VESSELS OF THE HEART

PR.M.D.EL AMRANI DR.CHAIMA KASSI

PLAN:

I. CORONARY ARTERIES

II. CARDIAC VEINS

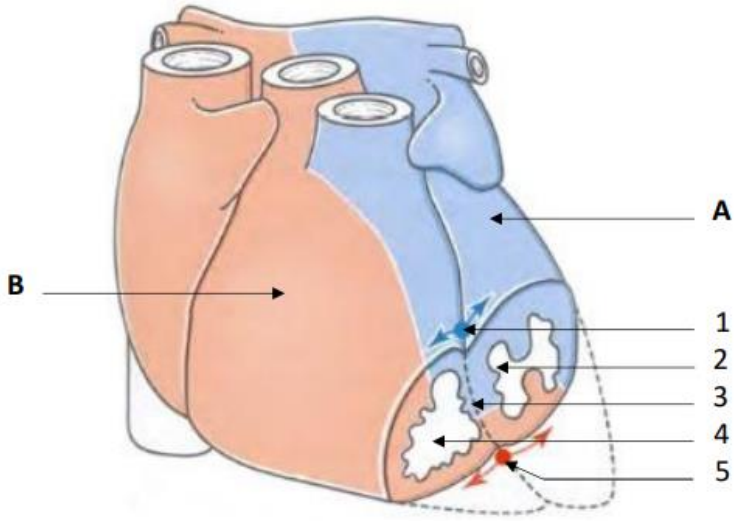
III. LYMPHATICS OF THE HEART

IV. CONCLUSION

I – CORONARY ARTERIES:

The arteries of the heart are called coronary arteries. We distinguish:

- The left or anterior coronary artery supplies most of the left ventricle and the interventricular septum.
- The right or posterior coronary artery supplies most of the right ventricle, the interatrial septum, the entire right atrium, and part of the left atrium.



A. Territory of the left coronary artery *(in blue)*
B. Territory of the right coronary artery *(in red)*

1. Anterior interventricular artery
2. Left ventricle
3. Interventricular septum
4. Right ventricle
5. Posterior interventricular artery

Vascular territories (anterior view)

1. Left coronary artery:

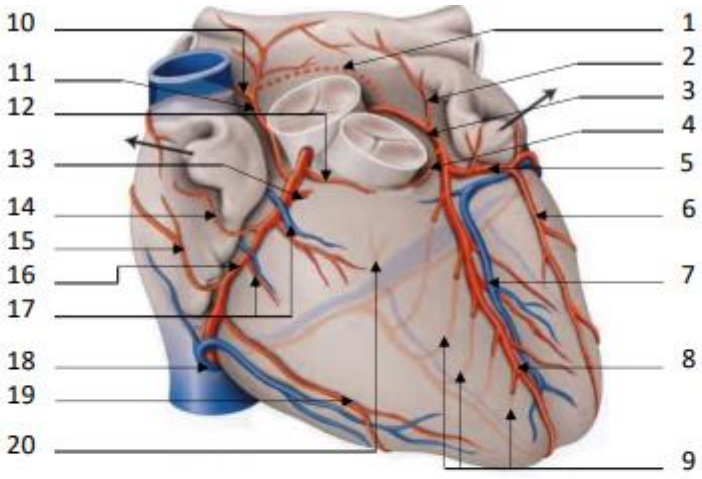
a. Origin – course:

– It arises from the aorta, just above the left semilunar valve.

– It runs through the sulcus separating the pulmonary artery from the left atrium and auricle. After a short course, it reaches the upper end of the anterior interventricular sulcus, where it divides into two terminal branches:

- the anterior interventricular artery

- and the circumflex artery.



1. Artery of the sinoatrial node *(inconstant)*
2. Left anterior atrial branch
3. Left coronary artery
4. Left branch of the conus arteriosus
5. Circumflex artery
6. Left marginal artery
7. Great cardiac vein
8. Anterior interventricular artery
9. Interventricular septal branches
10. Artery of the sinoatrial node
11. Right anterior atrial branch
12. Right branch of the conus arteriosus
13. Fatty artery
14. Right auricular branch
15. Right anterior atrial branch
16. Right coronary artery
17. Right anterior ventricular arteries & anterior cardiac veins
18. Small cardiac vein
19. Right marginal artery
20. Artery of the atrioventricular node

Vessels of the heart (anterior view)

b. Collateral branches:

The left coronary artery gives off multiple branches, including:

➢ Vascular branches :

- Intended for the adjacent walls of the aorta and the pulmonary artery.
- Among these branches, the left fatty artery stands out, which ramifies within the fatty layer located on the anterior surface of the pulmonary artery.

➢ The atrioventricular artery, or circumflex artery :

- This branch runs horizontally to the left and enters the atrioventricular sulcus.

- It terminates either at the posterior end of the interventricular sulcus, where it anastomoses with the right coronary artery, or on the inferior surface of the heart.
- It gives off:
    - The anterior left atrial artery, which in turn gives off branches to the left auricle, left atrium, interatrial septum, and the superomedial part of the right atrium. It supplies the Keith and Flack node.
    - The posterior left atrial artery, which distributes to the posterior surface of the left atrium.
    - The left marginal artery, which descends along the left surface of the ventricle.

➢ The anterior interventricular artery :

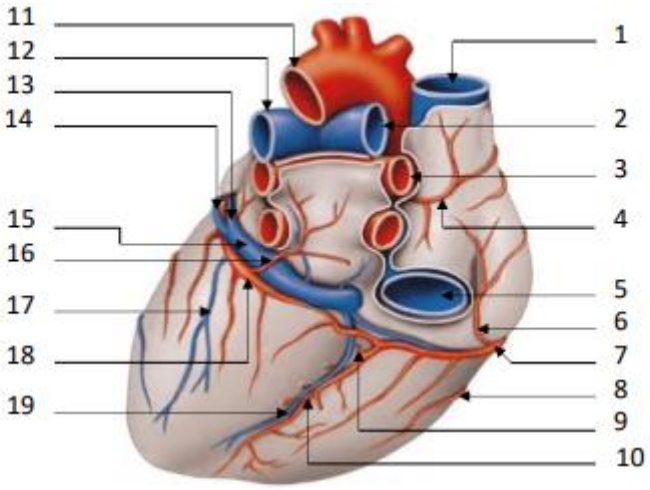
- It travels along the anterior interventricular sulcus down to the apex of the heart, which it curves around to reach the posterior interventricular sulcus, where it anastomoses with the right coronary artery.
- It gives off ventricular arteries:
    - Some extend to the right and left over the surface of the heart, then penetrate the ventricular wall at some distance from their origin.
    - Others, known as anterior septal arteries or anterior arteries of the septum, enter the heart wall immediately at their origin and supply the anterior two-thirds of the interventricular septum.

2. Right coronary artery:

a. Origin – course:

- This artery arises above the middle part of the right semilunar valve.
- It runs from back to front, between the pulmonary artery and the right auricle, then enters the right part of the atrioventricular sulcus.

– Upon reaching the posterior interventricular sulcus, it becomes the posterior interventricular artery and terminates a short distance from the apex of the heart, where it anastomoses with the left coronary artery.



1. Superior vena cava
2. Right pulmonary artery
3. Right superior pulmonary vein
4. Artery of the sinoatrial node
5. Inferior vena cava
6. Intermediate right atrial branch
7. Right coronary artery
8. Right marginal artery
9. Artery of the atrioventricular node
10. Posterior interventricular artery
11. Aorta
12. Left pulmonary artery
13. Oblique vein of the atrium
14. Great cardiac vein
15. Coronary sinus
16. Intermediate left atrial branch
17. Posterior vein of the left ventricle
18. Circumflex artery
19. Middle cardiac vein

Vessels of the heart (postero-inferior view)

b. Collateral branches:

The right coronary artery gives off, near its origin:

➢ Vascular branches :

To the walls of the aorta and the pulmonary artery, among which is the right fatty artery.

➢ Anterior atrial arteries :

– One of them, the largest, arises from the right coronary artery near its origin.
– It ascends and moves backward to enter the interatrial septum.

- It supplies this septum and the posterior surface of the right atrium.

➢ Atrial and ventricular branches :

- These arise within the atrioventricular sulcus.
- Among the atrial branches, the right marginal atrial artery can be distinguished.
- The most important of the ventricular branches is known, due to its course, as the right marginal artery of the heart.

➢ The posterior interventricular artery :

- In the posterior interventricular sulcus, the right coronary artery becomes the posterior interventricular artery.
- It gives off ventricular branches to both ventricles and posterior septal arteries to the septum.
- The first septal branch supplies the Tawara node.

c. Anastomoses :

The right and left coronary arteries are anastomosed in 50% of cases. These anastomoses are located:

- in the interventricular septum;
- in the posterior interventricular and atrioventricular sulci;
- at the apex of the heart;
- and around the pulmonary artery.

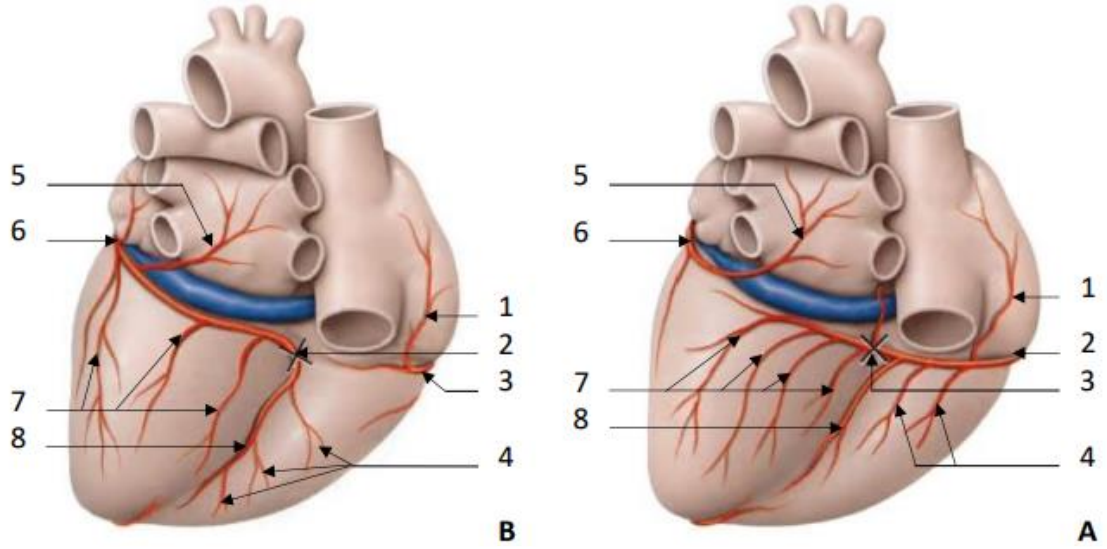
Note :

The anastomoses between the coronary arteries are not sufficient to establish collateral circulation in the event of an occlusion. These anastomoses, being of small calibre, are functionally ineffective, which is why the coronary arteries are considered end arteries.

d. Variations :

The distribution of the coronary arteries is variable. Additional aortic branches are frequently present.

In some cases, the heart may be supplied by a single coronary artery arising from the aorta.



A. Left type
B. Right type

1. Intermediate right atrial branch
2. Right coronary artery
3. Cardiac crux (cross of the heart)
4. Right ventricular branches
5. Intermediate left atrial branch
6. Circumflex artery
7. Left ventricular branches
8. Posterior interventricular artery

Posterior interventricular artery: variations (inferior view)

II – CARDIAC VEINS:

The venous system of the heart is very rich. The modes of drainage allow for the distinction of two groups of venous networks:

- The veins that open directly into the heart cavity.
- The coronary venous network.

1. The veins that open into the heart cavity:

Represented by:

a. The small cardiac veins or accessory cardiac veins :

- They arise from the anterior and right part of the right ventricle and open directly into the right atrium above the atrioventricular sulcus through openings called foramina.
- The most important of these veins is the right marginal vein of the heart, or the vein of Galen, which runs along the lateral border of the right ventricle and opens into the right atrium, at the base of the auricle.

b. The Thebesian veins:

- This name is given to small venules that originate from the walls of the heart and open into adjacent cavities through small openings or foramina of Lannelongue.
- The Thebesian veins are found in the walls of the atria and in the papillary muscles of the ventricles.

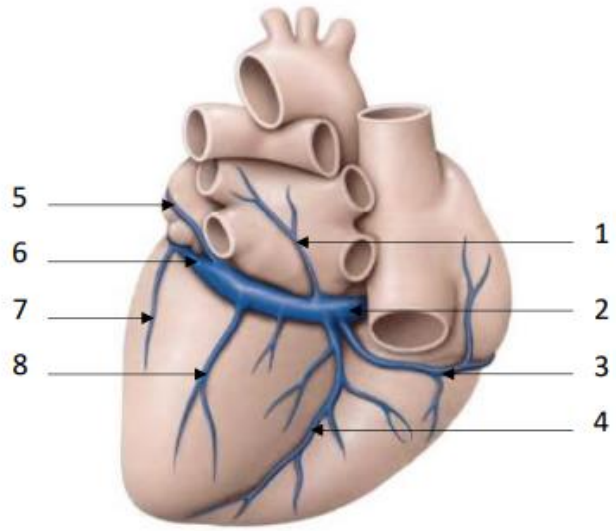
2. Coronary venous network:

a. The great cardiac vein:

It begins at the apex of the heart and runs along the anterior interventricular sulcus up to its upper end. It then curves to the left and enters the atrioventricular sulcus, traveling along this sulcus until it reaches the area near the inferior surface of the right atrium, where it terminates.

b. Coronary sinus:

- At its termination, the great cardiac vein suddenly increases in calibre.
- This terminal venous conduit, dilated and 3 cm in length, is called the coronary sinus.
- The coronary sinus, which has the Thebesian valve at its auricular opening, also has a second valve at its origin, at the junction with the coronary vein, known as the Vieussens valve. This crescent-shaped valve is located on the anterior surface of the venous trunk.
- The coronary sinus collects venous blood from almost the entire heart. It receives blood from:



1. Vein of the left atrium
2. Coronary sinus
3. Small cardiac vein
4. Middle cardiac vein
5. Oblique vein of the left atrium
6. Great cardiac vein
7. Left marginal vein
8. Posterior vein of the left ventricle

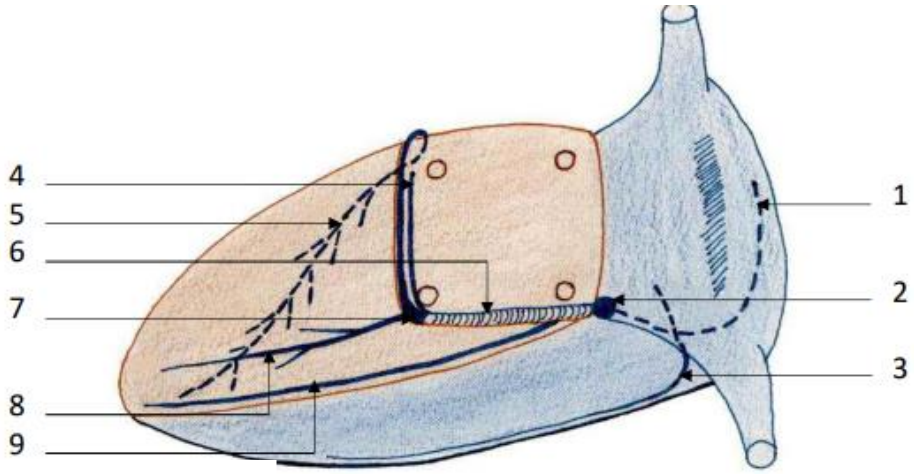
Veins of the heart (postero-inferior view)

➢ **The oblique vein of the left atrium or Marshall's vein :**

- Of small calibre, descends along the posterior surface of the left atrium, outside the left pulmonary veins, and terminates at the left end of the coronary sinus.
- At its lower end, near its opening into the coronary sinus, Marshall's vein raises a small fold of the pericardial serosa, known as the vestigial fold.

➢ **The left ventricular vein** runs along the inferior surface of the left ventricle.

- **The small coronary vein** runs along the right coronary artery on the lower part of the atrioventricular sulcus, from the right border of the heart to the terminal end of the coronary sinus.

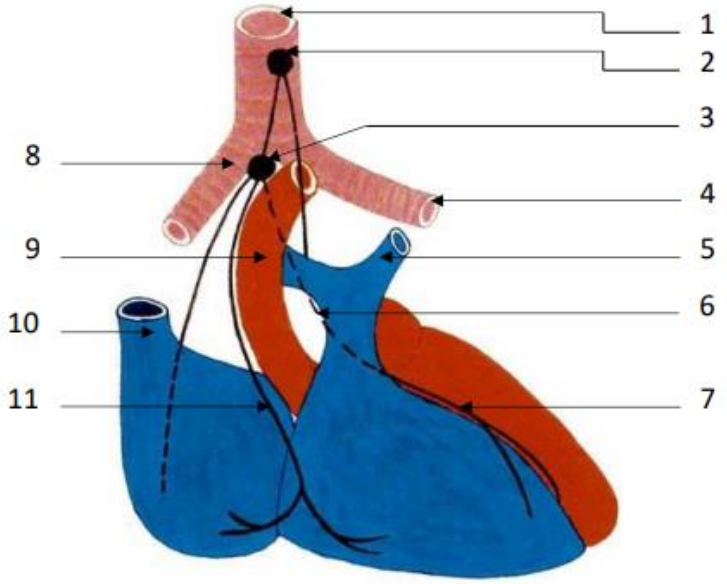


1. Small coronary vein
2. Thebesian valve
3. Right border vein
4. Oblique vein of the left atrium
5. Anterior interventricular vein
6. Coronary sinus
7. Vieussens' valve
8. Left border vein
9. Posterior interventricular vein

Schematic posterior view of the base of the heart showing the arrangement of the heart's veins

III – LYMPHATICS OF THE HEART :

- The surface of the heart is covered by a subpericardial lymphatic network, into which the networks of the myocardium and endocardium drain through the peri-arterial collectors.
- From the subepicardial lymphatic network, two main collecting trunks arise: one on the left and one on the right.



1. Trachea
2. Anterior mediastinal lymph node
3. Intertracheobronchial lymph node
4. Left main bronchus
5. Left pulmonary artery
6. Left efferent trunk
7. Interventricular collecting vessels
8. Right main bronchus
9. Aortic arch
10. Superior vena cava
11. Right efferent trunk (dorsal)

Schematic anterior view of the heart showing the lymphatic drainage pathways of the organ

1. The left anterior main collecting trunk:

It drains the left part of the network. It ascends, passing around the left side, then the posterior surface of the pulmonary artery, and terminates in an intertracheobronchial lymph node.

2. The right main collecting trunk:

Located in the right part of the network, it follows the right coronary artery in the atrioventricular sulcus, then ascends along the anterior surface of the aorta, along the interaortic-pulmonary sulcus, and terminates in a precervical lymph node of the anterior mediastinal chain.

IV – CONCLUSION:

In summary, the coronary arteries and their intricate network of venous and lymphatic systems play a vital role in the heart's function. The coronary arteries ensure the heart muscle receives the oxygen and nutrients it needs, while the veins and lymphatic vessels facilitate the removal of metabolic waste and maintain fluid balance. The understanding of these structures, including their variations and connections, is crucial for comprehending heart physiology and pathology, especially in cases of coronary disease or cardiac surgery.