

## STROKE TREATMENT, PREVENTION, & RECOVERY

### VALIR STROKE SURVIVORS & CAREGIVERS

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### HEART ATTACK & STROKE

#### Common, Deadly, Disabling

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- Leading causes of death in the U.S.:
  - Heart disease
  - Cancer
  - Lung disease
  - Accidents
  - Stroke
- Stroke is a leading cause of disability
- Oklahoma consistently ranks among top 10 states for deaths due to heart disease & stroke

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### HEART ATTACK & STROKE

#### Definitions

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- **Heart attack**
  - Sudden blockage of an artery surrounding the heart (coronary artery) with death of a section of heart muscle (myocardial infarction)
- **Stroke**
  - Sudden brain dysfunction due to artery problem
  - Mostly due to sudden blockage of an artery in the brain (cerebral artery) with death of a section of the brain (cerebral infarction or ischemic stroke)
  - Occasionally due to sudden bursting of an artery in the brain (hemorrhagic stroke)

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### STROKE DEFINITION & 3 TYPES

#### Stroke = Sudden Brain Dysfunction Due to Artery Problem

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Ischemic Stroke 85%		<ul style="list-style-type: none"> <li>• <b>Ischemic stroke (85%)</b> <ul style="list-style-type: none"> <li>– Due to low blood flow (usually blockage) in a cerebral artery with death of a section of the brain (= <b>cerebral infarction</b>)</li> </ul> </li> </ul>
Intracerebral Hemorrhage 10%		<ul style="list-style-type: none"> <li>• <b>Intracerebral hemorrhage (10%)</b> <ul style="list-style-type: none"> <li>– Due to bursting of an artery <u>within</u> the brain (cerebrum)</li> </ul> </li> </ul>
Subarachnoid Hemorrhage 5%		<ul style="list-style-type: none"> <li>• <b>Subarachnoid hemorrhage (5%)</b> <ul style="list-style-type: none"> <li>– Due to bursting of an artery <u>around</u> the brain (in subarachnoid space)</li> </ul> </li> </ul>

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### ISCHEMIC STROKE

#### Sudden Blockage of Artery in the Brain

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Infarction

Thromboembolus

Ischemia means low blood flow.  
Infarction means dead tissue.

- Usually due to **thromboembolus**
  - Thrombus = blood clot
  - Embolus = floating plug
  - Blood clot forms in vascular system (arteries or heart), travels downstream, plugs a brain artery
- Blood clots form for 1 of 2 reasons:
  - **Platelets (Velcro)** – stick to bumpy pipes
  - **Clotting factors (Jello)** – clump when blood stagnant
- Blood clots come from 1 of 3 locations:
  - Artery – esp. hardening of artery wall (atherosclerosis)
  - Heart – esp. irregular heart rhythm (atrial fibrillation)
  - Blood – blood too sticky (hypercoagulable state)

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### ISCHEMIC STROKE & TIA

#### Same Process, Different Outcome

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- **Acute ischemic stroke (AIS) = cerebral infarction**
  - Clot did not dissolve in time, resulting in infarction (dead tissue) and, usually, permanent deficit
- **Transient ischemic attack (TIA)**
  - Clot dissolved in time spontaneously with NO infarction and NO permanent deficit
  - Signals that patient is at risk for ischemic stroke in the near future—next time, the clot may not dissolve in time

Both are emergencies!

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### INTRACEREBRAL HEMORRHAGE (ICH)

**Sudden Rupture of Artery into the Brain**



**OUTER BRAIN**  
NOT due to hypertension

**INNER BRAIN ICH**

- Usually due to **chronic hypertension** (long-term high blood pressure) with resultant damage to small arteries in the **inner brain**
- Most common cause of ICH

**OUTER BRAIN ICH**


- Usually NOT due to high blood pressure
- Since lobes of the brain are on the outside, often called **lobar hemorrhage**
- Possible causes include:
  - Tumor
  - Abnormal brain vessels
  - Bleeding disorder

**INNER BRAIN**  
Likely due to **CHRONIC hypertension**

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### SUBARACHNOID HEMORRHAGE (SAH)

**Sudden Rupture of Artery around the Brain**



- **Berry aneurysm** rupture is most common cause of nontraumatic subarachnoid hemorrhage (SAH)
  - Berry aneurysm = weak outpouching in wall of artery in the skull
- Nontraumatic SAH requires emergency treatment (clip or coil aneurysm) & intensive care unit (ICU) management
- Death rate 50%, disability rate 25%

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### STROKE SYMPTOMS

**How You Know You're Having a Stroke**

**6 most common stroke symptoms**

- Sudden **weakness** on 1 side of the body
- Sudden **numbness** on 1 side of the body
- Sudden **inability to speak or understand speech**
- Sudden **difficulty seeing** in 1 or both eyes
- Sudden **"dizziness,"** esp. with other symptom
- Sudden **unusual headache**

*Ischemic stroke can cause the first 5  
Intracerebral hemorrhage can cause all 6  
Subarachnoid hemorrhage causes the last (sudden, severe headache)*

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### STROKE SYMPTOMS? CALL 911!

- If you or someone you know has any stroke symptom, call 911 immediately!
- Even if you live across the street from a hospital, call 911!
- Your goal is not to get to the hospital faster, it's to get treated faster
- Calling 911 results in faster treatment in the hospital

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### ACUTE ISCHEMIC STROKE

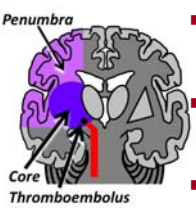
**Goals of Therapy**

- Dissolve clot (**thrombolysis**) with medicine or remove clot (**thrombectomy**) with a catheter in order to re-establish blood flow to (**reperfuse**) the brain
- Prevent pneumonia & other complications
- Find source of clot: artery, heart, or blood
- Give medicines to decrease future stroke risk
  - For artery health – keep pipes clean & less sticky
  - For blood thinning – prevent blood clots
- In select patients, open carotid artery narrowing
- Provide rehabilitation

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### ISCHEMIC STROKE IN THE FIRST FEW HOURS

**"Time Is Brain: Save the Penumbra"**



**Penumbra**

**Core Thromboembolus**

**pen (paene) = almost  
umbra = shadow**

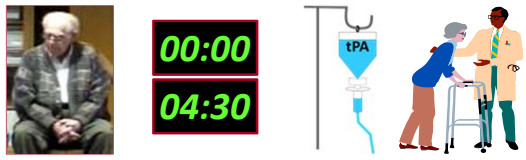
- **Penumbra** is zone of **reversible ischemia** (low blood flow) around **core** of irreversible infarction (dead tissue) during **first hours to day** after ischemic stroke onset
- **Intravenous tPA (tissue plasminogen activator)** given within first 4.5 hours, may break blood clot, save penumbra neurons, improve outcome—but may cause dangerous bleeding if given later
- **Mechanical thrombectomy**—removing certain large clots—in addition to tPA within 6 hours of onset or instead of tPA 6-24 hours after onset—may save penumbra neurons, improve outcome

*TPA opens up arteries just like Drano opens up clogged water pipes—but large, stubborn blockages may require physical removal (thrombectomy)*

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### ACUTE ISCHEMIC STROKE THERAPY

#### Thrombolysis (IV tPA) in First 4.5 Hours



**Patient** of any age

Last known well within 4.5 h

Administer IV tPA

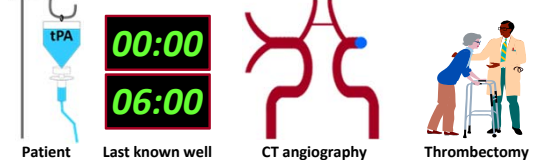
Thrombolysis decreases disability risk

*Goal is to reperfuse penumbra*

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### ACUTE ISCHEMIC STROKE THERAPY

#### Thrombectomy (Catheter) in First 6 Hours



Patient already received IV tPA

Last known well within 6 h

CT angiography shows MCA blockage

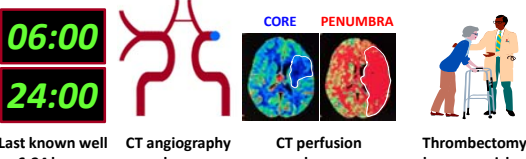
Thrombectomy decreases risk of death & disability

*Goal is to reperfuse penumbra in patients with large clots blocking middle cerebral artery (MCA)—which are often resistant to IV tPA alone*

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### ACUTE ISCHEMIC STROKE THERAPY

#### Thrombectomy (Catheter) in Hours 6-24



Last known well 6-24 h ago

CT angiography shows MCA blockage

CT perfusion shows small core & big penumbra

Thrombectomy decreases risk of death & disability

*Goal is to reperfuse penumbra in patients with large clots blocking middle cerebral artery (MCA) who arrive too late to receive IV tPA & also have evidence of salvageable penumbra*

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### ISCHEMIC STROKE IN THE HOSPITAL

#### Tests to Find the Source of the Clot

- **Brain** – visualize stroke
  - CT scan of the brain
  - MRI scan of the brain (can distinguish new vs. old strokes)
- **Arteries** – visualize artery narrowings
  - Carotid duplex ultrasound
  - Angiography (CT, MR, catheter)
- **Heart** – visualize heart rhythm & chambers
  - Electrocardiography (heart rhythm tracing = ECG)
  - Echocardiography (heart ultrasound)
    - Transthoracic – outside the chest, views front of heart
    - Transesophageal – down the throat, views back of heart
- **Blood** – determine if blood is too sticky
  - Hypercoagulable profile (special blood tests)

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### STROKE & HEART ATTACK (VASCULAR)

#### Risk Factors

- **Vascular risk factors** are conditions that increase the chances of having a stroke or heart attack
- **Risk factors are not causes:** they do not, themselves, cause arterial blockage or bursting—they cause diseased arteries, making the arteries prone to blockage or bursting
- **A combination of the following 5 risk factors accounts for ~ 95% of all heart attacks and ~ 75% of all strokes**
  - Advanced age
  - Hypertension
  - Hyperlipidemia
  - Diabetes mellitus
  - Cigarette smoking

} Focus of primary prevention strategies—damage arteries if present for *many years*

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### VASCULAR RISK FACTORS

#### How You Know You Have Them

- **High blood pressure** (= hypertension)
  - Take your blood pressure (BP higher than 130/80)
  - Does NOT cause headache or any other symptom
- **Diabetes mellitus**
  - Blood test (hemoglobin A1C over 6.5)
  - When advanced, causes excessive thirst & urination
- **High cholesterol** (= hypercholesterolemia)
  - Blood test (lousy/LDL cholesterol over 100)
- **Cigarette smoking** – Look at your hand
- **Advanced age** – Look in the mirror

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**ANOTHER LAYER OF VASCULAR RISK FACTORS**  
*Risk Factors for the Risk Factors*

RISK FACTOR	CONSEQUENCE(S)
Physical inactivity	↑ weight, ↑ blood pressure, diabetes, ↓ healthy cholesterol (HDL)
Poor diet	↑ weight, ↑ blood pressure, diabetes, ↑ lousy cholesterol (LDL)
Excessive alcohol	↑ weight, ↑ blood pressure, ↓ healthy cholesterol (HDL)
Poor sleep (↓ or ↑)	↑ weight
↑ weight	↑ blood pressure, diabetes, sleep apnea
Sleep apnea	↑ blood pressure, snoring, ↑ daytime sleepiness

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**PRIMARY STROKE PREVENTION**  
*How to Prevent Having One in the First Place*

VASCULAR RISK FACTORS	LIFESTYLE
<ul style="list-style-type: none"> <li>■ Hypertension</li> <li>■ Hyperlipidemia</li> <li>■ Diabetes mellitus</li> <li>■ Atrial fibrillation/flutter</li> </ul>	<ul style="list-style-type: none"> <li>■ Cigarettes</li> <li>■ Weight</li> <li>■ Exercise</li> <li>■ Sleep</li> <li>■ Diet</li> </ul>

*These risk factors don't cause symptoms & can only be discovered by seeing a health professional, & usually require medical treatment.*

*Patients often need guidance managing these risk factors and don't realize that sleep habits can affect stroke risk.*

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**PRIMARY STROKE PREVENTION**  
*Vascular Risk Factor Modification*

*"Check under your hood while you still feel good"*

- **High blood pressure**
  - Take medication to maintain BP < 130/80 (or, better, < 120/80)
- **High cholesterol**
  - Take medication (especially a statin) to keep lousy cholesterol (LDL) in range
- **Diabetes mellitus**
  - Take statin to keep lousy cholesterol (LDL) in range
  - Take specific kind of BP medication to keep BP < 130/80
  - Maintain hemoglobin A1C < 7.0
- **Atrial fibrillation or flutter (types of irregular heart rhythm)**
  - Take anti-Jello blood thinner (anticoagulant)

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**PRIMARY STROKE PREVENTION**  
*Lifestyle Modification*

- **Cigarettes** – Do NOT smoke; quit with assistance (Oklahoma Tobacco Helpline 1-800-QUIT-NOW +/- medications)
- **Weight** – maintain BMI (body mass index) < 25 kg/m<sup>2</sup>
- **Exercise** – brisk walk 15-30 minutes per day
- **Sleep** – 7-8 hours each night, CPAP if sleep apnea
- **Diet** – limit some foods, increase others
  - **Limit:** salt, simple carbs, bad fats/red meat, alcohol
  - **Increase:** fiber, good fat (olive, canola, sunflower, nut oil), good protein (lean meat, nuts, beans), fruit, vegetables

*Suggested diets include:*

*Mediterranean – high-plant (nuts, beans, fruits, olives, etc.), lean meat (non-fried fish, etc.)*  
*DASH – Dietary Approaches to Stop Hypertension (low-salt, high-plant, etc.)*  
*MIND – Mediterranean-DASH Intervention for Neurodegenerative Delay*

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**SECONDARY STROKE PREVENTION**  
*How to Prevent Having Another Stroke*

- **Vascular risk factor modification** – same as primary prevention
- **Blood thinner** – based on artery, heart, blood tests, take either:
  - Anti-Velcro (antiplatelet) medication
    - Aspirin or clopidogrel (Plavix)
  - Anti-Jello (anticoagulant) medication
    - Warfarin, apixaban (Eliquis), rivaroxaban (Xarelto), or dabigatran (Pradaxa)
- **Possible carotid artery procedure** – if severe narrowing of carotid artery in the neck caused the stroke, undergo either:
  - Carotid endarterectomy (surgery) with aspirin
  - Carotid angioplasty (balloon catheter) & stent with aspirin & clopidogrel

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**STROKE RECOVERY**

- After a stroke, new brain cells (neurons) form and grow around the stroke-damaged area
- This process takes weeks to months—and sometimes years—resulting in slow recovery
- These new neurons are less resilient than the neurons you're born with
- **Fatigue, fever, infections, alcohol, sedating medications, etc.** →
  - *Make the new (weaker) neurons function poorly before they affect the old (stronger) neurons* →
  - *Resulting in temporary worsening of the old deficit (weakness, aphasia, etc.) that may mimic a new stroke*

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## RECURRENT SIMILAR SPELLS

### *Are NEVER due to TIAs*

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- No one has the same stroke or TIA over and over
- If you have repeat spells that are always the same, one of three things is happening:
  - **Old stroke temporarily “reactivated”:** You had a stroke the first time and then had worsening of the same symptoms because of a fever, sedating medication, etc.; your MRI scan only shows the old stroke—no new stroke
  - **Seizures from old stroke:** You had a stroke the first time and then had “partial” seizures caused by the old stroke; your MRI only shows the old stroke—no new stroke
  - **Migraine aura:** You’re having migraine auras that mimic stroke and you never actually had a stroke; your MRI scans are always normal—no new or old stroke

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# THE END

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