STROKE

M Asif Taqi MD, FAHA,
Medical Director of Stroke and Neuro Endovascular
Comprehensive Stroke Center at
Los Robles Hospital and Medical Center
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Case

- 64 year old presented with left hemiplegia and neglect
- Improved twice then became hemiplegic again with right gaze deviation
- Went for procedure to remove clot
- Door to groin time was 48 minutes
TWO TYPES OF STROKE

Ischemic Stroke

Ischemic = type of condition in which oxygen is deficient

Often caused by a blood clot or plaque buildup that blocks blood flow

Hemorrhagic Stroke

Hemorrhage = bleeding

Occurs when a blood vessel ruptures, causing blood to leak into the surrounding tissue
Two Types of Stroke

87% of strokes are ischemic; only 1% of these patients get intervention.

13% of strokes are hemorrhagic:
- 10% intracerebral
- 3% subarachnoid

4 out of every 5 families is affected by stroke.

US PREVALENCE OF STROKE BY AGE AND SEX¹

Stroke kills more women than breast, ovarian, uterine and cervical cancer combined²

STROKE IS A LEADING CAUSE OF DEATH

Stroke accounts for 1 of every 18 deaths in the United States, that’s 1 death every 4 minutes

Race is a risk factor for stroke

African-Americans have a risk of first-ever stroke that is almost twice that of Caucasians.

An estimated 795,000 Americans will suffer a new or recurrent stroke this year…

…that’s one every 40 seconds.
TIA’S (TRANSIENT ISCHEMIC ATTACK)

- “Mini-Stroke” – symptoms can be similar to a stroke but resolve on their own within 24 hours.

- ~5 million Americans have been diagnosed with having had a TIA; true prevalence is probably greater because many TIA’s go undiagnosed.

- A meta-analysis shows that patients with TIA have a 10-17% risk of stroke within 90 days.

- Within 1 year of TIA, ~12% of patients will die.
The total estimated cost of stroke is $48 billion.

- Lost productivity due to mortality and morbidity: $15 billion
- Hospitalization costs: $16 billion
- Rehabilitation: $4.5 billion
- Physician costs: $4 billion
- Medications & other costs: $3.5 billion
- The lifetime cost of stroke to a single patient is more than $140,000
Statement Highlights:
- Stroke costs are predicted to more than double in the next 20 years.
- Americans 45-64 years old are expected to have the highest increase in stroke incidence.

Costs to treat stroke are projected to more than double and the number of people having strokes may increase 20 percent by 2030, according to the American Heart Association/American Stroke Association.

In a statement published in Stroke, an American Heart Association journal, the association cites the aging U.S. population as the main reason for the increases and predicts that by 2030:
- Almost 4 percent of U.S. adults — nearly one in 25 — will have a stroke. This translates into an additional 3.4 million people with stroke in 2030.
- Costs to treat stroke may increase from $71.55 billion in 2010 to $183.13 billion.
- Annual costs due to lost productivity could rise from $33.65 billion to $56.54 billion.
- Americans currently 45-64 years old are expected to have the highest increase in stroke at 5.1 percent.
# PHYSIOLOGICAL IMPACT OF STROKE

## Estimated Pace of Neural Circuitry Lost in a Typical Large Vessel Acute Ischemic Stroke

<table>
<thead>
<tr>
<th>Time</th>
<th>Neurons Lost</th>
<th>Synapses Lost</th>
<th>Myelinated Fibers Lost</th>
<th>Accelerated Aging</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 second</td>
<td>32,000</td>
<td>230 million</td>
<td>218 yards</td>
<td>8.7 hours</td>
</tr>
<tr>
<td>1 minute</td>
<td>1.9 million</td>
<td>14 billion</td>
<td>7.5 miles</td>
<td>3.1 weeks</td>
</tr>
<tr>
<td>1 hour</td>
<td>120 million</td>
<td>830 billion</td>
<td>447 miles</td>
<td>3.6 years</td>
</tr>
<tr>
<td>Avg. stroke</td>
<td>1.2 billion</td>
<td>8.3 trillion</td>
<td>4470 miles</td>
<td>36 years</td>
</tr>
</tbody>
</table>

35-40% OF ISCHEMIC STROKES ARE CONSIDERED “LARGE VESSEL”

- This subset of ischemic stroke comprises blockages in the:
  - Internal Carotid Artery (ICA)
  - Middle Cerebral Artery (MCA)
  - Vertebral / Basilar Artery

- If left untreated, patient prognosis with these types of stroke is poor

<table>
<thead>
<tr>
<th>Vessel</th>
<th>Mortality Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICA</td>
<td>53%(^1)</td>
</tr>
<tr>
<td>MCA</td>
<td>27%(^2)</td>
</tr>
<tr>
<td>Basilar Artery</td>
<td>89-90%(^3)</td>
</tr>
</tbody>
</table>

2. Furlan A et al. PROACT II Trial
Symptoms of Stroke

- Are abrupt and acute
- Usually effect one side of the body
- For typical symptoms remember FAST
- Some of the atypical symptoms include vertigo, double vision, confusion, loss of vision or blurred vision and gait problem
RISK FACTORS FOR STROKE

• Smoking
• Hypertension
• High Cholesterol
• Diabetes
• Atrial fibrillation
• > 70% Internal Carotid Stenosis
NON MODIFIABLE RISK FACTORS

• Family history

• Race
TYPES OF STROKE

• Ischemic: Lack of blood flow due to clot in the blood vessel

• Hemorrhagic: Rupture and bleeding into the brain tissue
ISCHEMIC STROKE

• Two types:

• 1- Small vessel Stroke also known as Lacunar stroke………...Treatment is medical IVtPA

• 2- Large vessel Stroke also known as ELVO………………..Treatment is surgical

• Primary stroke center can provide treatment to small vessel stroke……..Comprehensive stroke centers provide treatment for both small vessel and large vessel stroke
How does stroke occur

- It occurs due to a blockage in the brain blood vessel
- The blockage could be from:
- Plaque in the blood vessel of brain (less likely)
Clot traveling from heart or other blood vessels in the neck
HEMORRHAGIC STROKE

• Rupture of small blood vessel 80%
  Treatment is mostly medical

• Rupture of aneurysm of AVM 20%
  Treatment is mostly surgical or endovascular surgery
What has changed in stroke

- Stroke was not treatable before 1995
- In 1995 NIND trial was published that showed benefit of IV tPA in acute stroke.
- In 2004 system of care was developed to get stroke patients to appropriate centers.
- In 2012 comprehensive stroke center designations started
IA TREATMENT

- In 1998, PROACT I and PRACT II studies of intra-arterial tPA were done that showed higher rate of recanalization
- In 2004 first Endovascular device was marketed, called MERCI device
• In 2008 first suctioning catheter was marketed
• In 2012, first Stent retriever was introduced in the market
A Randomized Trial of Intravenous Treatment for Acute Ischemic Stroke

Randomized Assessment of Rapid Endovascular Treatment of Ischemic Stroke

Stent-Retriever Thrombectomy after Intravenous t-PA vs. t-PA Alone in Stroke

Endovascular Therapy for Ischemic Stroke with Perfusion-Imaging Selection

Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke
<table>
<thead>
<tr>
<th>Study</th>
<th>Selection Criteria</th>
<th>Time from symptom onset</th>
<th>Good recanalization rate</th>
<th>Good 90 day outcome in Intervention arm</th>
<th>Good 90 day outcome in medical arm</th>
<th>Symptomatic intracranial hemorrhage</th>
<th>Time to Groin</th>
</tr>
</thead>
<tbody>
<tr>
<td>MR Clean</td>
<td>Time</td>
<td>6 hrs.</td>
<td>58.7%</td>
<td>32.6%</td>
<td>19.1%</td>
<td>5.2%</td>
<td>260 O to G</td>
</tr>
<tr>
<td>ESCAPE</td>
<td>CT and multiphase CTA</td>
<td>12 hrs</td>
<td>72.4%</td>
<td>53%</td>
<td>29.3%</td>
<td>3.6%</td>
<td>241 O to R</td>
</tr>
<tr>
<td>EXTEND IA</td>
<td>CT perfusion (RAPID)</td>
<td>6 hrs</td>
<td>86%</td>
<td>71%</td>
<td>40%</td>
<td>0%</td>
<td>248 O to R</td>
</tr>
<tr>
<td>Swift Prime</td>
<td>CT Aspect</td>
<td>6 hrs</td>
<td>88%</td>
<td>60.2%</td>
<td>35.5%</td>
<td>1%</td>
<td>184 O to G</td>
</tr>
<tr>
<td>REVASC</td>
<td>CT ASPECT/ MRP ASPECT</td>
<td>8 hrs</td>
<td>90.2%</td>
<td>43.7%</td>
<td>28.2%</td>
<td>1.9%</td>
<td>NA</td>
</tr>
</tbody>
</table>
Case

- 77 y/o healthy female went to bathroom at 2:30am
- Developed acute onset left hemiplegia, husband called 911
- Patient brought in to LRHMC at 3:30am as stroke code ELVO
• 60 year old male presented with Hunt Hess V and Fisher IV aneurysmal subarachnoid hemorrhage

• Comatose and localize only with right arm on exam

• Emergent coil embolization performed to secure aneurysm after placement of ventriculostomy

• Required bedside critical care management for first 12 hours to resuscitate brain. Severe subarachnoid hemorrhage causing hydrocephalus with completely obstructed ventricular system.
• Intrathecal tPA was given

• 48 hours scan showed complete resolution of intraventricular blood

• At 72 hours patient is opening eye and following commands

• Will remain under neurocritical care service for vasospasm watch
• 22 year old presented with altered mental status to OSH in Oxnard

• CT showed right sylvian SAH and extensive intraventricular hemorrhage

• Angiogram showed right temporal AVM
CT on arrival showing large amount intraventricular blood.

Right temporal AVM and intra-nidal aneurysm on Angiogram.

Complete obliteration of AVM same night through embolization.
Next day surgical resection of AVM
Edison may have invented the light bulb, but our neurosciences team helped this man see the light.
WHAT DO I NEED TO KNOW

• TIME is brain
• Stroke onset is abrupt and acute
• Stroke symptoms are usually one sided
• FAST
• Levels of stroke centers in my community
THE END