

The Cardio-

VASCULAR

System

- Anatomy
- Histology
- Pathology
- Pharmacology
- Physiology
- Microbiology

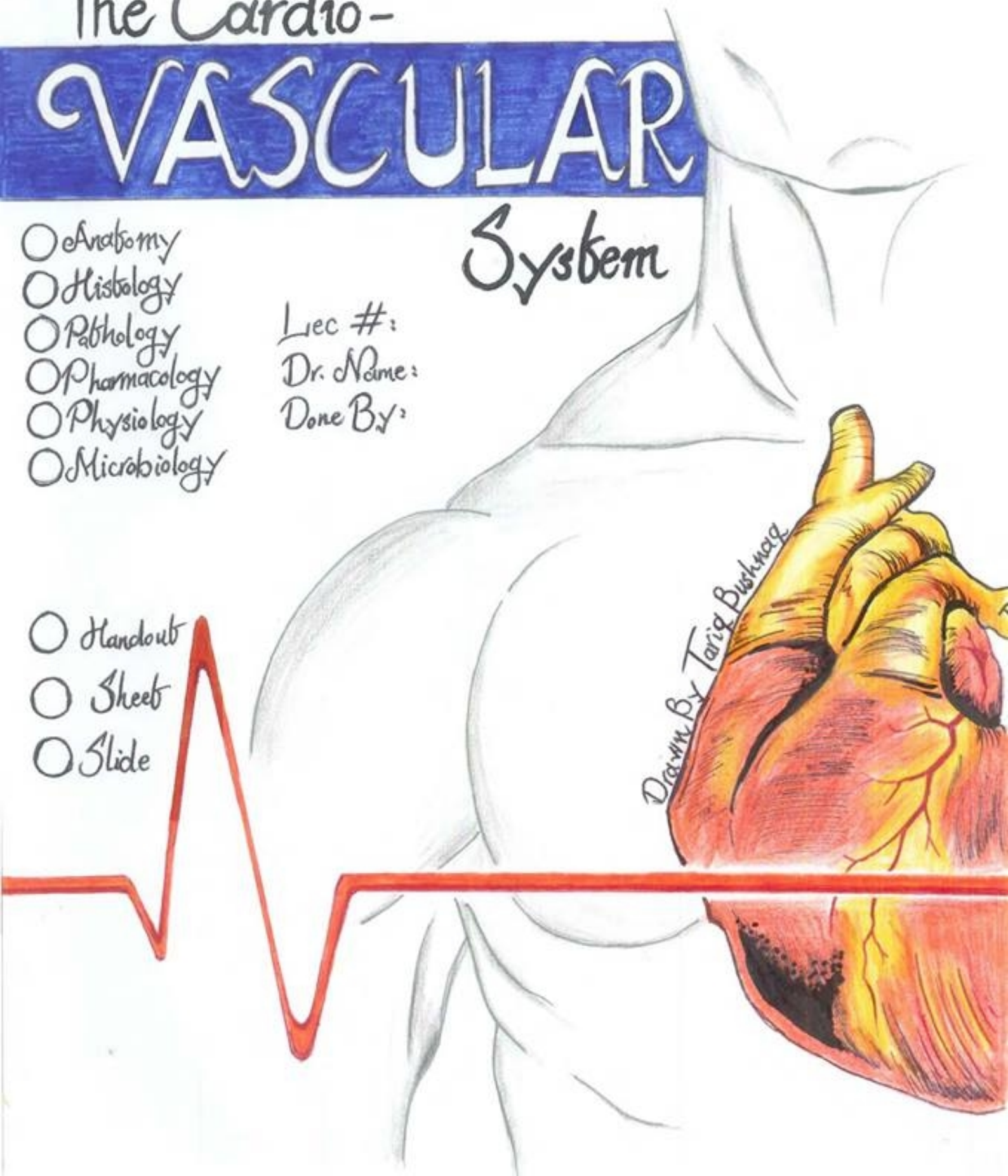
Lec #:

Dr. Name:

Done By:

- Handout
- Sheet
- Slide

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CARDIOVASCULAR DISEASES

- This sheet was written according to section 2 record
- Slide's contents were incorporated here so you don't need to refer back to them except for some pictures.
- Topics discussed in this sheet:
 - a) Global statistics
 - b) Classification of blood pressure
 - c) CVDs risk factors
 - d) Acute coronary syndrome
 - e) Myocardial infarction (symptoms, complications and management)
 - f) Stroke

◆ Global statistics

- ☑ In comparison to the past, Life expectancy in Jordan increased to reach **74** years. This improvement in life expectancy is due to Primary health care services.
- ☑ Cardiovascular diseases (CVDs) are the number one cause of death globally. More people die annually from CVDs than from any other cause. Although people usually sympathize with cancer patients, cancer isn't number one cause of death globally.
- ☑ Estimated by WHO: **17.3** million people died from CVDs in 2008 Representing **30%** of all Global deaths.
- ☑ There are many causes leading to CVDs including high cholesterol level, lack of exercise, smoking and Atherosclerosis. Atherosclerosis is number one leading cause of CVDs.

DR. Firas Hawwari in King Hussein Cancer Center made a study on hookah (الأرجيلة). Pulmonary function test was made for healthy young students and the percentages of blood gases (CO₂ and O₂) were taken. Those students were allowed to leave for an hour مشان يأرجلو. when they came back the test was made again and the results were worse for all of them.

Note: smoking hookah equals one pack of cigarettes.

- ☑ Of these deaths, an estimated **7.3** million were due to coronary heart disease (تصلب الشرايين التاجي) and **6.2** million were due to stroke (جلطة دماغية).
- ☑ Low- and middle-income countries are disproportionately affected: **over 80%** of CVD deaths take place in low and middle income countries and occur almost equally in men and women. This is due to bad Primary health care in these countries in comparison to high level income countries.

- ☑ The number of people who die from CVDs, mainly from heart disease and stroke, will increase to reach **23.3** million by 2030.
- ☑ CVDs are projected to remain the single leading cause of death.
- ☑ Tobacco kills up to **half** of its users (one of the most important risk factors of cardiovascular diseases).
- ☑ Tobacco kills nearly **6** million people each year. **More than five** million of those deaths are the result of direct tobacco use while **more than 600,000** are the result of non-smokers being exposed to second-hand smoke. Also people may die from third hand smoking which is the result of smoke present on surfaces such as clothes and tables on restaurants.
- ☑ Unless urgent action is taken, the annual death toll could rise **to more than eight** million by 2030 due to smoking.
- ☑ Nearly **80%** of the world's one billion smokers live in low and middle income countries.
- ☑ **347** million people worldwide have diabetes.
- ☑ In 2004, an estimated **3.4** million people died from consequences of high fasting blood sugar.
- ☑ **80%** of all diabetic **patients** are present in low and middle income countries. In high income countries they have policies such as: canteens are not allowed to sell unhealthy food to children which reduced diabetes in the future.
- ☑ Also **80%** of all diabetic **deaths** occur in low and middle income countries.

◆ Blood pressure classification

- ✓ Normal blood pressure is usually **under 120/80**.
- ✓ **Pre-hypertension stage : (120-139)/(80-89)** → In this stage the patient is advised to exercise, lose weight if obese and reduce the amount of salt used in his food.
- ✓ If it is **above 140/90** then the person is **Hypertensive**.
- ✓ **Hypertension stage one: (140-159)/(90-99)**
- ✓ **Hypertension stage two : equal or above 160/100**
- **Note:** it is normal for young females to have hypotension as long as no symptoms are present .They are advised to drink enough amount of water and carry something salty in their handbags.

◆ Risk factors for CVDs

1. Age: male above 45 and female above 55

- The 10 years gap between male and female is due to **Estrogen** Which provides protection for females against CVDs until menopause.
- After menopause the risk to have CVD is higher for smoker females than smoker males. For example: If we have a 60 years old smoker female and 60 years old smoker male, the female here has a higher risk to get CVD.

2. Family History : If a relative from the patient's family (father/ uncle/ cousin) had an evidence of sudden cardiac death or myocardial infarction { below age of 55 for males and 65 for females}, then the patient has a higher risk to get a CVD.

3. Hypertension

4. Smoking : smoking effect on the heart stays up to 3 years for those who stopped smoking.

5. Diabetes mellitus

- Diabetes affects the whole body from head to foot.
- Diabetic patients with uncontrolled diabetes usually lose sensation and get what is known as **Glove and Sock distribution**. So if a patient stepped on a nail, he will get injury and bleeding will occur but he won't feel anything and he might not even realize that he was injured for 4 or 5 days. In this period his foot will be infected and gangrene will occur ending up with amputation.

6. Dyslipidemia.

7. Physical inactivity.

8. Obesity:

When a patient is obese he is more likely to have high cholesterol and blood pressure in addition to diabetes which are all risk factors of CVDs.

- Part of these risk factors can be controlled and the other part cannot be controlled (Age and family history).

◆ Acute Coronary Syndrome (ACS)

- usually occurs as a result of one of three problems:

1. Unstable Angina.

2. Non-ST segment elevation Myocardial Infarction (NSTEMI).

3. ST segment elevation Myocardial Infarction (STEMI).

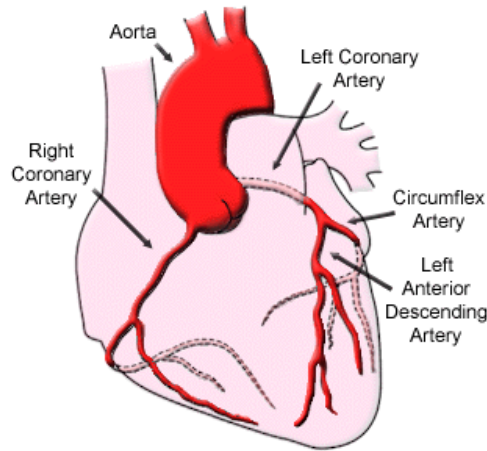
(we will shortly discuss these 3 later on , so keep them in your mind)

(STEMI and NSTEMI represent the classification for myocardial infarction according to the appearance of the electrocardiogram (ECG/EKG))

✚ Anatomy revision:

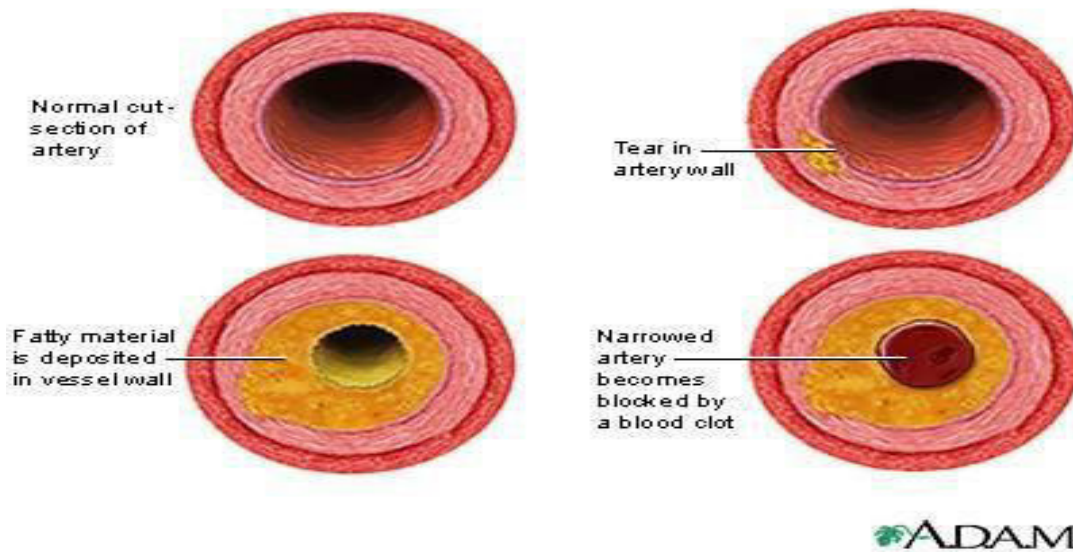
We have 2 coronary arteries supplying the heart :

- **Left main coronary artery (LMCA)** Arising from **Aorta** above the **left** cusp of the aortic valve . It divides into **Left Anterior Descending Artery (LAD)** and **Circumflex Artery**.
- **Right Coronary Artery** Arising from **Aorta** above the **Right** cusp of the aortic valve.



✚ How ACS occurs?

- ✓ A person who smokes , has dyslipidemia, diabetes and family history will end up with **Atherosclerosis** (تصلب الشرايين التاجية) .
- ✓ The different elements involved in the atherosclerosis formation will accumulate in the **Tunica Intima** in the wall of coronary arteries producing what is known as **plaque intimal deposits**. The process of accumulation takes several years. In fact We all have normally intimal thickening with fatty streaks in our arteries. These fatty streaks increase in amount to become fat and plaque deposits because of the risk factors that we discussed previously.
- ✓ Most acute coronary syndromes (ACS) are believed to result from the **loss of integrity of a protective covering over an atherosclerotic plaque**; this occurs with **plaque rupture or erosion**.
- ✓ This disruption of the protective covering allows blood to come in contact with the highly thrombogenic contents of the necrotic core/collagen of the plaque and luminal thrombosis to occur. i.e. when a plaque ruptures the body thinks that there is an injury (just like if you cut your finger: platelet adhesion → activation → aggregation → Thrombosis)



- ✓ Intraluminal thrombosis after exposure of the blood to calcified nodules has also been observed.

This process increases the risk of

Unstable Angina.

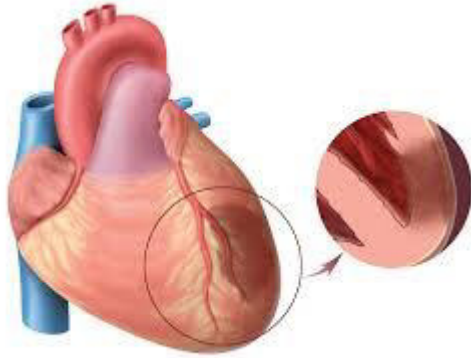
Non-ST segment elevation Myocardial Infarction (NSTEMI).

ST segment elevation Myocardial Infarction (STEMI).

Notice that:

- ✗ In **Unstable angina**: {no rupture} occur and the patient comes to ER complaining from chest pain.
- ✗ In **STEMI** : {Rupture occurs} leading to thrombus formation **completely** blocking the whole artery.
- ✗ In **NSTEMI**: {Rupture occurs} leading to thrombus formation **partially** blocking the artery. (those patients can wait as the priority is given for STEMI patients in ER)
- ✗ There is intimal thickenings in all ages even in children but it becomes a problem and causes atherosclerosis when these thickenings are increased beyond the

capability of a coronary artery to tolerate.



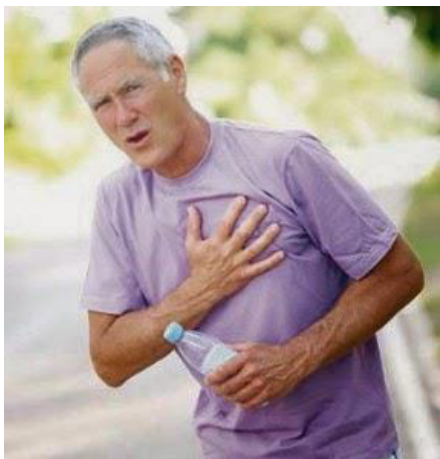
This picture shows a myocardial infarction due to the blockage of the coronary artery.

◆ Symptoms of MI :

- ✓ **Retrosternal (central) Chest pain** with different description, it can be presented either as tightness or pressure. The pain radiates to the left shoulder, arm , neck or jaw, usually present with levine's sign explained later.
 - ✓ **Diaphoresis** (Sweating)
 - ✓ **Dyspnea** (shortness of breath)
 - ✓ **Nausea or vomiting**
 - ✓ **Palpitations or lightheadedness**
 - ✓ **Levine's sign** ★
- ✚ If these symptoms appear on a person:
- 1- **Aspirin** should be given quickly and it is better to be chewed (takes from 20-30 minutes to give an effect) than swallowed (45-60 min.)
 - 2- Call 911.

★Levine's sign

The patient will come to ER with a clenched fist held over the chest to describe ischemic chest pain. It is seen as one of the following two pictures .



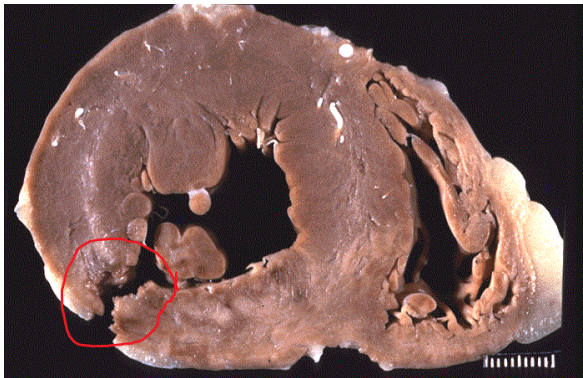
◆ Complications of MI (lead to death)

- **Free wall rupture** : wall of left ventricle (mainly left) will get ruptured
- **VSD** (ventricular septal defect): a hole in the membranous part of interventricular septum. Usually doesn't cause death.
- **Papillary muscle rupture causing mitral regurgitation**
- **Cardiogenic shock** : left ventricular failure
- **Arrhythmias (VF, VT, AF)**
- **Ventricular aneurysm**
- **Pericarditis**

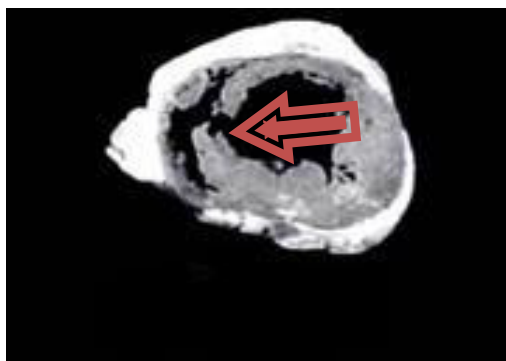
VF: Ventricular Fibrillation

VT: Ventricular Tachycardia

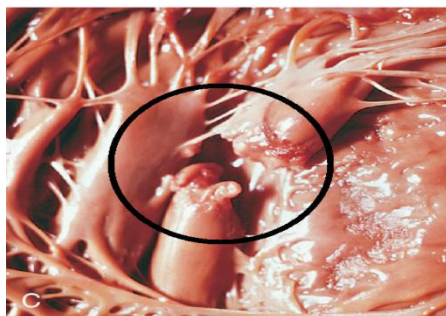
AF: atrial fibrillation



In this picture you can see a pathological specimen showing **left ventricular free wall rupture** after MI (the red circle)



In this picture you can see a pathological specimen showing **rupture of interventricular septum (VSD)** after MI (the arrow)

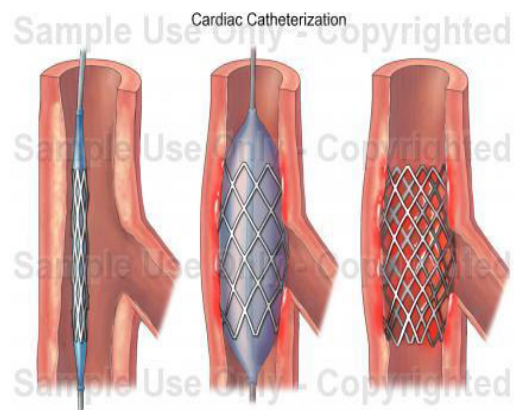
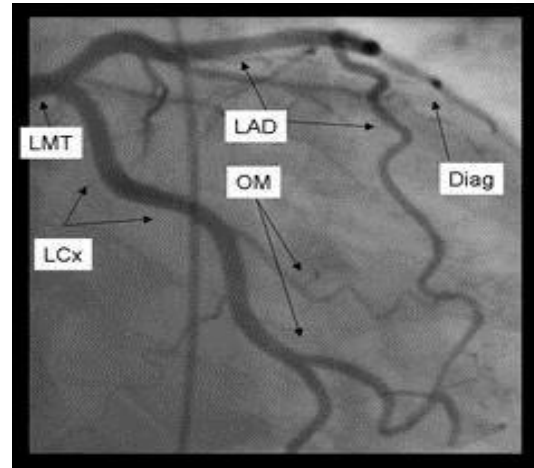


Papillary muscle rupture after MI (the circle)

- What to do if a patient is presented to you with blocked coronary artery due to MI ? → catheterization

◆ Catheterization

- Cardiac catheterization requires the use of fluoroscopy to visualize the path of the catheter (شبكة أو قسطر) as it enters the coronary arteries. To achieve this we use a dye known as contrast which contains iodine.
- In this process, a cylindrical Stent is inserted in the blocked artery to open it. This stent stays with the patient forever but as it is a foreign object to the body, he should take antiplatelet drugs (Aspirin and Plavix) to prevent the closure of the stent.



◆ Stroke

- A clinical problem:

A 60 years old patient with a past medical history of hypertension and smoking is presented to the ER with sudden aphasia (unable to speak) and weakness in his right arm and leg. What is the case ?

This is stroke/cerebrovascular accident.





- Risk factors for stroke are the same as those for CVDs.
- Stroke is the acute neurologic injury that occurs as a result of one of these pathologic processes and according to that it is classified into 2 major types:
 - (80% of cases) Ischemic** due to thrombosis, embolism, or systemic hypoperfusion {treated by thrombolytics in 1st 3 hours of accident because if delayed will be useless}.
 - (20% of cases) Brain hemorrhage** due to intracerebral hemorrhage or subarachnoid hemorrhage or subdural hematoma in case of trauma due to very high blood pressure {treated by neurosurgery to withdraw this blood}.

- In case of cerebral stroke you don't give aspirin until you make sure there is no hematoma by doing a CT scan, because if the cause of the stroke is hematoma rather than ischemic cause, you only make things worse (bleeding is worsened).
- **Transient Ischemic Attack (TIA)** , AKA Mini-stroke : the symptoms here are same to stroke but they are transient (resolve within short time).

✚ Symptoms :

- ✓ The most common symptom of a stroke is sudden weakness or numbness of the face, arm or leg, most often on one side of the body.
 - ✓ Confusion
 - ✓ Difficulty speaking or understanding speech.
 - ✓ Difficulty seeing with one or both eyes.
 - ✓ Difficulty walking, dizziness, loss of balance or coordination (depending on where the stroke occurred: in cerebellum , cerebrum or great stem).
 - ✓ Severe headache with no known cause.
 - ✓ Fainting or unconsciousness.
- ✚ How to act in case of stroke?
(the doctor read the following picture)

STROKE is an Emergency.
Every minute counts.
ACT F.A.S.T!

	F ACE	Does one side of the face droop? Ask the person to smile.
	A RMS	Is one arm weak or numb? Ask the person to raise both arms. Does one arm drift downward?
	S PEECH	Is speech slurred? Ask the person to repeat a simple sentence. Is the sentence repeated correctly?
	T IME	If the person shows any of these symptoms, Call 911 or get to the hospital immediately.

"كل إنسان خلق له هدف وغاية، فإن عرفها يسر للخير وإن جهلها حرم التيسير"