

## 11. STROKE

**!! JAY AMBE !!**

## 11. STROKE

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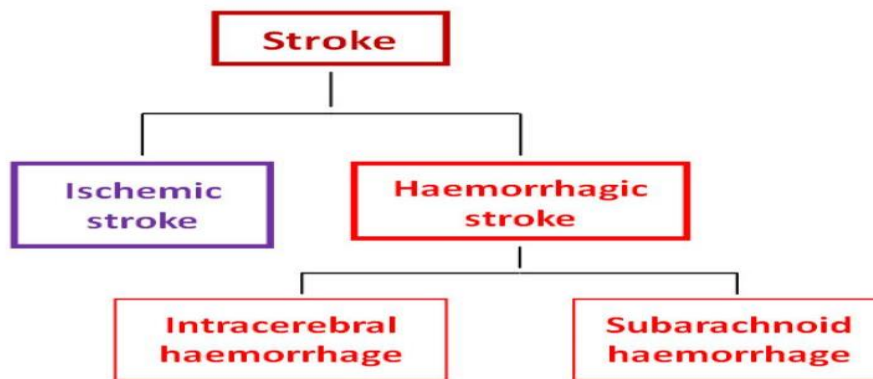
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### WHAT IS A STROKE?

- The sudden death of brain cells due to lack of oxygen, caused by blockage of blood flow or rupture of an artery to the brain.
- This effect produce brain damage, long-term disability, or even death.
- A stroke is a medical emergency, and prompt treatment is crucial. Early action can reduce brain damage and other complications.
- According to the Centres for Disease Control and Prevention (CDC), stroke is the fifth-leading cause of death in the United States.
- A stroke also is called a cerebrovascular accident, CVA, or "brain attack."

### TYPES OF STROKE

There are three main types of stroke:



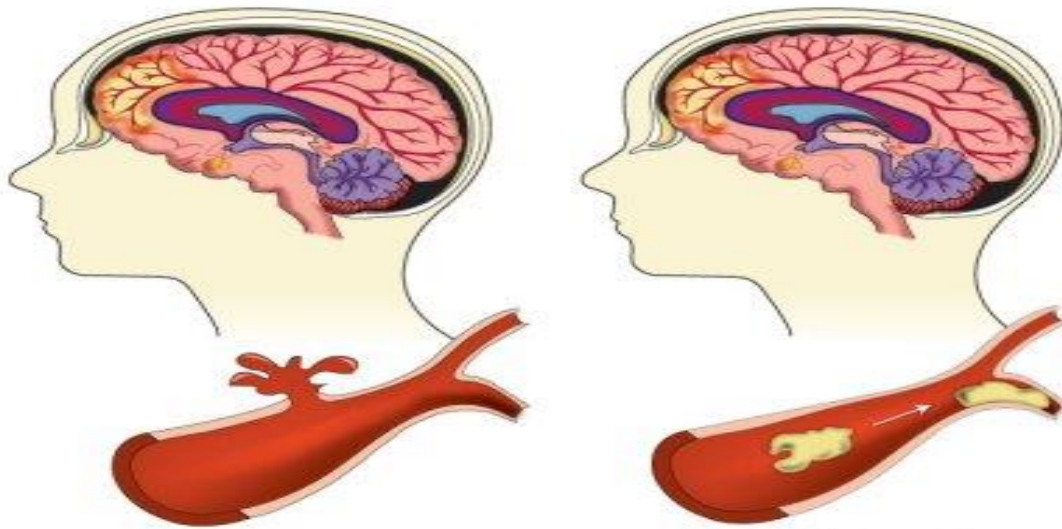
#### **Ischemic stroke:**

- This is the most common type of stroke, making up 85% of all cases.
- A blood clot prevents blood and oxygen from reaching an area of the brain.
- Ischemic stroke is caused by arterial embolism and in situ small vessel diseases.
- Embolism in brain results in oxygen and glucose deprivation, leading to brain damage and neurologic deficit. The cellular and molecular mechanisms underlying ischemic stroke-induced brain damage have been extensively investigated.
- Excitotoxicity, oxidative stress, and inflammation have been considered as major contributors to ischemic neuronal injury.

#### **Hemorrhagic stroke:**

- This occurs when a blood vessel ruptures.
- Hemorrhagic stroke (15%) that may result from intracerebral hemorrhage and subarachnoid hemorrhage

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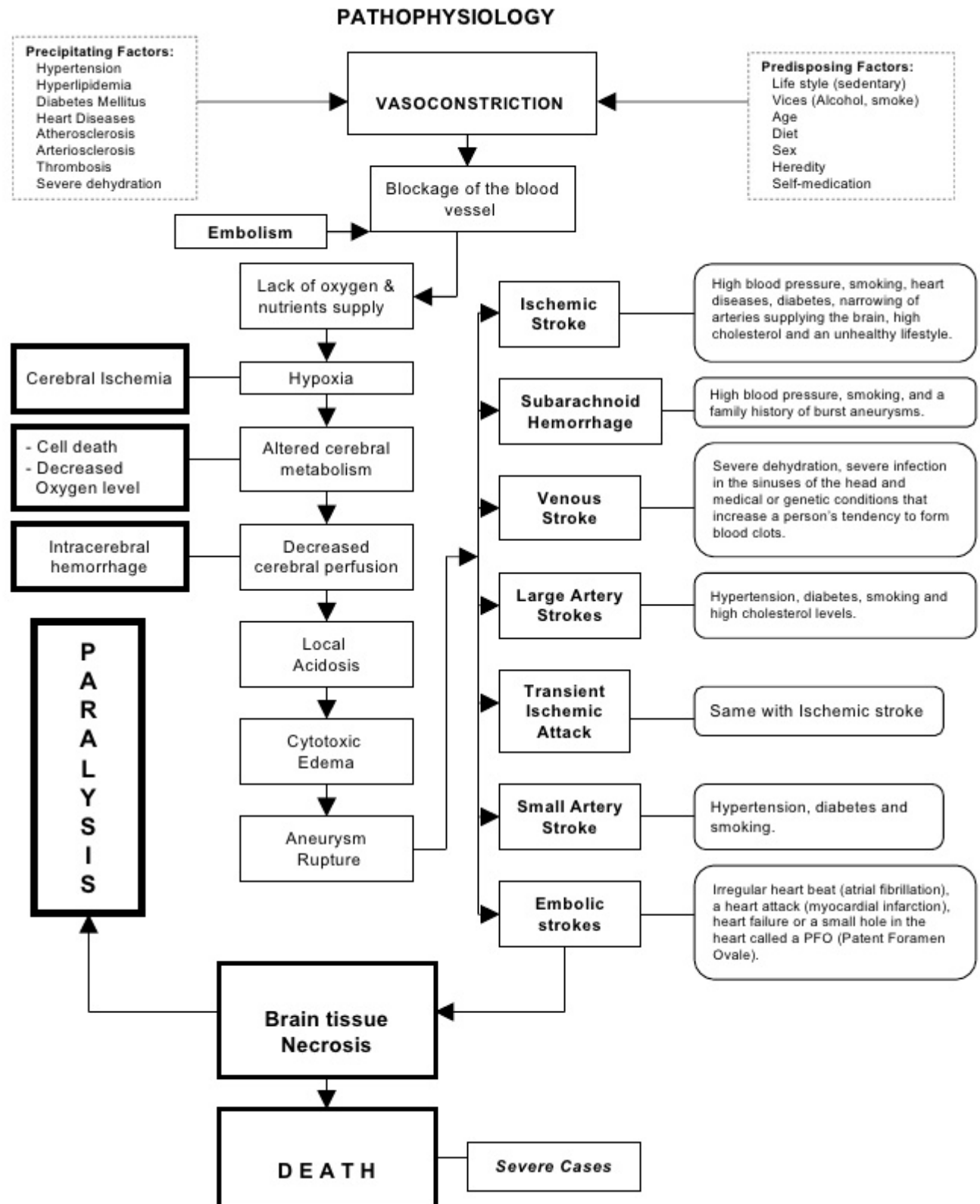
A hemorrhagic stroke occurs when a blood vessel bursts within the brain.

An ischemic stroke occurs when a blood clot blocks the blood flow in an artery within the brain.

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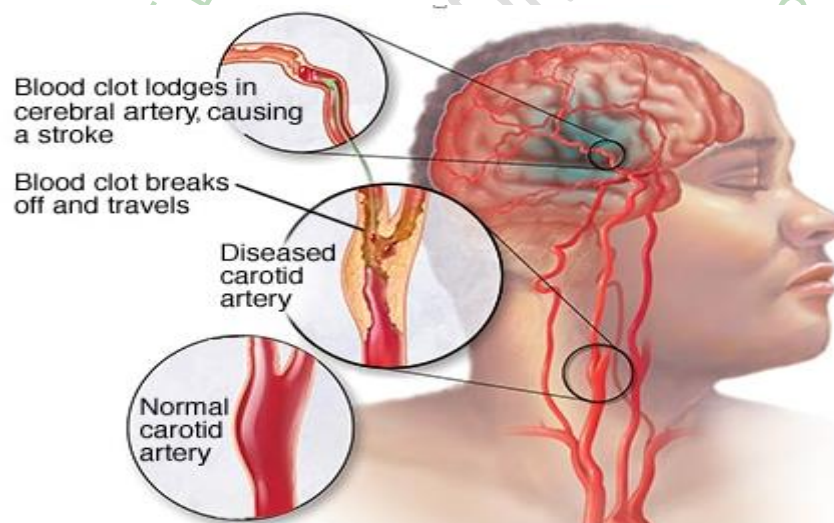
### COMMON PATHOPHYSIOLOGY OF STROKE



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### 1. ISCHEMIC STROKE

- This is the most common type of stroke.
- It happens when the brain's blood vessels become narrowed or blocked, causing severely reduced blood flow (ischemia).
- Blocked or narrowed blood vessels are caused by fatty deposits that build up in blood vessels or by blood clots or other debris that travel through your bloodstream and lodge in the blood vessels in your brain.
- An ischemic stroke occurs when an artery in the brain becomes blocked.
- The brain depends on its arteries to bring fresh blood from the heart and lungs.
- The blood carries oxygen and nutrients to the brain, and takes away carbon dioxide and cellular waste.
- If an artery is blocked, the brain cells (neurons) cannot make enough energy and will eventually stop working.
- If the artery remains blocked for more than a few minutes, the brain cells may die.
- This is why immediate medical treatment is critical.



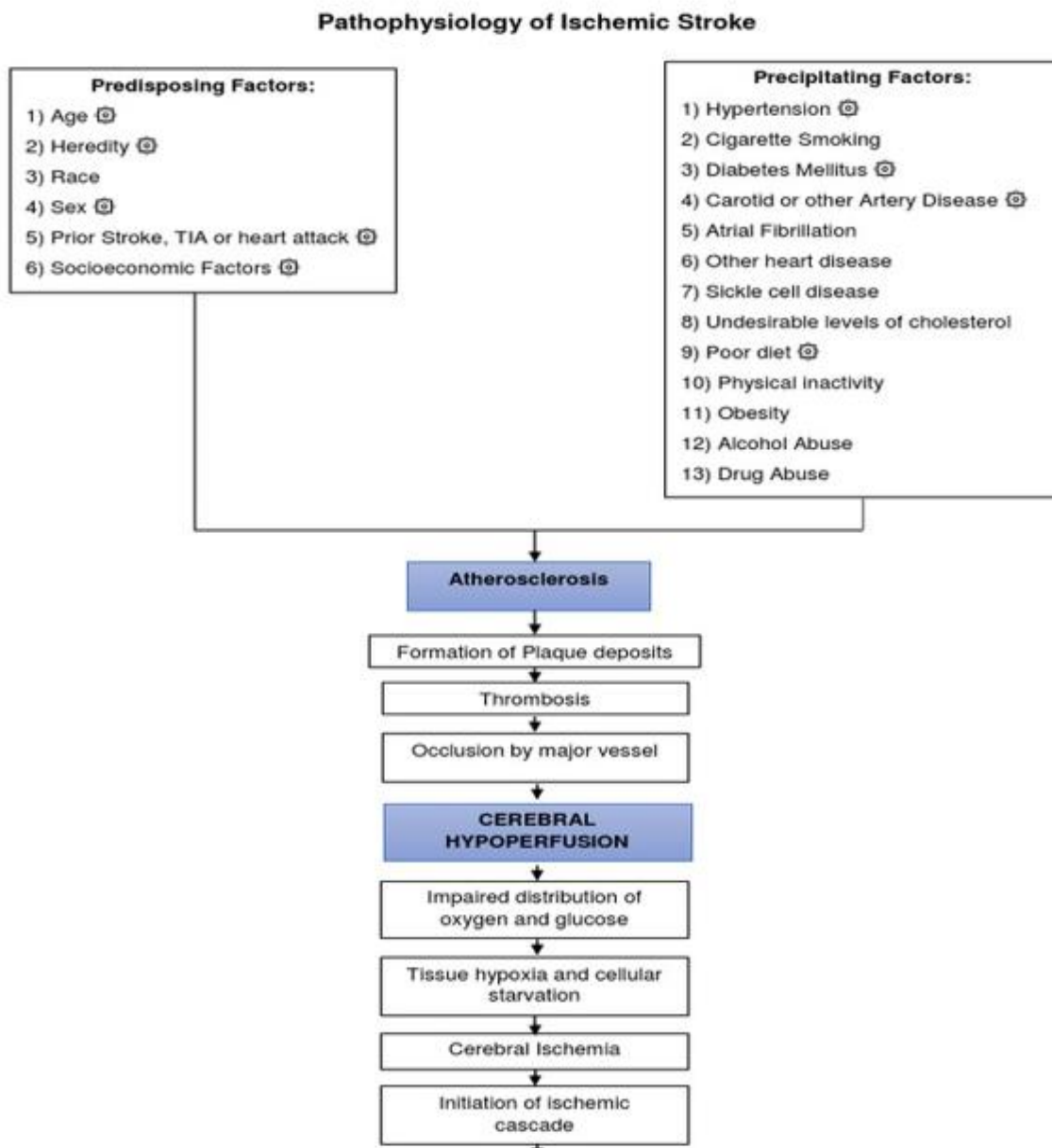
### CAUSES

- Ischemic stroke can be caused by several different kinds of diseases. The most common problem is narrowing of the arteries in the neck or head.
- This is most often caused by atherosclerosis, or gradual cholesterol deposition. If the arteries become too narrow, blood cells may collect and form blood clots.
- These blood clots can block the artery where they are formed (thrombosis), or can dislodge and become trapped in arteries closer to the brain (embolism).

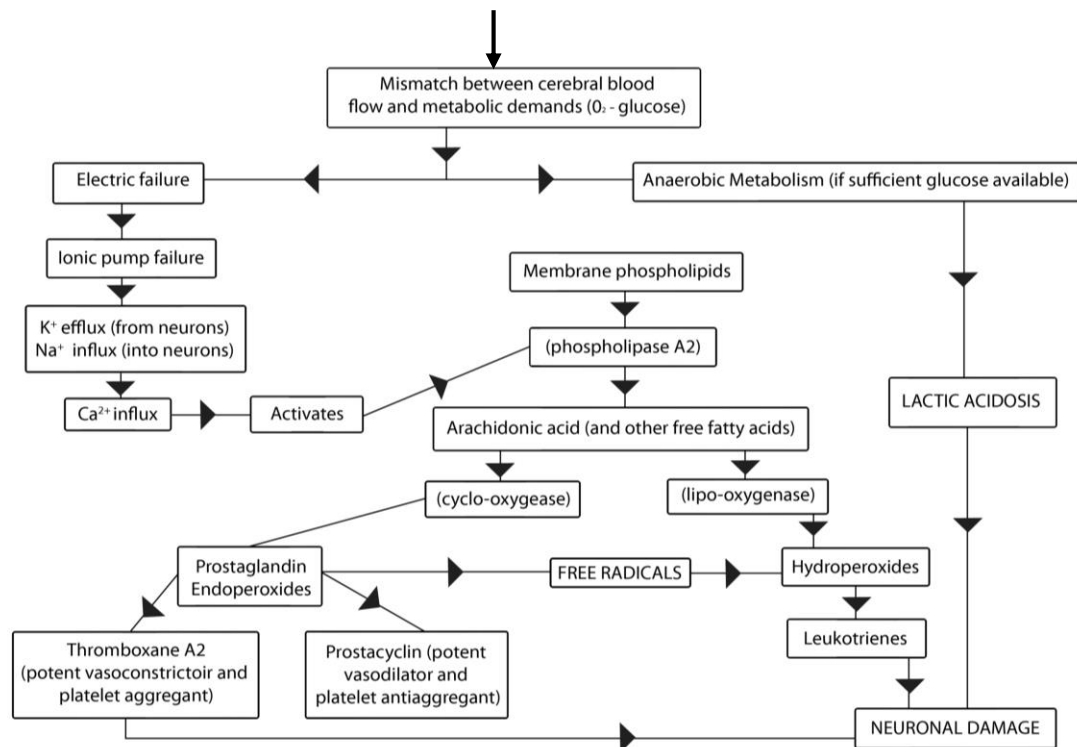
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- Another cause of stroke is blood clots in the heart, which can occur as a result of irregular heartbeat (for example, atrial fibrillation), heart attack, or abnormalities of the heart valves.
- While these are the most common causes of ischemic stroke, there are many other possible causes.
- Examples include use of street drugs, traumatic injury to the blood vessels of the neck, or disorders of blood clotting.

### PATHOPHYSIOLOGY OF ISCHEMIC STROKE



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### TYPES OF ISCHEMIC STROKE?

Ischemic stroke can be divided into two main types:

1. Thrombotic stroke
2. Embolic stroke

#### Thrombotic stroke

- ❖ A thrombotic stroke occurs when diseased or damaged cerebral arteries become blocked by the formation of a blood clot within the brain.
- ❖ Clinically referred to as cerebral thrombosis or cerebral infarction, this type of event is responsible for almost 50 percent of all strokes.
- ❖ Cerebral thrombosis can also be divided into an additional two categories that correlate to the location of the blockage within the brain:
  - a) Large-vessel thrombosis and
  - b) Small-vessel thrombosis.
- ❖ Large-vessel thrombosis is the term used when the blockage is in one of the brain's larger blood-supplying arteries such as the carotid or middle cerebral.
- ❖ While small-vessel thrombosis involves one (or more) of the brain's smaller, yet deeper, penetrating arteries. This latter type of stroke is also called a lacunar stroke.

#### Embolic stroke

- ❖ An embolic stroke is also caused by a clot within an artery, but in this case the clot (or emboli) forms somewhere other than in the brain itself.



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- ❖ Often from the heart, these emboli will travel in the bloodstream until they become lodged and cannot travel any farther.
- ❖ This naturally restricts the flow of blood to the brain and results in near-immediate physical and neurological deficits.

**\*\*Some initial research shows that COVID-19 infection may be a possible cause of ischemic stroke, but more study is needed.**

### **SYMPTOMS**

Specific symptoms of an ischemic stroke depend on what region of the brain is affected. Vision problems, such as blindness in one eye or double vision

- Weakness or paralysis in your limbs, which may be on one or both sides
- Dizziness and vertigo
- Confusion
- Loss of coordination
- Drooping of face on one side

### **DIAGNOSIS**

- ❖ A doctor can usually use a physical exam and family history to diagnose ischemic stroke. Based on symptoms, they can also get an idea of where the blockage is located.
- ❖ If person have symptoms such as confusion and slurred speech, doctor might perform a blood sugar test. That's because confusion and slurred speech are also symptoms of severe low blood sugar.
- ❖ A cranial CT scan can also help distinguish ischemic stroke from other issues that cause brain tissue death, such as a hemorrhage or a brain tumor.
- ❖ Once doctor has diagnosed ischemic stroke, they'll try to figure out when it started and what the root cause is.
- ❖ An MRI is the best way determine when the ischemic stroke started.
- ❖ Tests used to determine a root cause might include:
  - ✓ An electrocardiogram (ECG or EKG) to test for abnormal heart rhythms
  - ✓ Echocardiography to check your heart for clots or abnormalities
  - ✓ An angiography to see which arteries are blocked and how severe the blockage is
  - ✓ Blood tests for cholesterol and clotting problems

### **TREATMENT OF ISHEMIC STROKE**

The treatment for ischemic stroke is clot removal.



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### Medication Treatment with Alteplase IV r-tPA

- ❖ Considered the gold standard, **tissue plasminogen activator – r-tPA** (otherwise known as alteplase) is approved by the Food and Drug Administration to treat ischemic stroke, which is caused when a vessel supplying blood to the brain is blocked.
- ❖ Doctors administer Alteplase IV r-tPA through an IV in the arm, dissolving the clot and improving blood flow to the part of the brain being deprived.

### Mechanical Treatment to Remove the Clot

- ❖ An endovascular procedure or a mechanical thrombectomy is a strongly recommended option to remove a clot in eligible patients with a large vessel occlusion or LVO.
- ❖ In this procedure, doctors use a wire-cage device called a stent retriever. They thread a catheter through an artery in the groin up to the blocked artery in the brain. The stent opens and grabs the clot. Special suction tubes may also remove the clot.
- ❖ The procedure:
  - ✓ Should be done within six hours of onset of acute stroke symptoms.
  - ✓ Can benefit patients under certain conditions if done even within 24 hours of onset.
  - ✓ Should include Alteplase IV r-tPA treatment in eligible patients

## 2. HEMORRHAGIC STROKE

- ❖ A hemorrhagic stroke is when blood from an artery begins bleeding into the brain.
- ❖ This happens when a weakened blood vessel bursts and bleeds into the surrounding brain.
- ❖ Pressure from the leaked blood damages brain cells, and, as a result, the damaged area is unable to function properly.

### TYPES OF HEMORRHAGIC STROKE:

- a) **Intracerebral hemorrhage:** The bleeding occurs inside of the brain. This is the most common type of hemorrhagic stroke.
- b) **Subarachnoid hemorrhage:** The bleeding occurs between the brain and the membranes that cover it.

### RISK FACTORS RELATED TO HEMORRHAGIC STROKE INCLUDE:

- ❖ Uncontrolled high blood pressure
- ❖ Overtreatment with blood thinners (anticoagulants)
- ❖ Bulges at weak spots in your blood vessel walls (aneurysms- an excessive localized swelling of the wall of an artery.)

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- ❖ Trauma (such as a car accident)
- ❖ Protein deposits in blood vessel walls that lead to weakness in the vessel wall (cerebral amyloid angiopathy)
- ❖ Cerebral cavernous malfunctions – when blood vessels do not form correctly in the brain.
- ❖ Ischemic stroke leading to hemorrhage
- ❖ A less common cause of bleeding in the brain is the rupture of an abnormal tangle of thin-walled blood vessels (arteriovenous malformation).

### **SYMPTOMS OF A HEMORRHAGIC STROKE CAN VARY, BUT COMMON SIGNS**

#### **INCLUDE:**

- ❖ Sudden severe headache
- ❖ Vision changes
- ❖ Loss of balance or coordination
- ❖ Becoming unable to move
- ❖ Numbness in an arm or leg
- ❖ Seizures
- ❖ Loss of speech or difficulty understanding speech
- ❖ Confusion or loss of alertness

#### **DIAGNOSIS**

- ❖ During the physical exam, a doctor will look for visible signs and symptoms.
- ❖ They will check a person's mental alertness, coordination, and balance. Numbness or weakness in the face, confusion, and trouble talking, are other signs doctors will look for.
- ❖ As there are several different types of stroke, imaging tests must be done to find out if there is bleeding inside the brain. For hemorrhagic strokes, computed tomography (CT) scans are often the fastest and one of the most useful tests.
- ❖ Other tests include:
  - ✓ magnetic resonance imaging (MRI)
  - ✓ blood tests
  - ✓ MRI angiography, where dye is injected into the brain
- ❖ An electroencephalogram (EEG) or lumbar puncture (spinal tap) can be done to confirm the diagnosis of a hemorrhagic stroke.

#### **TREATMENT**

- ❖ Acute treatments for hemorrhagic stroke focus on stopping the bleeding. The first step is to find the cause of bleeding in the brain.

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- ❖ The next step is to control it:
  - ✓ If high blood pressure is the cause of bleeding, person may be given blood pressure medicines.
  - ✓ If an aneurysm is the cause, may need aneurysm clipping or coil embolization. These are surgeries to prevent further leaking of blood from the aneurysm. It also can help prevent the aneurysm from bursting again.
  - ✓ If an arteriovenous malformation (AVM) is the cause of a stroke, may need an AVM repair. An AVM is a tangle of faulty arteries and veins that can rupture within the brain. An AVM repair may be done through
    - ✓ Surgery
    - ✓ Injecting a substance into the blood vessels of the AVM to block blood flow
    - ✓ Radiation to shrink the blood vessels of the AVM
- ❖ Stroke rehabilitation can help relearn skills lost by person because of the damage. The goal is to help become as independent as possible and to have the best possible quality of life.

### TRANSIENT ISCHEMIC ATTACK (TIA)

A transient ischemic attack (TIA) is a stroke that lasts only a few minutes.

- ❖ It happens when the blood supply to part of the brain is briefly blocked.
- ❖ Symptoms of a TIA are like other stroke symptoms, but do not last as long.
- ❖ They happen suddenly, and include
  - ✓ Numbness or weakness, especially on one side of the body
  - ✓ Confusion or trouble speaking or understanding speech
  - ✓ Trouble seeing in one or both eyes
  - ✓ Difficulty walking
  - ✓ Dizziness
  - ✓ Loss of balance or coordination
- ❖ Most symptoms of a TIA disappear within an hour, although they may last for up to 24 hours.
- ❖ TIAs are often a warning sign for future strokes. Taking medicine, such as blood thinners, may reduce risk of a stroke.

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### WHY IS A TIA AN EMERGENCY?

- ❖ It is not safe to assume don't need urgent medical care. In fact, person should call 108 right away.
- ❖ The warning signs for a TIA are the same as a stroke and sudden onset of the following:
  - ✓ Weakness, numbness or paralysis on one side of your body
  - ✓ Slurred speech or difficulty understanding others
  - ✓ Blindness in one or both eyes
  - ✓ Dizziness
  - ✓ Severe headache with no apparent cause
- ❖ Educate people on the warning signs of stroke — and do it F.A.S.T.
  - ✓ F – Face drooping
  - ✓ A – Arm weakness
  - ✓ S – Speech slurred
  - ✓ T – Time to call 108
- ❖ A TIA can signal a future stroke. Take the warning seriously and don't delay.

### TREATMENT

Several treatment options are available. Ministrokes don't cause lasting brain tissue damage or disabilities, but they can be an early warning sign of a stroke. Treatment for ministrokes focuses on starting or adjusting medications that improve blood flow to the brain.

It also requires identifying abnormalities that your doctor can fix to reduce your risk of future ministrokes or strokes.

Treatment options include drugs, medical procedures, and lifestyle changes.

#### ❖ **Antiplatelet drugs**

Antiplatelet drugs make your platelets less likely to stick together to prevent blood clots. These medications include:

- ✓ Aspirin
- ✓ Clopidogrel (plavix)
- ✓ Prasugrel (effient)
- ✓ Aspirin-dipyridamole (aggrenox)

#### ❖ **Anticoagulants**

These medications prevent blood clots by targeting proteins that cause clotting, rather than targeting the platelets. This category includes:

- ✓ warfarin (Coumadin)

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- ✓ rivaroxaban (Xarelto)
- ✓ apixaban (Eliquis)

### ❖ Minimally invasive carotid intervention

- ✓ This is a surgical procedure that involves accessing the carotid arteries with a catheter.
- ✓ The catheter is inserted through the femoral artery in groin.
- ✓ The doctor uses a balloonlike device to open up clogged arteries. They'll place a stent or small wire tube inside the artery at the point of narrowing to improve blood flow to the brain.

### ❖ Surgery

- ✓ May need surgery to prevent future strokes. If have a severe narrowing of the carotid artery in neck and aren't a candidate for a carotid angioplasty and stenting, doctor may recommend a surgery called a carotid endarterectomy.