Pathology

Sheet

Lec No: 3

Subject: Cerebrovascular accidents CVA

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This sheet was written according to the recording of section 2
Everything in the slides is mentioned in this sheet

Stroks or CVA (cerebrovascular accident)

- What does CVA mean ? or how do you define CVA ?

Accident means something that happens quickly or suddenly or ACUTLY , so there are sudden onset symptoms in the cerebrum or cranium which are related to vascular events or causes .

- Cerebrovascular diseases are a major cause of death .
- Are the most common cause of neurologic morbidity
- Mechanisms : thrombi / emboli / vascular rupture
- Stroke : clinical term applies to all three when symptoms are **acute**

- What do we mean by vascular events ?

Hemorrhage or occlusion , this means that the symptoms happen due to ischemia or due to hemorrhage .

According to this we have 2 types of strokes :

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 and vasculitis .

- Ischemic strokes account for 85% of strokes .

- Why is it important to differentiate between the 2 types ?

Because they differ in the treatment

- How ?

If a patient had an occlusion by a thrombus or embolus we give him fibrolytic agents or anti thrombotic agents , but if we give fibrolytic

agents to a hemorrhagic stroke patient the hemorrhage will increase and the patient will die .

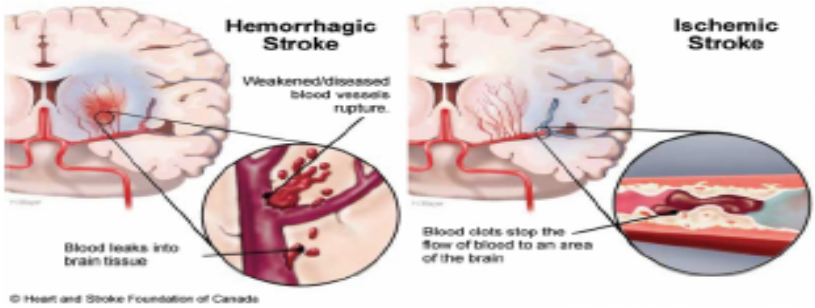
- How to know if the stroke is hemorrhagic or ischemic ?

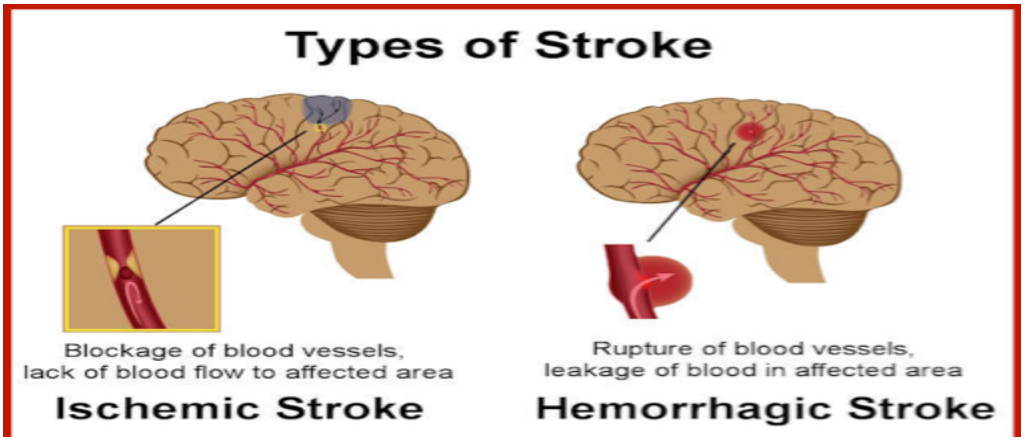
Through imaging techniques , MRI or CT scan , we can know if the patient has ischemic infarction or hemorrhage in the cerebrum .

The ischemic infarction is usually triangular in shape , because the proximal parts of the cerebrum that are near the occluded artery still receive some oxygen comparing to the more distal parts , the more we get further from the occluded artery the ischemic area gets bigger because the oxygen reaching there is less and less . so the ischemic area appears as a triangle .

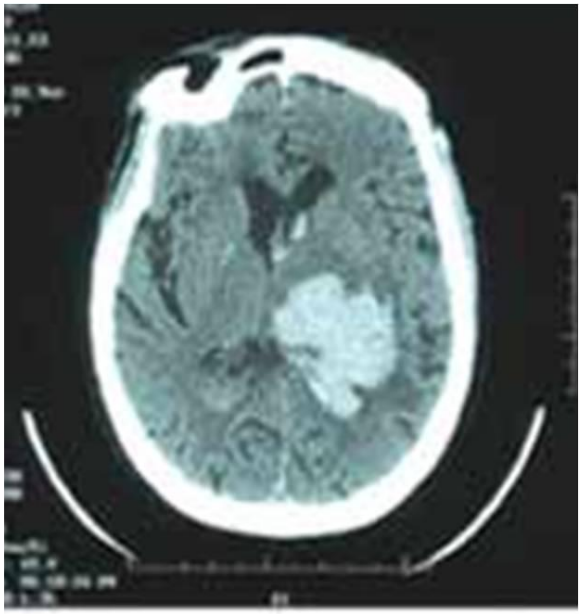
The hemorrhagic stroke takes a more irregular shape .

In the screening , the hemorrhage appears in white colour while ischemic infarction appears in black .





cerebral infarction



intracranial hemorrhage

- **If the stroke was hemorrhagic , which predisposing conditions could cause it ?**

1. Severe hypertension , could cause rupture in the vessels .
2. Aneurysms also can cause vessel rupture.
3. Vasculitis.
4. Trauma.

- Hemorrhagic strokes can be caused by hemorrhage from a ruptured vessel.
- OR are due to perfusion through collaterals of after dissolution of emboli.

- **What could cause ischemic strokes ?**
  Embolus or thrombus

Note : severe hypotension could cause ischemia , but it causes global ischemia rather than local ischemia . For an ischemic infarction to happen ,it requires a local ischemia in a limited area.

Where do these thrombi and emboli come from ?

1. **Thrombus** : it's an occlusion due to atherosclerosis in the vessel affected .

   The vessels that supply the cranium(the circle of Willis) are :
   -Posteriorly : branches from the Basilar artery.
   -Anterrioly : branches from the carotid artery.

   Atherosclerosis affect mainly :
   i. Carotid bifurcation
   ii. Origin of middle cerebral artery
   iii. Ends of basilar artery
   (these are the main sites for atherosclerosis , occlusions and atheroma , resulting in ischemic infarction .)

2. **Embolus :** it flows with the blood and gets stuck in narrow vessels , which means the bifurcation of vessels and ends of vessels .

   Where do these emboli come from ?
   i. The heart (cardiac mural thrombi) : arise due to myocardial dysfunction , valvular disease , and atrial fibrillation.

   ii. Venous thrombi : they cross to arterial circulation through cardiac defects.
   This only happen when there is a defect in the heart. In order for the emboli , that originates from the veins in the lower limb, to cross the heart from right to left and go to the systemic circulation and then the brain , there should be a defect in the heart . And we call them paradoxical emboli.

like, fat emboli, and DVT (deep vein thrombosis).

iii. Arterial atheroma : in carotid arteries or aortic arch .

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

Risk factors :

- What are the risk factors for strokes ?

Age / obesity and unhealthy eating / smoking / diabetes / heart disease / hypertension / hyperlipidemia / inactivity / drinking and substance misuse / oral contraception and HRT (hormone replacement therapy) / previous strokes and TIAs / family history and ethnicity .

- In other words, anything that predispose to atherosclerosis could lead to a stroke .

TIAs (Transient Ischemic Attack):

Stroke patients can have temporary symptoms like confusion and numbness .

- Sometimes in patients with strokes , the main attack of the stroke is preceded by certain vague symptoms and can't be localized to a certain area in the brain, lasting for a short period of time, from few minutes to few hours, these temporary symptoms could be confusion, numbness, transient loss of memory, transient change in eye movement, transient blurred vision, or any other neurological symptom. This depends on which area in the cerebrum is having ischemia.
- And this is called TIA (transient ischemic attack) .

It's very important to know if the patient is having TIA , if he does , you should not let him go home without treatment . because it's very common that patients with TIA , after a short period of time , could have full-blown stroke .

It's very rare to find patients with TIA in the emergency room , it’s usually patients with full strokes , but if it happens and you found a patients in the TIA stage you should treat him immediately, this would lower the chance of having a stroke by 80% .

FAST :

Patients that come with full strokes have main symptoms that can be remembered with the word FAST : (those are the classical signs or symptoms for strokes)

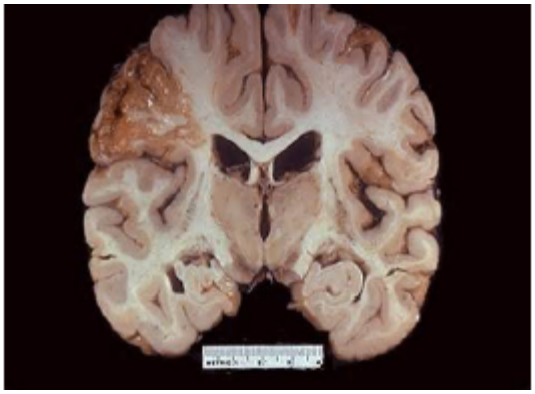
1. **Face** : asymmetry in the face.
   The face may have dropped on one side, the person may not be able to smile or their mouth or eye may have dropped .
2. **Arms** : abnormality in one arm , the person with suspected stroke may not be able to lift both arms and keep them there because of arm weakness or numbness in one arm .
3. **Speech** : their speech may be slurred or garbled, or the person may not be able to talk at all despite appearing to be awake .
4. **Time** : if the patient had these three symptoms you should act very fast, dial emergency team immediately .

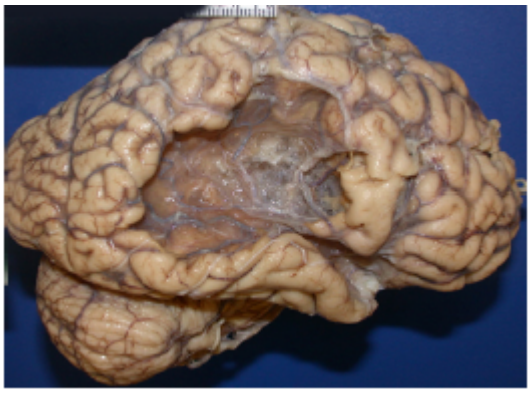
Morphology of NON- haemorrhagic infarcts grossly and microscoply :

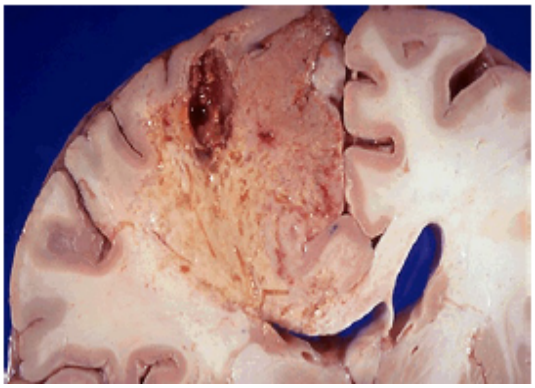
Grossly (macroscopic appearance) :

1. By 48 hours : soft (the tissue is starting to die), pale and swollen.
2. Day 2-10 : the second stage, the brain become more gelatinous and friable (هش)
3. Day 10 to 3 weeks : liquefaction and cavitations , the liquid will be absorbed by macrophages and we'll end up with a large cavity lined by glial cells and fibroblast.
   Cavity means old infarction(dead tissue which cannot be regenerated).

   These stages only happen in non-hemorrhagic infarcts . In hemorrhagic infarcts the same thing happens but with blood extravasations (leakage) .







Microscopic appearance :

1. Early changes
2. Subacute changes
3. Repair

- <u>After 12 hours</u> : first thing that appears is RED NEURONS + edema
- <u>Up to 48 hours</u> : neutrophils will recruit to phagocyte the red neurons .
- <u>2-3 weeks</u> : comes macrophages , and they will turn to a foamy appearance + glial cell that will turn to gemistocytic astrocytes .

- Why do macrophages appear in foamy appearance ?
    - Because they have lipids inside , after microphages phagocyte myelin and other materials, they get broken down in the cytoplasm to lipids.
- What happens to glial cells ?
    - Hyperplasia + hypertrophy = gemistocytic astrocytes.

- <u>Months</u> : gemistocytes regress , cavity persists .

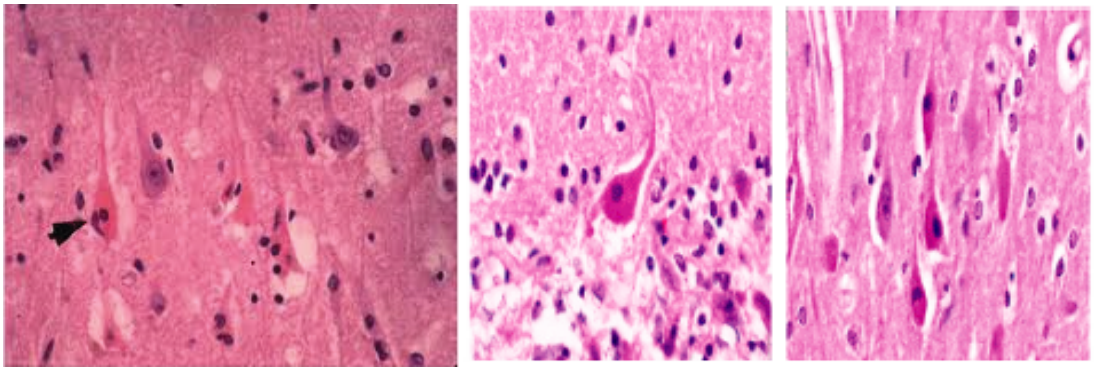
In more details :

1. **Early stages** (12-24 hours after insult) :
    - Acute neural cell damage = RED NUORONS , followed by eosinophilia then pyknosis and karyorrhexis .
    - Similar changes later on glial cells
    - Then : neutrophilc infiltrate .

Wikipedia

Pyknosis : irreversible condensation of chromatin in the nucleus of a cell undergoing necrosis or apoptosis . it's followed by karyorrhexis .

Karyorrhexis : fragmentation of the nucleus of a dying cell.



2. **Subacute changes** (24 hours to 2 weeks) :
    - Necrosis
    - Macrophages
    - Vascular proliferation
    - Reactive gliosis
    - Here the foamy appearance of macrophages appear .
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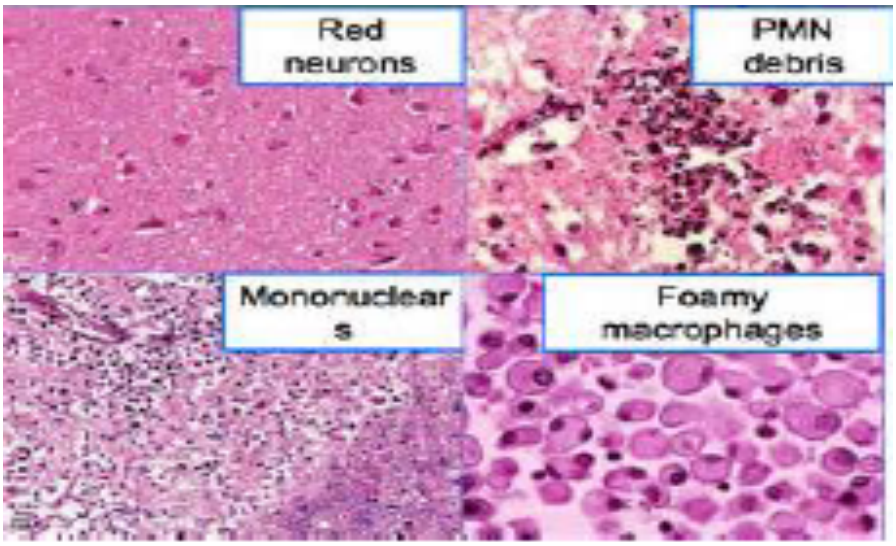
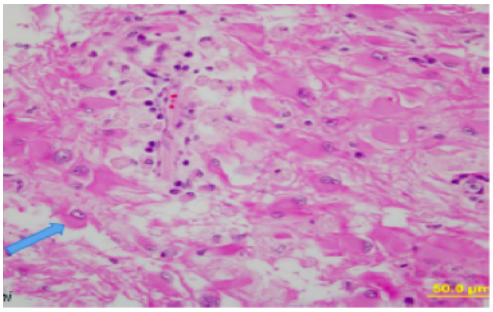
Gliosis : nonspecific reactive change of glial cells in response to damage to the CNS , involves hypertrophy of several types of glial cells .



3. **Repair** (after 2 weeks) :
    - Removal of necrotic tissue
    - Gliosis
    - Loss of organized CNS structure
    - Astrocytes are the main cells responsible for repair and scar formation (gliosis)

- The Injury causes the following changes in glial cells :

1. Hypertrophy and hyperplasia in astrocytes
2. Enlarged nuclei
3. Prominent nucleoli
4. Increased pink cytoplasm
5. Increased ramifying (متشعبة) processes .
   (these changes in astrocytes = gemistocytic astrocytes)



case study :

what should we do when we see a patient having a stroke ?

1. 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 , we should act FAST
   - **Note** : the patient was awake, as long as the patient in awake , there is no fear on his respiration
   - The first thing you should do is check the respiration is fine ,and the air passages are open. Then call the emergency.
   - If the air passages were closed try to open them then call the emergency.
   - If you were with another person, ask him to call the emergency and you take care of the patient.
   - Any symptoms related to the cranium or the CNS happening acutely means a stroke, and you should act fast .

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

2. In the emergency department, the daughter reports that the 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 2 minutes .

   - In the emergency department, first thing to do is to take history from the patient, if the patient is unconscious, ask the closest person that came with him.
   - From the history the daughter gave, we can conclude that the mother had TIA 3 days before the stroke.
   - What do you call these symptoms ? TIA.

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 .
- Research findings indicate that 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%.

3. 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 .

Controlling hypertension lowers the chances of having a stroke.

- Which of the above is a risk factor for having a stroke ?
  Hypertension .

Hypertension :

- Patient M has two significant risk two significant risk factors for stroke ;
  1. one is a long history of hypertension . more than two-thirds of individuals older than 65 years of age are hypertensive , and it's important for individuals with hypertension to have regular blood pressure screening .
  2. And to maintain a blood pressure less than 140/90 mm Hg . Antihypertensive therapy has been found to reduce the incidence of stroke by 30% to 40 % .
     Patient M's noncompliance with her antihypertensive medicine likely includes her among the 65% of known hypertensive individuals in whom blood pressure is not controlled .

4. 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.
   - any neurological symptoms happening acutely , specially in women , means stroke .
   - women usually carry non-typical symptoms during strokes.

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

5. 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 the patient ?
     It's an ischemic stroke, so we can give her anticoagulant therapy.

- Patient M is eligible for thrombolytic therapy with thrombolytic agents because : (شروط العلاج)
  1. Her blood pressure is lower than185/110 mm Hg
  2. The onset of symptoms is less than 3 hours prior the start of the treatment.
  3. And the laboratory values are within normal limits : There should be no problems in the platelets otherwise it would result in bleeding.

6. 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 .

7. The exercise program developed for patient M is designed to help her regain the ability to independently carry out the 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 risks of recurrent strokes .

- She still has a risk to develop more stroke , this need to be fixed.
- She also has a chance of developing complications , any patient with a stroke , can develop complications .
- Other complications are personality changes and depression .
- Any chronic illness could predispose depression .
- If patient developed paresis and stayed in bed for a long time he could have bed ulcers .
- Reflexes could be affected , and the most dangerous one is swallowing reflex which could result in aspiration .
- One of the complications is muscle weakness , and we use physical therapy for treatment .

Stroke complication :

- 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 .

Some questions : (True / False)

1. Stroke is rare in patients less than 65 .
2. Strokes are more common in females
3. Oral contraceptives increase the risk of strokes
4. Symptoms of TIA can persist for up to 24 hours
5. Atrial fibrillation can predispose stroke
6. People who suffered from heart attack have an increased chance of CVA

Answers :

1. This statement rather True (نوعا ما) : the chances of having a stoke increases with age .But even in patients who are 30 or 40 years old or even 25 and have neurological symptoms, stroke is possible , you should never let these patient go back home without treatment.
   In these patient, what kind of predisposing factors have led to the stroke ?
   Most important risk factor is smoking. It could be hemorrhagic stroke because of a trauma on the head .
2. True : because females live longer than males, and because strokes increase with age, strokes are more common in females .
3. True : a patient who takes contraceptives and has a sudden migraine, this is a risk factor that she might have a stroke .
4. True : TIA symptoms last from few minutes to a few hours , but they can also persist up to 24 hours.
5. True : atrial fibrillation means there's a turbulent blood movement which increases clotting, more clotting more emboli.
6. True : Because they have the same risk factors.