Van der Worp, HB, et al. NEJM 2007;357:572-9. Saver JL. Time is Brain. *Stroke. 2006; 37: 263-266*

# ACLS Suspected Stroke Algorithm

1. Identify signs & symptoms of stroke
2. Activate EMS
3. Immediate general assessment & stabilization
4. Immediate neurologic assessment by stroke team

NINDS TIME GOALS



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# ACLS Suspected Stroke Algorithm

2. Critical EMS assessment & action:
   - Support ABC's; provide $O_2$ if hypoxic (Pox < 94%)
   - Prehospital stroke assessment (see next slide)
   - Establish time of symptom onset (time the pt was last normal)
   - Transport to stroke center or closest hospital that can administer fibrinolytic therapy
   - Alert hospital
   - Check **glucose** if possible

# Prehospital Stroke Assessment

- Cincinnati Prehospital Stroke Scale:
  - Facial droop
  - Arm drift
  - Abnormal speech
- Interpretation: If any 1 of these signs is abnormal, probability of stroke is 72%

**Stroke Assessment**

**The Cincinnati Prehospital Stroke Scale**

**Facial Droop** (have patient show teeth or smile):

- Normal—both sides of face move equally
- Abnormal—one side of face does not move as well as the other side

*Left: Normal. Right: Stroke patient with facial droop (right side of face).*

**Arm Drift** (patient closes eyes and extends both arms straight out, with palms up, for 10 seconds):

- Normal—both arms move the same *or* both arms do not move at all (other findings, such as pronator drift, may be helpful)
- Abnormal—one arm does not move *or* one arm drifts down compared with the other

*Left: Normal. Right: One-sided motor weakness (right arm).*

**Abnormal Speech** (have the patient say "you can't teach an old dog new tricks"):

- Normal—patient uses correct words with no slurring
- Abnormal—patient slurs words, uses the wrong words, or is unable to speak

*Interpretation:* If any 1 of these 3 signs is abnormal, the probability of a stroke is 72%.

Modified from Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. Cincinnati Prehospital Stroke Scale: reproducibility and validity. *Ann Emerg Med*. 1999;33:373-378. With permission from Elsevier.

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# ACLS Suspected Stroke Algorithm

3. Immediate general assessment & stabilization (ED providers):
   - Activate Stroke Team (pre-arrival)
   - Assess ABC's; assess vital signs (BP, HR, T, RR)
   - Provide $O_2$ if Pox < 94%
   - Obtain IV access & perform lab tests
     - Electrolytes, Scr, **glucose**
     - H/H, plt count
     - PT/INR, aPTT
     - Troponin

# ACLS Suspected Stroke Algorithm

3. Immediate general assessment & stabilization continued:
   - Treat hypoglycemia (BS < 60) with IV dextrose
   - Obtain 12-lead ECG
   - Perform neurologic assessment (see next slide)
   - Order emergent CT scan or MRI of brain


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# ACLS Suspected Stroke Algorithm

4. Immediate neurologic assessment by Stroke Team in ED:
   - Review patient history
   - Establish time of symptom onset or last known normal
   - Perform neurologic exam (NIH Stroke Scale)
     - Level of consciousness, orientation, response to commands, visual fields and gaze, facial movement, motor fxn (arms, legs), limb ataxia, sensory, language, articulation, inattention
     - Total score range from 0-42
   - **CT scan to evaluate for hemorrhage** (ED goal: door to CT initiation ≤ 25 minutes)

# CT Scan: Hemorrhage or not a Candidate for Alteplase

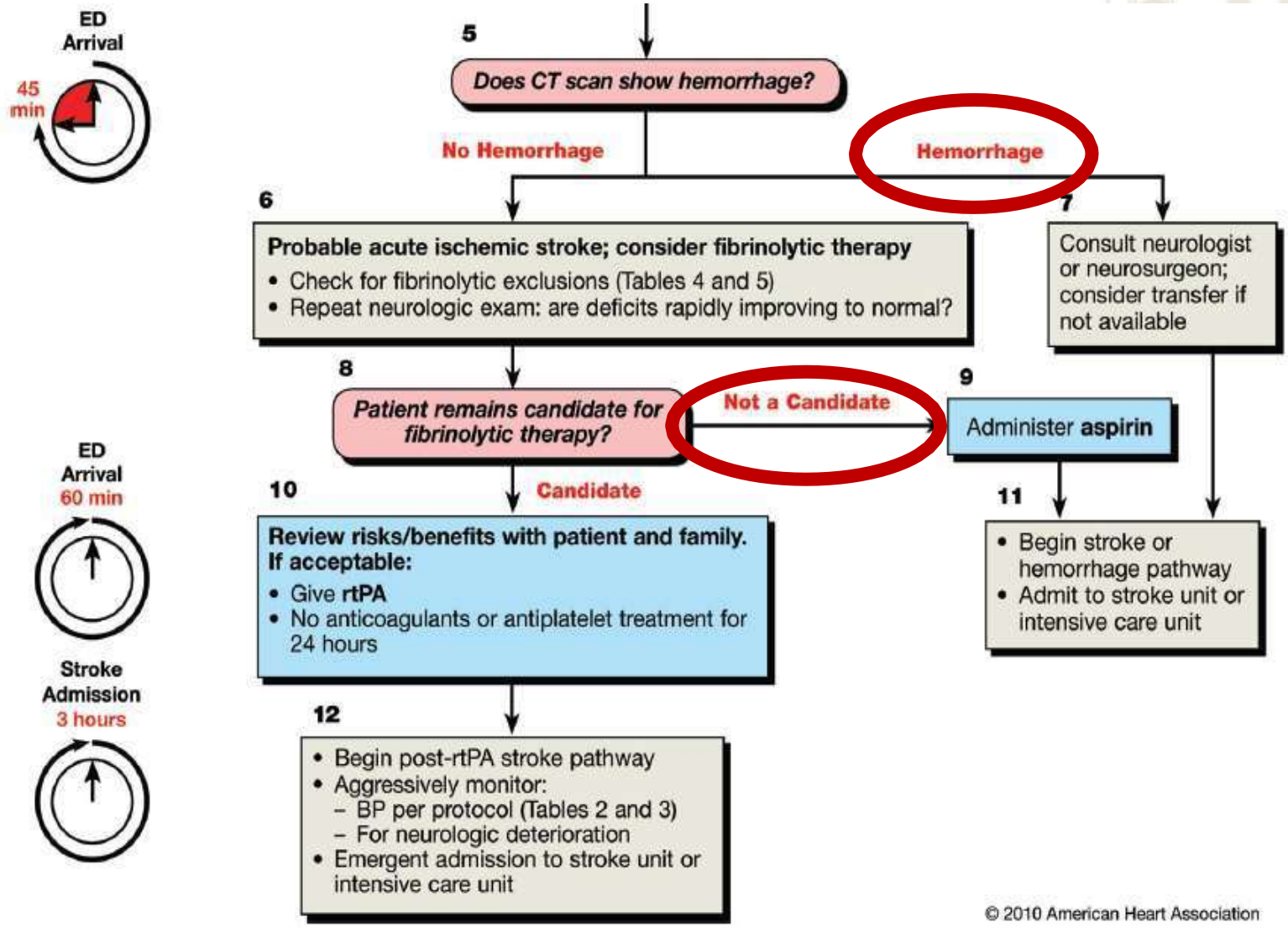



**Figure.** Goals for management of patients with suspected stroke.

# CT Scan: AIS (no hemorrhage)

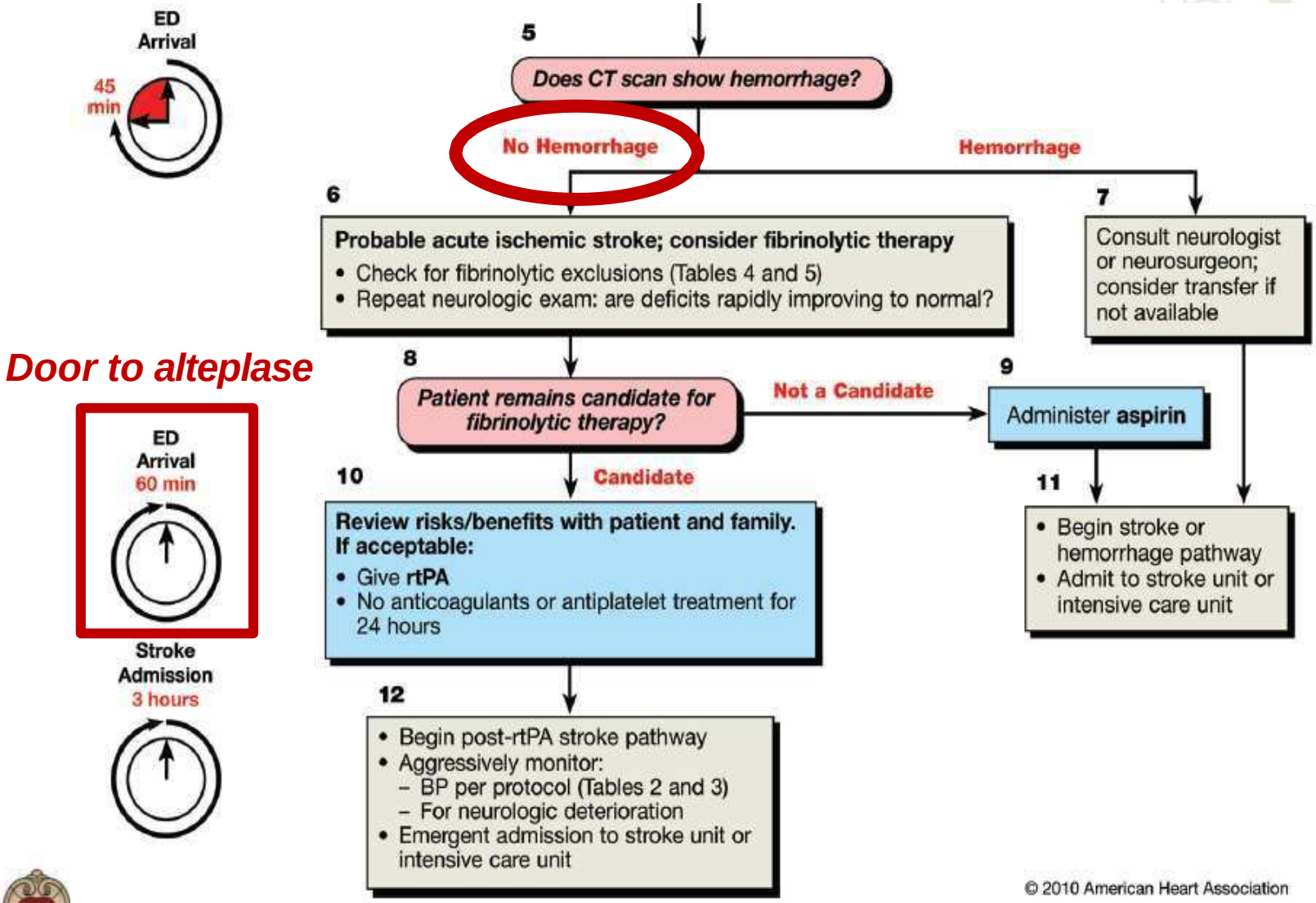
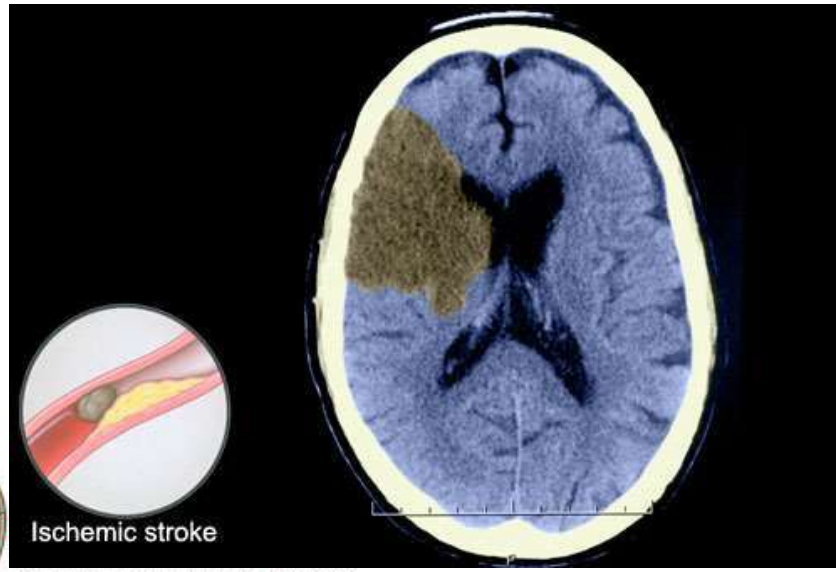
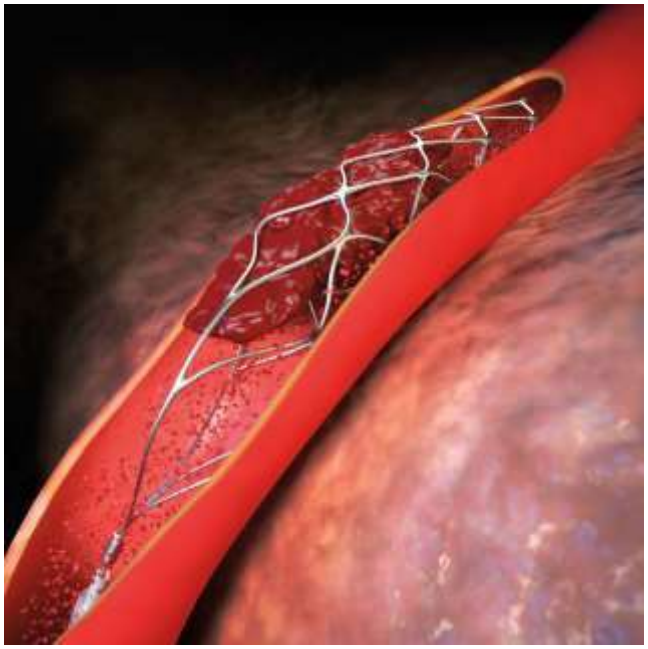



**Figure.** Goals for management of patients with suspected stroke.

# CT Scan: AIS (no hemorrhage)

6. Probable acute ischemic stroke:
   - Consider fibrinolytic therapy (alteplase)
   - Consider endovascular thrombectomy
   - If not a candidate: administer aspirin 325 mg



# Alteplase

- Patients who can be treated with alteplase within 3 hours from symptom onset or last known normal:
  - Diagnosis of ischemic stroke causing measurable neurologic deficit
    - Mild to severe
  - Onset of symptoms < 3 hrs before beginning tx
  - Age ≥ 18 years

# Extended Time Since Onset of Symptoms

- Patients who can be treated with alteplase within 3 - 4.5 hours from symptom onset:
  - Age ≤ 80 yrs, without H/O both DM and prior CVA, or not taking any OACs
  - Diagnosis of ischemic stroke causing measurable neurologic deficit (NIHSS score ≤ 25)
    - Benefit in patients with NIHSS > 25 is uncertain

# Alteplase Exclusion Criteria

- Patients who **CANNOT** be treated with alteplase within 3 or 4.5 hours from symptom onset:
  - Severe head trauma or prior ischemic stroke in previous 3 months
  - Intracranial/intraspinal surgery within 3 months
  - History of GI malignancy or recent bleeding event within 21 days
  - History of previous intracerebral hemorrhage (ICH)
  - **Systolic BP > 185 mm Hg or diastolic > 110 mm Hg**

# Alteplase Exclusion Criteria Continued

- Patients who **CANNOT** be treated with alteplase within 3 or 4.5 hours from symptom onset continued:
  - Platelet count < 100,000
  - **LMWH treatment dose within 24 hours**
  - **DOAC within 48 hours (and renal fxn normal)**
  - **Current use of warfarin with INR > 1.7, aPTT > 40 sec, or PT > 15 sec**
  - Blood glucose < 50 mg/dL or > 400 mg/dL (unless normalized)
  - CT demonstrates multilobar infarction

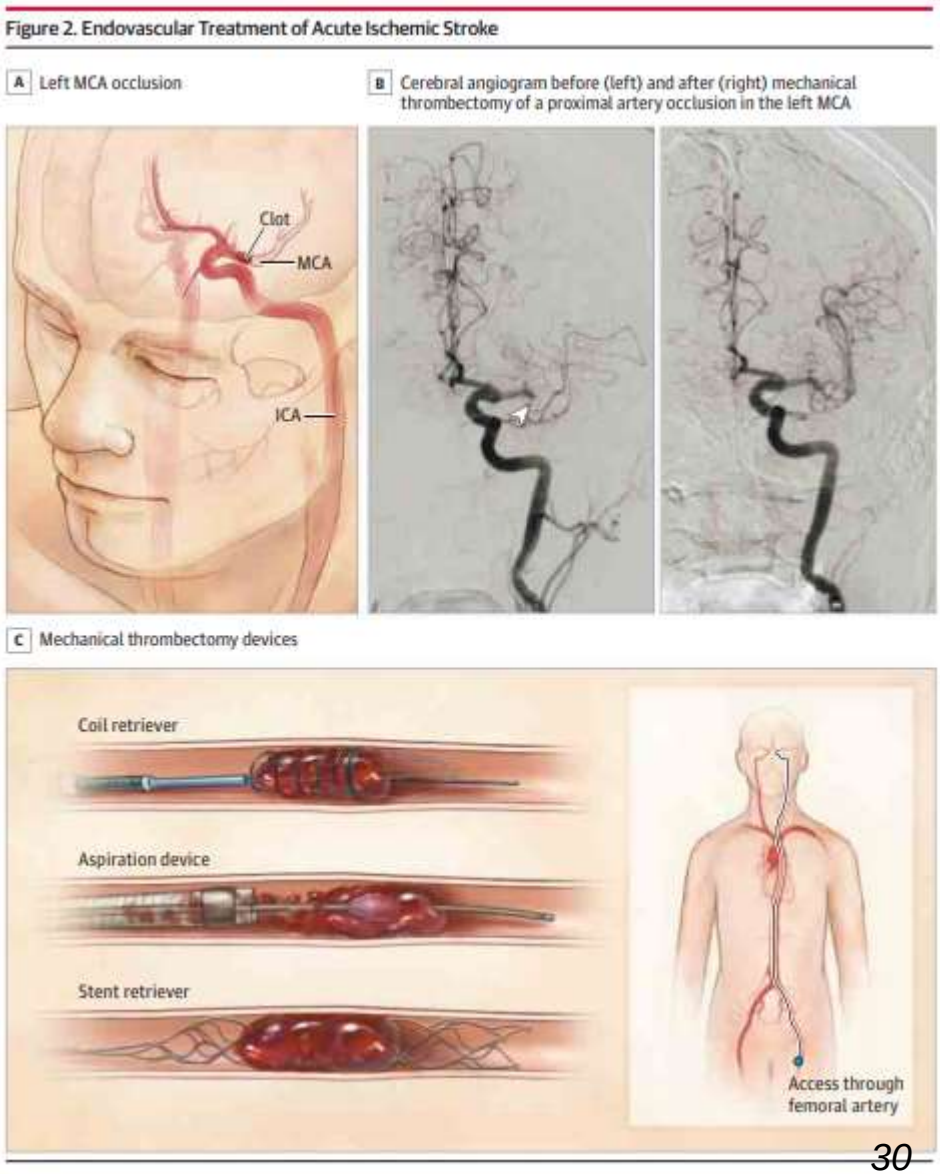
# Alteplase *Relative* Exclusion Criteria

- Patients who may or may not be treated with alteplase within 3 hours from symptom onset:
  - Only minor or rapidly improving stroke symptoms
  - Seizure at onset with postictal residual neurologic impairments
  - Major surgery or serious trauma within previous 14 days
  - Recent acute NSTEMI (within previous 3 months)

# Mechanical Thrombectomy

Patients meeting criteria are eligible for mechanical thrombectomy up to 24 hours after last known normal.

- Have a large vessel (intracranial) occlusion
- Not a candidate for alteplase
- Failed alteplase




Prabhakaran S et al. JAMA 2015;313:1451-62

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# Patient Case

- 72 yo female
- PMH: HTN, DM, HLD, tobacco use
- HPI: sudden R-sided weakness
  - BP: 180/112 mm Hg
  - BS: 140 mg/dL
  - Weight: 70 kg
  - CT: no hemorrhage

***Is this patient a candidate for alteplase therapy?***

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- PMH: HTN, DM, HLD, tobacco use
- HPI: sudden R-sided weakness
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  - Weight: 70 kg
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***Is this patient a candidate for alteplase therapy?***

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# Stroke and HTN

**Prior to administration of alteplase:**

- **If SBP > 185 or DBP > 110 mmHg, give:**
  - –Labetalol 10-20 mg IV push over 1-2 min, may repeat x 1

    OR
  - – Nicardipine 5 mg/hr, titrate by 2.5 mg/hr every 5-15 min, max rate 15 mg/hr

    OR
  - – Clevidipine 1-2 mg/hr, titrate by doubling the dose every 2-5 min until BP target reached, max rate 21 mg/hr
- **If BP cannot be maintained ≤ 185/110 mmHg, do not administer alteplase!**

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# Alteplase Administration


- Goal: Begin administration within 60 minutes of arriving to ED
- **Dose: 0.9 mg/kg (max dose = 90 mg)**
  - **10% of dose (0.09 mg/kg) given as bolus over 1 minute**
  - **Remaining 90% of dose (0.81 mg/kg) infused over 60 minutes**

***What are the alteplase bolus and infusion doses for RN? (wt 70 kg)***

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# Alteplase Administration


- Goal: Begin administration within 60 minutes of arriving to ED

- **Dose: 0.9 mg/kg x 70 kg = 63 mg**
  - **Bolus = 6.3 mg IV push over 1 minute**
  - **Infusion = 56.7 mg infused over 60 minutes**

# Alteplase Preparation


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# Alternative Fibrinolytics?

- Tenecteplase considered an alternative to alteplase in patients with minor neurologic impairment and no major intracranial occlusion
  - 0.4 mg/kg single IV bolus
  - Not proven to be superior or inferior to alteplase

# Patient Monitoring with Alteplase

- ICU for 24 hours or transfer to Stroke Center
  - "Drip and Ship"
- Frequent Neuro & BP assessments:
  - Q15 min x 2 hours from the start of alteplase, then Q30 min x 6 hours, then Q 1 hour for 16 hours
- Potential side effects:
  - Intracerebral hemorrhage: highest risk within the first 24 hours of receiving alteplase
  - Bleeding
  - Angioedema

# Patient Monitoring with Alteplase

- Treatment of angioedema (FYI):
  - May require intubation
  - Discontinue alteplase infusion
  - **Hold ACEIs**
  - Give IV methylprednisolone 125mg, IV diphenhydramine 50mg, and IV famotidine 20mg
  - IV or nebulized epinephrine for further increase in angioedema

# Patient Monitoring with Alteplase

- If patient develops severe HA, acute HTN, N/V, or worsening neurological exam:
  - S/Sx ICH
  - Discontinue alteplase infusion, STAT head CT

- **To minimize risk for ICH:**
  - **Hold antiplatelet & anticoagulants for 24 hours after alteplase administration**
  - **Repeat head CT prior to starting AP and AC**

# Stroke: Treatment of HTN

**During or after administration of alteplase:**

- **Maintain BP < 180/105 mmHg for at least the first 24 hrs after alteplase treatment**
- If SBP >180-230 or DBP >105-120 mmHg, give:
  - Labetalol 10mg IV push, then 2-8 mg/hr OR
  - Nicardipine (same dosing)
  - Clevidipine (same dosing)
  - Consider IV sodium nitroprusside infusion if BP not controlled or DBP > 140 mmHg
- Transition to oral therapy as soon as patient passes swallow study

# Other Management Issues

- Delay placement of nasogastric tubes, indwelling bladder catheters, or intra-arterial pressure catheters if patient can be safely managed without them
- **Control hyperthermia ( T > 38°C)**
  - Identify sources and treat
  - Use antipyretics to lower temperature
- **Control blood sugars**
  - **Keep BS between 140-180 mg/dL**
  - **Avoid hypoglycemia (BS < 60 mg/dL)**

# Other Management Issues Continued

- **Prevent DVTs in immobile stroke patients using intermittent pneumatic compression**
  - UFH or LMWH use is not well established
- **Control seizures**
  - Prophylactic AEDs not recommended
- **Nothing by mouth** (NPO) until speech swallow assessment
- Monitor intracranial pressure (ICP)
  - Intubation
  - Decompression surgery
  - Mannitol or hypertonic saline

# Patient Case

- 72 yo female
- PMH:  HTN, DM, HLD, tobacco use
- Received alteplase 63mg in ED
- Now in neuro ICU with strict bedrest and remains NPO

***Does this patient require DVT prophylaxis?***

***What therapy would you recommend starting and when?***

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- 72 yo female
- PMH:  HTN, DM, HLD, tobacco use
- Received alteplase 63mg in ED
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***Does this patient require DVT prophylaxis?***

Yes, she is under strict bedrest.  Use sequential compression device.

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# Patient Case

- 72 yo female
- PMH:  HTN, DM, HLD, tobacco use
- Received alteplase 63mg in ED
- Now in neuro ICU with strict bedrest and remains NPO

***What therapy would you recommend starting and when?***

1. ***ASA (PR) next day***
2. ***Maintain BP < 180/105 mmHg***
3. ***Keep BS 140-180 mg/dL***
4. ***NRT for tobacco cessation***
5. ***Statin once passes swallow test***

# Patient Case

- 72 yo female
- PMH:  HTN, DM, HLD, tobacco use
- Received alteplase 63mg in ED 2 days ago
- Passed swallow study
- Home meds:  aspirin 81 mg daily, lisinopril, simvastatin, metformin

***What are your recommendations for resuming home meds?***

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# Thanks, and Think FAST!