Stroke: Time is Brain

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Objectives

- Stroke warning signs and symptoms
- What to do when Stroke signs and symptoms are identified
- Types of strokes
- Acute stroke therapies
- Non-modifiable and modifiable risk factors
- Stroke prevention
- Caregivers
Stroke is a Medical Emergency

Target Stroke: Acute Care & EMS

The sooner that rt-PA is given to stroke patients, the greater the benefit, especially if started within 90 minutes of symptom onset.
Stroke is a Big Deal

In the USA someone has a stroke every 40 seconds.

Stroke Death Rates, 2000-2006
Adults Ages 35+, by County

Age-Adjusted Average Annual Deaths per 100,000

| 35 - 96 | 679 |
| 97 - 105 | 624 |
| 106 - 114 | 676 |
| 115 - 125 | 615 |
| 126 - 129 | 544 |

Rates are spatially smoothed to enhance the stability of rates in counties with small populations.

ICD-10 codes for stroke: I60-I69

Data Source: National Vital Statistics System and the U.S. Census Bureau

CDC

Massachusetts General Hospital

Fireman Vascular Center
The Stroke Care Pyramid

**Comprehensive Stroke Center**
Neuroendovascular, Neurosurgeon
Full spectrum of hemorrhagic stroke care, research, redundancy

**“Primary” Stroke Center:**
Stroke coordinator, Stroke service, continuum of inpatient care

**Acute Stroke Capable Hospitals:**
IV tPA, CT scanner

**Basic Care:**
Assessment, identification and stabilization
• A Stroke occurs when the blood supply to the brain is interrupted, either due to a blockage or a rupture in the blood vessel. When this occurs, the brain is deprived of oxygen and nutrients causing brain cells to die.
Frontal lobe
Executive functions, thinking, planning, organising and problem solving, emotions and behavioural control, personality

Motor cortex
Movement

Sensory cortex
Sensations

Parietal lobe
Perception, making sense of the world, arithmetic, spelling

Occipital lobe
Vision

Temporal lobe
Memory, understanding, language
Disability

- Stroke is a leading cause of adult disability in the US.

- With timely treatment, the risk of death and disability from stroke can be lowered.

- In 2010, stroke cost the US approx $73.7 billion in health care services, medications, and lost productivity.

CDC; AHA
Estimated Cost of Stroke

- Hospital $25,409/stroke
- Nursing Home care $20,377/stroke
- Physicians/other professionals $4,654/stroke
- Medical durables $1761/stroke
- Home healthcare $5535/stroke
- Loss of productivity/earnings $28,931/stroke
- Loss of productivity cost taxpayers in the state of Massachusetts $8.4 billion dollars in the year 2009
The Stroke Continuum

- Prevention
- Recognition
- 9-1-1
- Emergency Medical Services
- Emergency Department
- Inpatient Hospitalization
- Rehabilitation
- Re-integration to the Community
Public Awareness

SPOT A STROKE

FACE DROPPING
ARM WEAKNESS
SPEECH DIFFICULTY
TIME TO CALL 911

Stroke Warning Signs and Symptoms
Sudden Symptoms of Stroke

• Beyond F.A.S.T. – Other Symptoms You Should Know
  – Sudden **NUMBNESS** or weakness of face, arm, or leg, especially on one side of the body
  – Sudden **CONFUSION**, trouble speaking or understanding speech
  – Sudden **TROUBLE SEEING** in one or both eyes
  – Sudden **TROUBLE WALKING**, dizziness, loss of balance or coordination
  – Sudden **SEVERE HEADACHE** with no known cause

• If someone shows any of these symptoms, immediately call 6-3333 and follow MGH In-House Stroke protocol
Types of Stroke

- Blockage
- Rupture

Cerebral artery
Different Types of Stroke, 2000

- Cerebral Embolus: 24%
- Intracerebral Hemorrhage: 9%
- Subarachnoid Hemorrhage: 3%
- TIA: 3%
- Hemorrhagic Stroke: 12%
- Ischemic Stroke: 88%

Cerebral Thrombosis: 61%

TIA = transient ischemic attack.

Ischemic Stroke

- Ischemic stroke is the most common type of stroke. An ischemic stroke happens when an artery in the brain is blocked. There are two types of ischemic stroke.
An embolic stroke is caused by a blood clot or a plaque that travels from another area of the body, usually from the heart or the large arteries leading to the brain. When it reaches the brain, the clot blocks a blood vessel which causes a stroke.
Sources of Embolic Strokes

- Atrial Fibrillation
- Carotid Stenosis
- DVT through PFO
- Embolic Myxoma
- Septic Emboli
Thrombotic strokes are caused by a clot or plaque fragment that forms inside an artery in the brain and causes a stroke.
Recanalization Options

Opening vessels can be accomplished in 2 ways:

- Intravenous (thrombolytics like tPA)
- Endovascular (thrombectomy)
Benefit of IV tPA

Measured at 3 months after stroke

Normal or nearly normal
Better
No major change
Worse
Dead or severe disability

Early course
No early worsening with brain bleeding
Early worsening with brain bleeding

Lansberg, Stroke 2008
TIME TARGETS for tPA

- Discovery of Symptoms to CT - 20 minutes
- Discovery of Symptoms to CT result - 45 minutes
- Discovery of Symptoms to Needle (tPA administration) time - 45 minutes
- Acute Stroke Team arrival - 10 minutes after notification
Medication Treatment for Acute Ischemic Stroke

- IV t-PA is the only FDA-approved treatment for ischemic strokes.
- It can improve outcomes of Stroke patients.
- It is a clot-busting drug that is given through an IV in the arm and may restore blood flow to that area of the brain.
- It needs to be given within 3 hours of Stroke symptoms or within 4.5 hours for certain eligible patients for it to be effective.
IV tPA Has Limitations

Large clots = proximal occlusions
Mechanical Endovascular Treatment for Ischemic Stroke

- Some patients who have had stroke symptoms within 24 hours may be eligible for a procedure which can physically remove the clot.
- A specially trained doctor threads a catheter through and artery to the blocked artery in the brain. The stent opens and grabs the clot, which then is removed from the vessel hopefully restoring blood flow to that area of the brain.
Outcome is Time Dependent

Probability of good clinical outcome over time to successful angiographic reperfusion

The typical patient loses almost 2 million neurons/min in which stroke is untreated…
Core Determines Outcome
The Thirsty Brain

<3% of body mass

>20% of total resting:
Oxygen
Blood flow
Glucose
Endovascular Treatment
Big Strokes = Bad Outcomes

Proximal occlusions account for:
>2/3 of the severe disability
>3/4 of the mortality from stroke

No symptoms 0 1 2 3 4 5 6
Modified Rankin Score
success failure Death
Access

For the brain and spine, *access* is the issue.

**Q:** How can you get anywhere in the human body from a single portal of entry?

**A:** By using the circulation system…

*Arterial + venous*
Before Endovascular Treatment
After Endovascular Treatment
Number Needed to Treat

- **Endovascular Stroke Rx**
- **IV tPA <3hrs**
- **PCI for STEMI**
- **Statins**

Adapted from Jeff Saver
Time to Treatment is Essential

Save a minute, save a week

Meretoja, et al, Neurology 2017
Intracerebral Hemorrhage

- Rupture of a blood vessel
- Most commonly occurring in patients with hypertension or patient who are on anticoagulation therapy
- ICH is a devastating neurovascular emergency without effective therapies
Intracerebral Hemorrhage
ICH Treatment

- ABC’s
- ICH Score on arrival
- Stroke and Neurosurgery Consult
- Blood Pressure Management - SBP < 160
- Correct Coagulopathy - INR > 1.4
  - PCC
  - Vitamin K IV
Subarachnoid Hemorrhage

- Subarachnoid hemorrhage usually occurs spontaneously.
- It causes bleeding from in between the arachnoid membrane and the pia mater.
- It is usually caused by a ruptured aneurysm.
Subarachnoid Hemorrhage

- SAH occurs when blood leaks into the fluid filled spaces that surround the brain and its blood vessels.
- Accounts for 5% strokes in the US
- Aneurysm, AVM, Smoking, hypertension are the most common reasons for SAH
Subarachnoid hemorrhage
SAH Treatment- Aneurysmal

- Neuroendovascular and Neurosurgery consult
- Hunt and Hess Score on arrival to hospital
- Coiling or clipping procedure as quickly as possible
- Bedrest
- NPO until procedure
What is a TIA?
• TIA is a medical emergency and a warning sign too dangerous to ignore

• The 90 day risk of recurrent stroke was significantly reduced with rapid assessment and treatment
  – 10.3% → 2.1%

• By 90 days, the odds of neurological deterioration were 5 times greater for TIA patients than for stroke patients
• Up to 500,000 TIA’s are estimated each year; the incidence may be higher as many go unrecognized or unreported

• As many as 10% of patients will suffer a stroke in the 48 hours following a TIA

• Up to one-quarter of TIA patients will die within 1 year

• The financial impact is huge
During Hospitalization

- Neurological Assessments
- They will do many tests to try to find the cause of the stroke to help reduce the risk of another one.
- Manage any risk factors.
- Education
  - Stroke warning signs and symptoms
  - Risk factors
  - Prescribed medications
  - Follow up
  - Call 911 if stroke symptoms occur
Rehabilitation is a very important phase of recovery. It helps you return to independent living.
What Will I do in Rehabilitation?

- Self care skills
- Mobility skills
- Communication skills in speech and language
- Cognitive skills such as memory or problem solving
- Social skills for interacting with people
Uncontrollable Risk Factors for Stroke

• Age- Arteries become more rigid with age. The likelihood doubles every 10 years after age 55

• Gender- Women have more strokes than men due to pregnancy, preeclampsia, gestational diabetes, oral contraceptive use and post menopausal hormone therapy

• Race and Ethnicity- African-Americans and Hispanics have increased risks for Stroke. African Americans have nearly 2x the risk for a first time ever stroke as whites.

• Family History- If one of your parents had an ischemic stroke before 65, you are at 3x the risk of having one yourself

• Previous Stroke

• Fibromuscular Dysplasia

• Patent Foramen Ovale

• Transient Ischemic Attack
Remember An Ounce of Prevention
Controllable Risk Factors for Stroke

- High Blood Pressure – # 1 cause of Stroke
- Tobacco Use
- Diabetes
- High Cholesterol
- Physical inactivity and obesity
- Carotid or other artery disease
- Transient ischemic attacks
- Atrial Fibrillation
- Certain blood disorders
- Excessive alcohol intake
- Illegal drug use
Hypertension

- High Blood Pressure is known as the “silent killer”.
- It is the leading cause of stroke and the most significant controllable risk factor.
- People often do not experience any symptoms with hypertension.
- High blood pressure quietly damages blood vessels by damaging the inner lining of the blood vessels, forming atherosclerotic plaque.
- There is no cure for hypertension but lifestyle changes can help to maintain quality of life and reduce the risk of stroke.
- Take medications as prescribed by MD
Health Threats from High Blood Pressure
High Blood Pressure

• Most people who have a first stroke have high blood pressure
• At age 50, people without high blood pressure have a life expectancy 5 years longer than people with high blood pressure.
• Nearly 1 in 6 American adults with high blood pressure don’t know they have it.
• Normal Blood Pressure is below 120/80
Smoking

- Smoking doubles the risk of stroke
- Smoking makes blood clots more likely to form and increases the plaque buildup in your arteries.
- Nicotine causes a short term increase in blood pressure, heart rate and the flow of blood from the heart. It also causes the arteries to narrow.
- Carbon monoxide reduces the amount of oxygen in the blood.
- These substances in the blood create affect the supply and demand for oxygen in the blood
- Artherosclerosis is caused by the toxic elements in cigarette smoke.
## Smoking Post Stroke

<table>
<thead>
<tr>
<th>Catastrophe</th>
<th>Risk of death (%)</th>
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<tbody>
<tr>
<td>Smoking poststroke</td>
<td>9</td>
</tr>
<tr>
<td>Accidental injury</td>
<td>2.7</td>
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<tr>
<td>MVA</td>
<td>1.0</td>
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<tr>
<td>Suicide</td>
<td>0.83</td>
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<tr>
<td>Fall</td>
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<tr>
<td>Earthquake</td>
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<td>Lightning</td>
<td>0.001</td>
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<tr>
<td>Asteroid collision</td>
<td>0.0002</td>
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</tbody>
</table>
High Cholesterol

- High Cholesterol in the arteries can block blood flow to the brain and cause a stroke.
- All ischemic stroke patients have a lipid panel done within 48 hours of arrival to the hospital.
- Patients who have had a stroke are prescribed statin medication.
Overweight and obesity affects 66% of Americans.

Obesity increases the risk of stroke due to inflammation caused by excess fatty tissue which can lead to difficulty in blood flow and decreased blood flow to the brain.

AHA recommends adults get at least 150 minutes of moderate or 75 minutes of vigorous physical activity per week.- 30 minutes, 5 times per week is a reasonable goal.

People who are obese are more likely to have sleep apnea which can cause other stroke risk factors such as hypertension and Atrial Fibrillation.

People who are obese are more likely to develop left ventricular hypertrophy.
Benefits of Physical Activity

• Lose or control your weight
• Reduces your risk for many diseases and cancer
• Strengthens your bones and muscles
• Improves your mental health and mood
• Improve your everyday functioning and prevent falls
• Live longer
Carotid Disease

- Carotid Disease is the thinning of the carotid arteries which are the 2 main blood vessels in the neck that supply blood to the brain. It is usually caused by plaque buildup and can become severe enough to cause a complete blockage of an artery.
- It is often asymptomatic and quite often isn’t identified until the patient has experienced a stroke or a TIA.
Atrial Fibrillation

- Atrial Fibrillation increases the risk of stroke because it keeps the heart from beating effectively. It allows the blood to pool in the atria where blood clots can form and travel to the brain.

- People who have AFib/Flutter who have had a stroke are treated with anticoagulation if they have no contraindication to anticoagulation.

- In some cases, surgery is an option.
Excess Alcohol Consumption

• Alcohol can increase blood pressure, affect blood sugar in people with diabetes, can trigger atrial fibrillation, increase weight, can cause bleeding in the brain due to liver dysfunction which are all stroke risk factors.

• Alcohol can also worsen depression, affect your memory and thinking in patients who have had a stroke.

• Recommendation is no more than 1 drink per day for women and 2 drinks per day for men.
Illegal Drug Use

- Illegal drug use can increase the chances for the following risk factors for stroke:
  - Hypertension
  - Cerebral Vasospasm
  - Vasculitis
  - Embolization (fective endocarditis)
  - Hemostatic hematologic abnormalities
    - Increased blood viscosity, platelet aggregation
  - Intracerebral hemorrhage
Stroke Prevention

• Up to 80% of Strokes can be prevented
• Healthy diet
• Healthy weight
• Physical activity
• No smoking
• Limited alcohol
Stroke Teaching- Required

- Stroke warning signs and symptoms
- Activate EMS as soon as stroke warning signs and symptoms occur
- Personal modifiable risk factors discussed- individualize! ongoing documentation
- Prescribed Medications
- Stroke Follow up
- Documentation of written instructions given to patient/family
Stroke Caregivers

- Organize healthcare needs
- Provide emotional support
- Promote independence
- Provide socialization opportunities for yourself and your survivor
What is Caregiver Burnout?

• Caregiver burnout is mental, physical and emotional exhaustion that may be accompanied by a change in attitude—from positive and caring to negative and unconcerned.

• It can occur when caregivers don’t get the help they need or if they try to do more than they are able.
Social Support and Cognitive Function

- Emotional support helps to promote cognitive resilience
- Social ties provide cognitive reserve that protects against impaired cognition after stroke.
Symptoms of Caregiver Fatigue

- Withdrawal from friends and family
- Loss of interest in activities previously enjoyed
- Feeling blue, irritable, hopeless and helpless
- Changes in appetite, weight or both
- Changes in sleep patterns
- Getting sick more often
- Feelings of wanting to hurt yourself or the person for whom you are caring
Thank you!