

# CNS pathology

## Third year medical students 2019

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Lecture 6: stroke

# ILOS

1. Define stroke
2. Know differences between hemorrhagic and non-hemorrhagic stroke
3. Understand the morphologic changes of stroke types
4. Have an idea about clinical presentation of stroke
5. Apply the above knowledge in clinical scenarios

# Cerebrovascular diseases = CVA= stroke

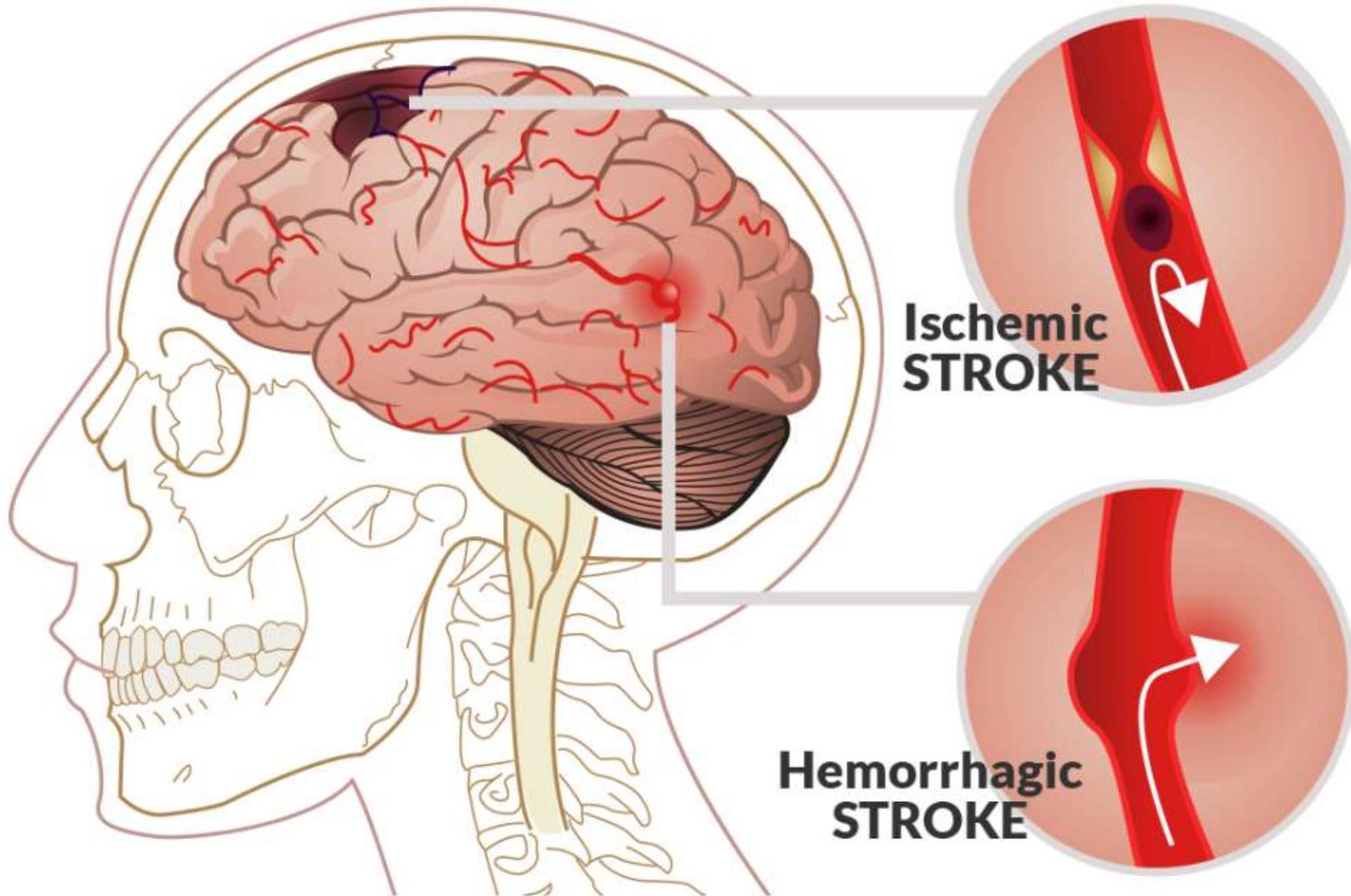
- CVA is a major cause of death .
- CVA is the most common cause of neurologic morbidity.
- mechanisms: **thrombi**  
**emboli**  
**vascular rupture**
- stroke**: clinical term applies to all three when symptoms are acute.

# Definition

- Stroke: rapidly developing symptoms and signs of loss of focal CNS function lasting for 24 hours or leading to death.
- So: symptoms develop quickly (within seconds or minutes) but they persist for at least 24 hours.
- if the symptoms last for less than 24 hours, it is called: transient ischemic attack.

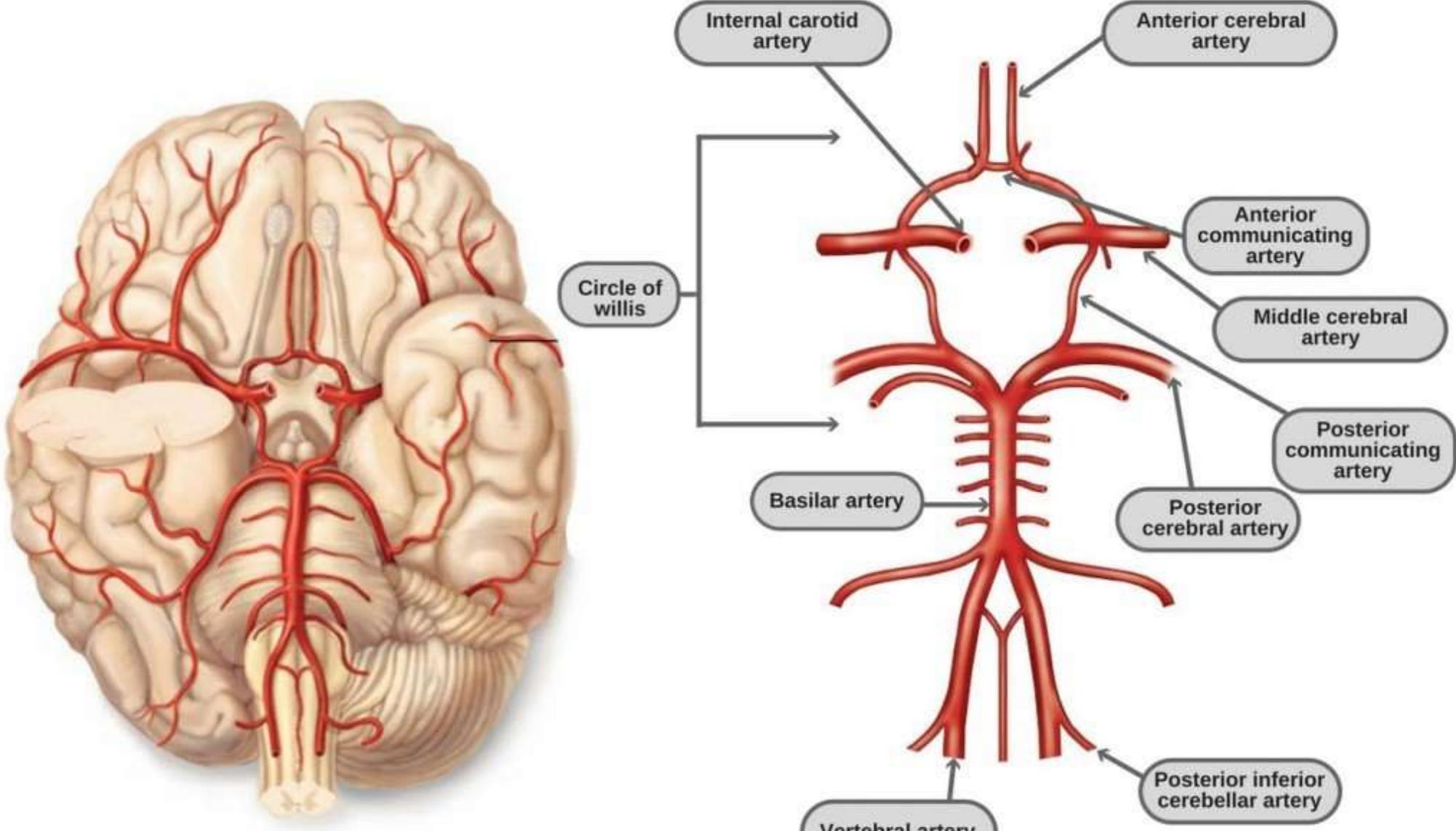
# Types of stroke

- THERE ARE TWO TYPES OF STROKE:
- 1. **ischemic stroke** caused by vascular obstruction by a thrombus or embolus
- 2. **hemorrhagic stroke** caused by vessel rupture secondary to several vascular diseases, like hypertension or vasculitis.
- Ischemic strokes account for 85% of strokes.
- It's very important to distinguish between the two types because ischemic stroke is treated by anticoagulants, whereas if you use anticoagulants in hemorrhagic stroke you might kill the patient



# BRAIN STROKE

# Brain blood supply



# Ischemic stroke : 1. Thrombotic occlusions

- Atherosclerosis of cerebral arteries causing thrombosis.

## Common sites:

1. Carotid bifurcation
2. Origin of middle cerebral artery
3. Ends of basilar artery

# Ischemic stroke; 2. Embolic infarcts

- **More common than thrombotic infarcts**
- Source: 1. **cardiac mural thrombi**, arise due to myocardial dysfunction, valvular disease, and atrial fibrillation
- 2. **arterial atheroma** in carotid arteries or aortic arch
- 3. **venous thrombi** crossing to arterial circulation through cardiac defects = paradoxical embolism.. DVT, fat emboli

- Most common site of embolic occlusion : middle cerebral artery, a direct extension of the internal carotid.
- Emboli lodge where vessels **branch** or in **stenotic** areas caused by atherosclerosis

# Hemorrhagic stroke causes hemorrhagic infarcts

- Can be caused by haemorrhage from a ruptured vessel.
- OR are due to reperfusion through collaterals or after dissolution of emboli.
- Causes of haemorrhage will be discussed in the next lecture.

# Stroke: risk factors; basically these are the same risk factors of atherosclerosis



# Clinical features of stroke

- **Signs and symptoms= FAST**
- The main symptoms of stroke can be remembered with the word FAST: Face-Arms-Speech-Time.
- **Face** - the face may have dropped on one side, the person may not be able to smile or their mouth or eye may have dropped.
- **Arms** - the person with suspected stroke may not be able to lift both arms and keep them there because of arm weakness or numbness in one arm.
- **Speech** - their speech may be slurred or garbled, or the person may not be able to talk at all despite appearing to be awake.
- **Time** - it is time to dial emergency team immediately if you see any of these signs or symptoms.

# Stroke – there's treatment if you act FAST.



**F** *Face*  
Face look  
uneven?



**A** *Arm*  
One arm  
hanging  
down?



**S** *Speech*  
Slurred  
speech?



**T** *Time*  
Call 911  
NOW!

# Transient ischemic attack (TIA),

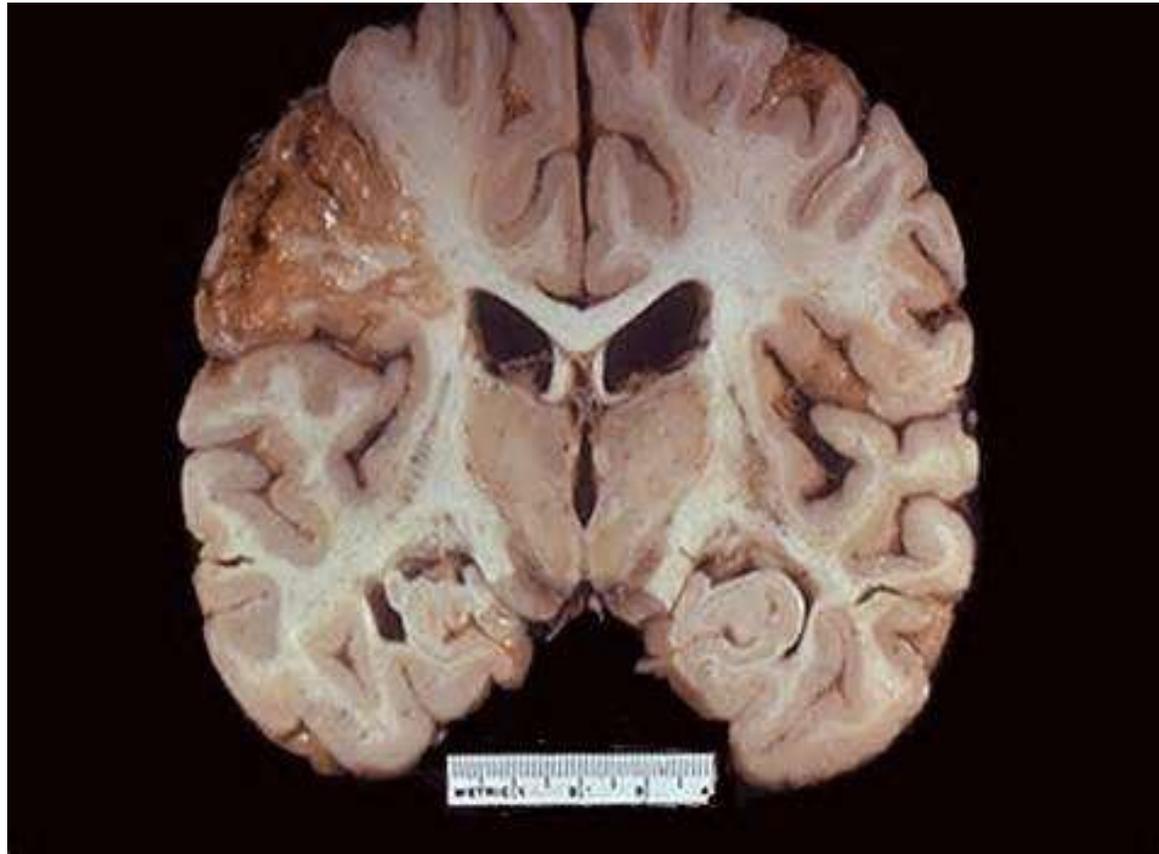
- Sometimes, stroke is preceded by transient ischemic attacks TIA.
- These are important to recognize clinically because they are a warning sign that a full-blown stroke is imminent
- TIA means that the supply of blood to the brain is temporarily interrupted, causing a "mini-stroke" often lasting between 30 minutes and several hours.
- TIAs should be treated seriously as they are often a warning sign that there is risk of having a full stroke in the near future

# Life after a stroke

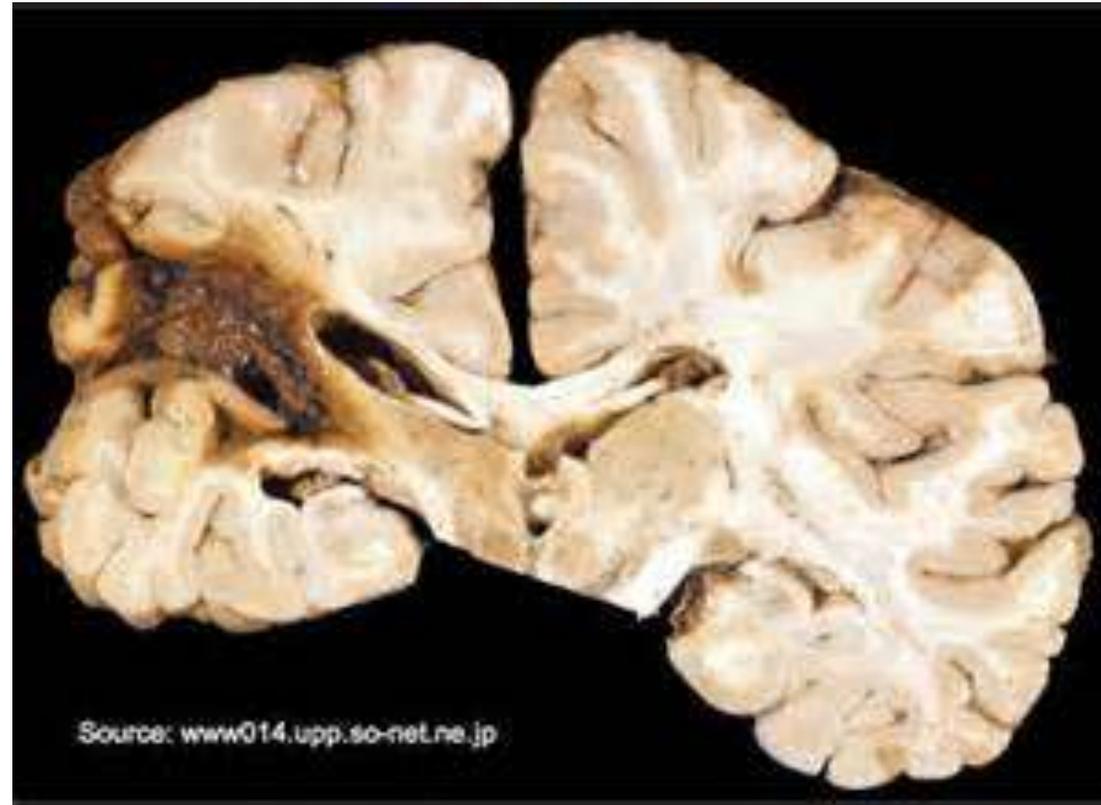
- Around one in every four people who have a stroke will die, and those who do survive are often left with long-term problems resulting from the injury to their brain.
- Some people need to have a long period of rehabilitation before they can recover their former independence, while many will never fully recover and will need support adjusting to living with the effects of their stroke.

- Morphology/ non-haemorrhagic infarcts  
macroscopic appearance
- By 48 hours: pale, soft swollen area.
- Day 2-10: gelatinous and friable.
- Day 10 to week 3: liquefaction ending in a fluid filled cavity.

infarct



# Brain infarct



infarct: note the cavity and liquefaction.  
Ischemic damage to the brain causes liquefactive necrosis.



Old infarct: the infarct is resolved leading a cavity.



# Morphology / non-hemorrhagic microscopic appearance

- microscopic appearance of brain infarcts is divided into:
  - Early changes
  - Subacute changes
  - repair

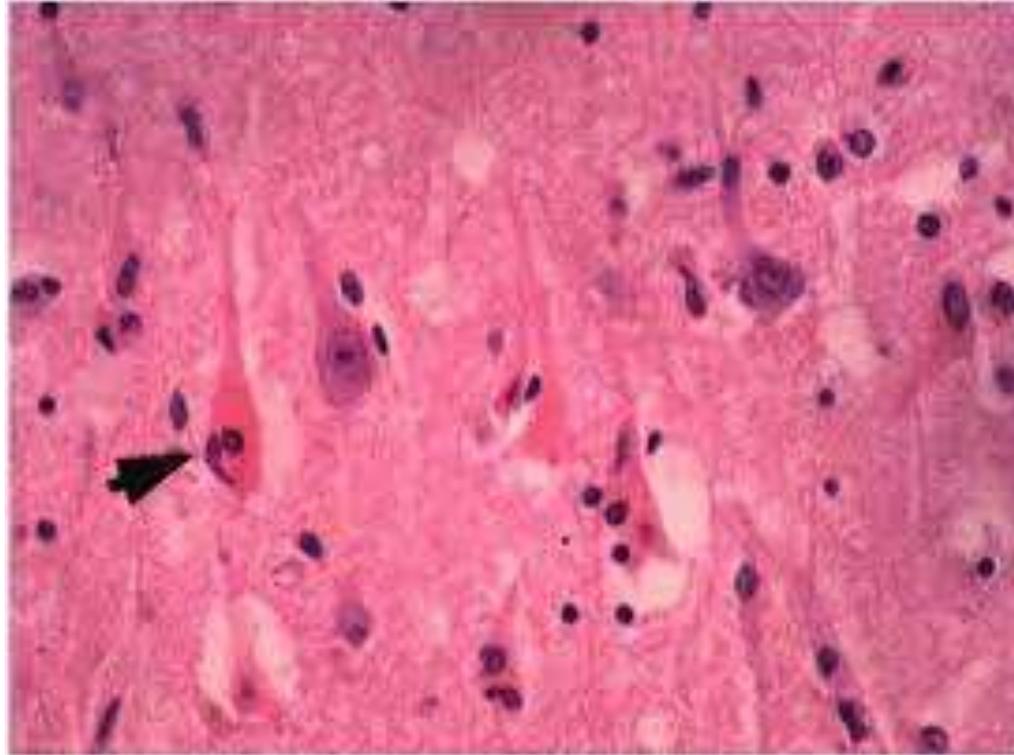
# Morphology/ non-hemorrhagic

- early ( first 24 hours): red neurons + edema + neutrophils
- subacute (24 hours to 2 weeks): macrophages, gemistocytic astrocytes.
- repair (after 2 weeks): gemistocytes regress, cavity persists

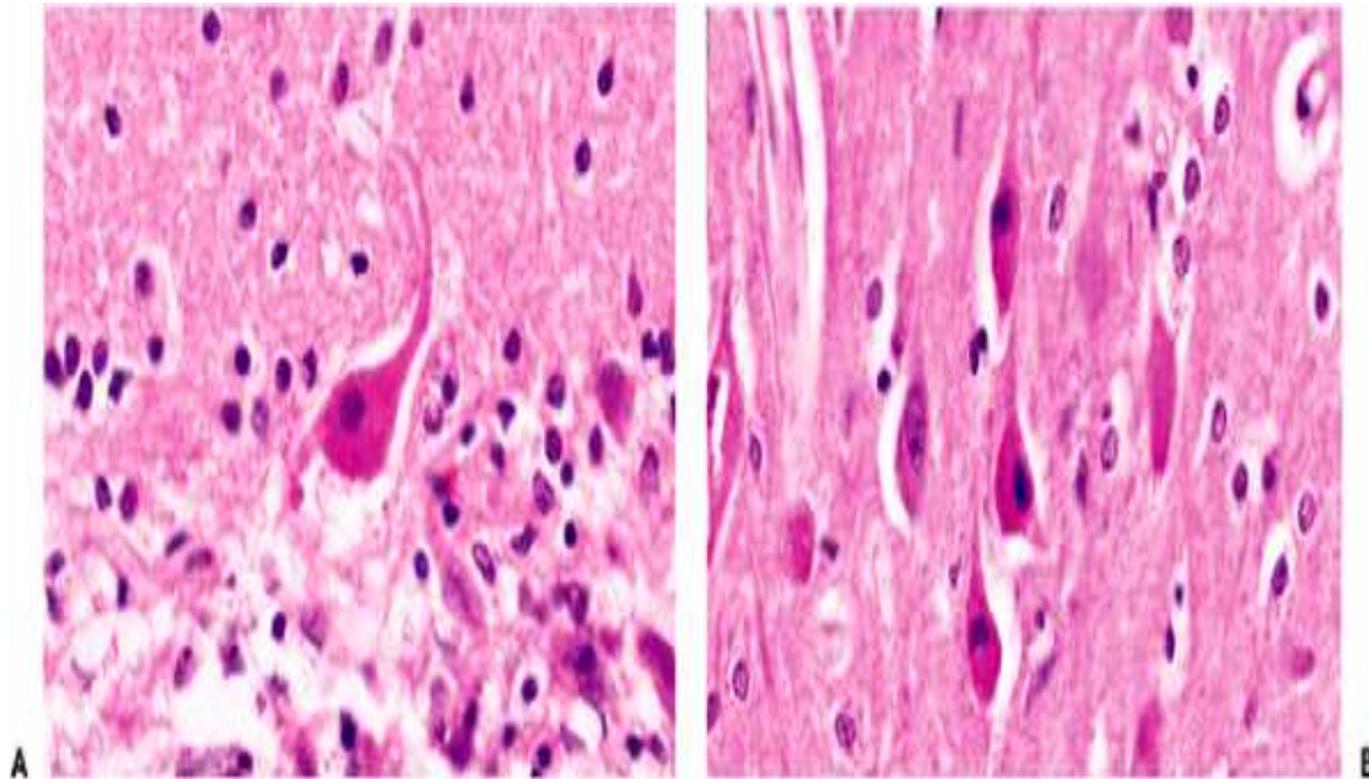
# Early changes

- Acute neuronal cell damage= **red neurons** , followed by cytoplasmic eosinophilia then pyknosis and karyorrhexis
- Similar changes later on glial cells
- Then: neutrophilic infiltrate.

# Red neurones



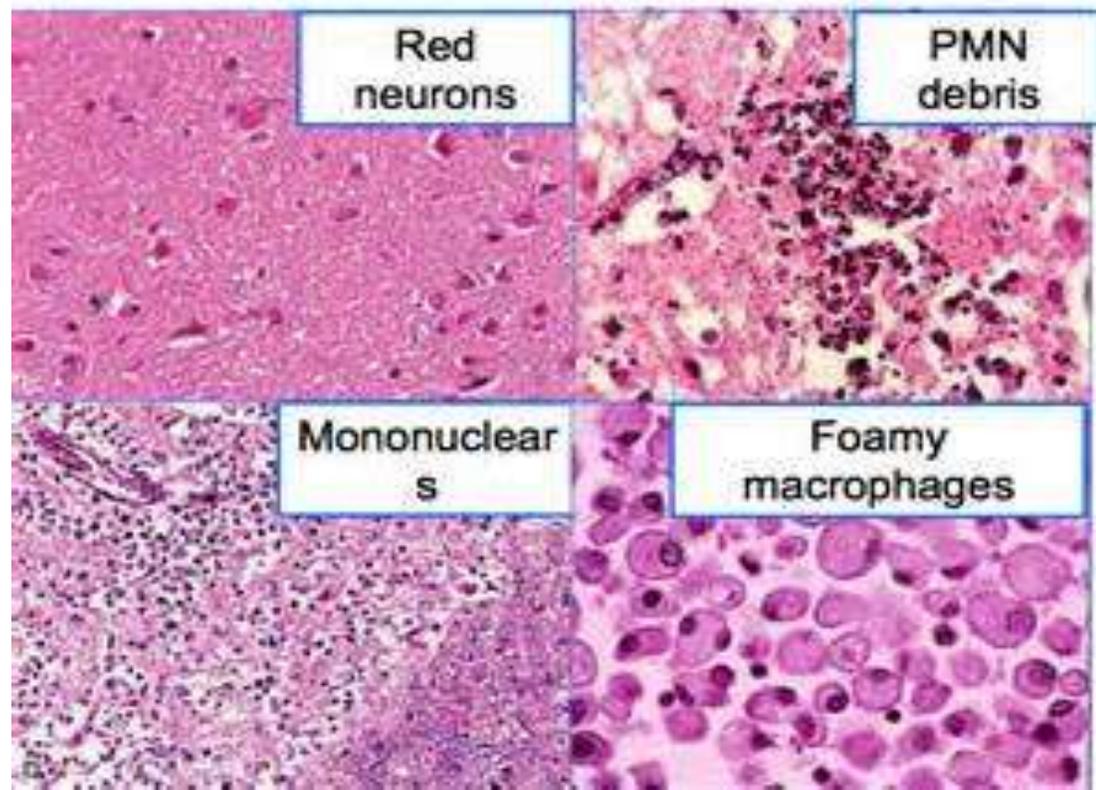
# Red neurones



# Subacute change

24 hours to 2 weeks

- Necrosis
- Macrophages
- Vascular proliferation
- Reactive gliosis



# repair

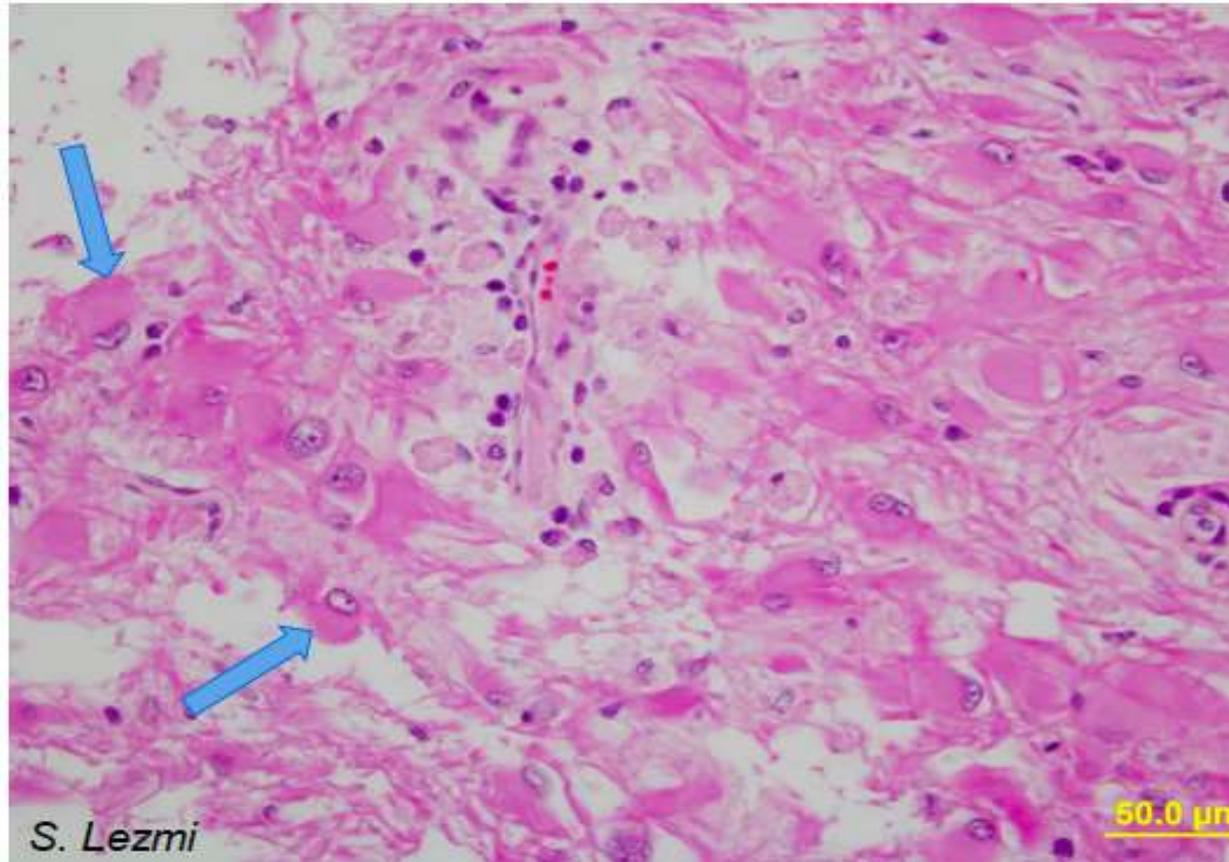
- After 2 weeks
- Removal of necrotic tissue
- Gliosis
- Loss of organised CNS structure

# repair

- Astrocytes are the main cells responsible for repair and scar formation (gliosis).
- Injury.. Causes
  1. hypertrophy and hyperplasia in astrocytes.
  2. enlarged nuclei
  3. prominent nucleoli.
  4. increased pink cytoplasm.
  5. increased, ramifying processes

These changes in astrocytes: **gemistocytic astrocyte**.

# gemistocytes



# Case study

- Patient M is an active woman, 70 years of age, who lost consciousness and collapsed at home. Her daughter found her mother on the floor, awake, confused, and slightly short of breath. The daughter estimated that she called emergency services within 5 minutes after the collapse, and they responded within 10 minutes.
- Was the daughter's action correct?

# Yes, she was right

- The triage ( evaluation of condition) and transportation of an individual with suspected stroke should be similar to that for an individual with serious trauma, and **treatment is recommended within 3 hours** after the onset of stroke.

- in the emergency department, the daughter reports that her mother had had an episode of sudden-onset numbness and tingling in the right limb, with slight confusion and slurred speech, 3 days previously. The episode lasted only 5 minutes.
- What do you call these symptoms?

# these symptoms are TIA

- Research has shown that approximately **5% of patients will have an ischemic stroke within 7 days after a TIA.** In addition, the risk of stroke within 7 days is doubled for patients with TIAs who did not seek treatment.
- **urgent treatment should be provided for TIAs, as early treatment for TIA and minor stroke has been shown to reduce the risk of early recurrent stroke by 80%.**

- Additional information provided by the daughter indicates that Patient M has been treated for hypertension for 10 years but notes that she is often not compliant with her antihypertensive medicine, a diuretic. The patient has never smoked, and is of normal weight
- Which of the above is a risk factor for having stroke?

# Hypertension

- Patient M has a significant risk factors for stroke; which is a long history of hypertension. More than two-thirds of individuals older than 65 years of age are hypertensive, and it is important for individuals with hypertension to have regular blood pressure screening
- Antihypertension therapy has been found to reduce the incidence of stroke by 30% to 40%.
- Patient M's noncompliance with her antihypertension medicine likely includes her among the 65% of known hypertensive individuals in whom blood pressure is not controlled.

- On physical examination, Patient M's blood pressure is 150/95 mm Hg. She has pain in her left arm and a slight headache. There are slight carotid bruits on the right. She is found to have left hemiparesis.
- Are the patient's symptoms typical of stroke?

# NO. !!!remember, typical symptoms are the **FAST acronym**

- Many of the patient's symptoms, including her loss of consciousness, shortness of breath, pain, and headache, are **nontraditional symptoms of stroke**.
- Studies have demonstrated that **nontraditional symptoms are more prevalent among women**, often leading to a delay in the evaluation for stroke.
- Clinicians should be aware of the potential for nontraditional symptoms in women and carry out a diagnostic evaluation addressing a suspicion of stroke.

- The results of laboratory tests, including a complete blood count, prothrombin time, serum electrolyte levels, cardiac biomarkers, and renal function studies, are all within normal limits. CT of the brain indicates a thrombus in a branch of the right internal carotid artery, with approximately 50% occlusion due to atherosclerosis. There is an area of infarction in the right anterior hemisphere. There is no evidence of a subarachnoid hemorrhage.
- How would you treat this patient?.

- Patient M is eligible for thrombolytic therapy with thrombolytic agents because:
  - 1. her blood pressure is lower than 185/110 mm Hg,
  - 2. the onset of symptoms is less than 3 hours prior to the start of treatment,
  - 3. and the laboratory values are within normal limits.
- these three conditions are needed to give thrombolytic therapy.

- When Patient M's condition is stabilized, her primary care physician and consultant neurologist provide a referral for stroke rehabilitation. The patient's cognitive and communication skills are intact on evaluation.
- Psychosocial assessment, as well as review of the medical history and conversations with the patient and her children; no signs of depression are present.

- The exercise program developed for Patient M is designed to help her regain the ability to independently carry out activities of daily living safely and to regain a functional level of ambulation. The benefits of an exercise program include increasing fitness, strength, and flexibility; improving function; preventing injuries and falls; and reducing the risk of recurrent stroke.

# Comment/ stroke complications

- . Evaluating a stroke survivor's risk of complications is an important component of the overall assessment, and among the most common complications are falls, deep vein thrombosis, pressure ulcers, swallowing dysfunction, bladder and bowel dysfunction, and depressive symptoms.

- WHAT ADVISE YOU ALSO SHOULD GIVE PATIENT M?

- *To take her antihypertensive drugs regularly*

# Summary 1/2

- Stroke = CVA, is a clinical term describing acute neurological symptoms caused by vascular disease.
- stroke can be ischemic or hemorrhagic. Ischemic is commoner
- Ischemic stroke can be embolic or thrombotic. Embolic is commoner.
- Most common site of embolic occlusion is the middle cerebral artery.
- Ischemic strokes might be preceded by TIA= vascular occlusion causing symptoms lasting from minutes to several hours.
- TIAs predict a full stroke and should be treated promptly.
- Ischemic infarcts in the brain cause liquefactive necrosis.
- in the acute stage we see red nuclei and neutrophilic infiltrate
- in subacute stage we see macrophages ,gemistocytes and gliosis.
- in the late stages, gemistocytes disappear leaving a cavity behind.

# Summary 2/2

- the classical symptoms of stroke are FAST: face asymmetry, arm weakness and speech problems.
- Non traditional symptoms are even more common than traditional ones
- in non hemorrhagic stroke thrombolytic treatment is effective in the first 3 hours.
- Rehabilitation is needed after treating stroke to improve long term outcome

Thank you!

