Academic Year 2025–2026
University of Constantine 3.
Faculty of Medicine. Department of Medicine.
Laboratory of General Anatomy.
Course intended for second-year medical students.

BLOOD SUPPLY OF THE HEART

OBJECTIVES:

- To describe the origin, course, and termination of the coronary arteries.
- Identify the main branches and their territories.
- To describe the venous and lymphatic drainage of the heart.

COURSE OUTLINE:

1. Introduction
2. Arterial blood supply:
    - 2.1. Left coronary artery
    - 2.2. Right coronary artery
    - 2.3. Vascular territories
3. Venous blood supply:
    - 3.1. Coronary sinus system
    - 3.2. Deep venous system
4. Lymphatic drainage
5. Conclusion

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1. Introduction:

the arterial blood supply of the heart is supplied by the right and left coronary arteries, which are the first collateral branches of the ascending aorta. Their main trunks run within the coronary sulci, forming a crown around the base of the heart, hence the name coronary arteries. Their tortuous course allows adaptation of their length during the cardiac cycle.

Two systems are responsible for coronary venous return:

- A main system (coronary sinus system), which includes the superficial veins accompanying the coronary arteries.
- An accessory system, consisting of deep veins that drain directly into the cardiac chambers.

Lymphatic drainage is provided by two main lymphatic collectors that drain into the mediastinal lymph nodes.

2. Arterial blood supply:

The arteries of the heart are subject to considerable variations. We will describe the balanced pattern.

2.1. Left coronary artery:

Origin: It arises from the ascending portion of the aortic arch, in a dilated part called the aortic sinus (sinus of Valsalva). Its opening is located above the left anterolateral semilunar valve. This opening is the left coronary ostium.

Course: Its origin is short (3–4 cm). It runs anteriorly and to the left in a depression located behind the pulmonary trunk and in front of the anterior surface of the left atrium and left auricle.

NB: This is not a surgical segment.

Termination: Upon reaching the coronary sulcus, it bifurcates into two terminal branches:

- The anterior interventricular artery
- The atrioventricular artery (circumflex artery)

Collateral branch

- Left fatty artery of Vieussens, supplying the walls of the aorta and pulmonary artery.

Terminal branches:

➢ Anterior interventricular artery:

- It is highly tortuous. It runs along the anterior interventricular sulcus, crosses around the right border of the heart 2 cm medial to the apex of the heart, and terminates in the posterior interventricular sulcus.
- It gives collateral branches, **all** supplying the ventricles.
  - Parietal branches: They supply the right ventricle and, **mainly**, the left ventricle. The first two are large and are called the diagonal arteries.
  - Septal branches: There are 12 to 15 septal branches. They supply the anterior two-thirds of the interventricular septum.

➢ Atrioventricular artery (circumflex artery)

- It runs within the atrioventricular sulcus and terminates before the crux of the heart, on the inferior surface of the left ventricle.
- It gives two types of collateral branches:
  - Atrial branches: Generally, three branches: anterior, left lateral, posterior.
  - Descending ventricular branches: Anterior and posterior branches, as well as the lateral (marginal) artery, whose occlusion causes a lateral myocardial infarction.

2.2. Right coronary artery:

Origin: It arises from the ascending portion of the aortic arch, in the aortic sinus (sinus of Valsalva). Its opening is located above the right anterolateral semilunar valve. This is the right coronary ostium.

Course: It passes between the pulmonary artery and the right auricle, then runs along the right atrioventricular sulcus and subsequently passes through the inferior segment of the right atrioventricular sulcus.

Termination: Before reaching the crux of the heart, it bifurcates into two terminal branches:

- The inferior (posterior) interventricular artery.
- The left retroventricular artery.

Collateral branches:

- Several fatty and vascular branches supplying the arterial pedicle.
- Descending ventricular branches:
  - Right anterior branches.
  - Right lateral branch, particularly the right marginal artery, which runs along the right border of the heart.
  - Right inferior branches.

- Ascending atrial branches:
    - Right anterior atrial artery, generally supplying the sinoatrial node.
    - Right lateral atrial artery.
    - Right posterior atrial artery, inconstant.

Terminal branches:

➢ Inferior (posterior) interventricular artery:

- It runs within the inferior interventricular sulcus and terminates before reaching the apex.
- It gives two types of ventricular collateral branches:
- Parietal branches: Right and left inferior ventricular branches.
- Septal branches: There are 7 to 12 septal branches. They supply the inferior one-third of the interventricular septum.

➢ Left retroventricular artery:

- It runs within the posterior atrioventricular sulcus.
- It gives atrial branches, particularly branches to the atrioventricular node, and ventricular branches supplying the inferior surface of the left ventricle.

2.3. Vascular territories:

➢ **The left coronary artery supplies:**

- The left atrium and its auricle.
- The left ventricle.
- The part of the right ventricle adjacent to the anterior interventricular sulcus.
- The anterior two-thirds of the interventricular septum.
- The right branch of the atrioventricular bundle (bundle of His) and part of its left branch.

➢ **The right coronary artery supplies:**

- The right atrium and right auricle.
- The interatrial septum.
- The right ventricle.
- The part of the left ventricle adjacent to the posterior interventricular sulcus.
- The posterior one-third of the interventricular septum.
- Almost the entire **cardiac conduction system**: the sinoatrial node, atrioventricular node, trunk of the atrioventricular bundle (bundle of His), and part of its left branch.

3. Venous blood supply:

The venous vascularization of the heart is provided by two systems: a main superficial system (or coronary sinus system), which drains into the right atrium and an accessory intramyocardial system, which drains directly into the cardiac chambers.

3.1. Coronary sinus system:

It consists of the coronary sinus and its tributaries (afferent veins).

3.1.1. Coronary sinus

- It is a dilated venous segment (ampullary), 3 cm long and 1 cm wide.
- It is a continuation of the termination of the great cardiac vein.
- It occupies the terminal part of the left atrioventricular sulcus.
- It terminates on the inferior surface of the right atrium through a valved opening (**Thebesian valve**).

- It collects venous blood from almost the entire heart.

3.1.2. Tributaries of the coronary sinus

- **Great cardiac vein**: It is the main tributary.

Origin: It arises in the anterior interventricular sulcus, near the apex.
Course: It ascends within this sulcus, then turns to the left to join the left atrioventricular sulcus.
Termination: It terminates posteriorly in the coronary sinus, from which it is separated by the **valve of Vieussens**.
Collateral branches: Along its course, it receives collateral branches:

- Right and left ventricular veins.
- Left marginal vein.
- Veins of the interventricular septum.
- Veins of the left atrium and left auricle.

- **Other tributaries of the coronary sinus:** They are less important:

- Middle cardiac vein (inferior interventricular vein): runs within the posterior interventricular sulcus.
- Posterior veins of the left ventricle.
- Small cardiac vein (small coronary vein): runs within the inferior right coronary sulcus.
- Oblique vein of the left atrium, or vein of Marshall.

3.2. Deep venous system:

Two groups of intramyocardial veins drain directly into the cardiac chambers.

3.2.1. Anterior cardiac veins or small cardiac veins (Veins of Gallien)

They are located on the anterior surface of the right atrium and right ventricle. They open directly into the **right atrium**, the largest is the right marginal vein, which accompanies the right marginal artery.

3.2.2. Smallest cardiac veins (Thebesian veins)

They are tiny intramural venules, mainly located in the right side of the heart. They open into the four cardiac chambers through small openings.

4. Lymphatic drainage:

- The heart is drained by two deep lymphatic networks: a subendocardial network and an intramyocardial network.
- The two deep networks drain into the superficial subepicardial network.
- The subepicardial network is drained by two collectors: a main left collector and an accessory right collector.

Main left collector: It runs within the anterior interventricular sulcus, then passes around the pulmonary trunk and terminates in the inferior tracheobronchial lymph nodes, and then in the right lymphatic duct.

Accessory right collector: It runs within the right coronary sulcus, then passes along the anterior surface of the aorta and terminates in the prevascular lymph nodes, and then in the thoracic duct.

5. Conclusion:

The arterial vascularization of the heart is of the terminal type (with no collateral circulation). Obstruction of one of the arteries causes myocardial ischemia (myocardial infarction).

The **left coronary artery system** is called the **system of cardiac contraction**, because it supplies a large part of the myocardium of the heart.

The **right coronary artery system** is called the **conduction system**, because it supplies almost all components of the nodal tissue.

Knowledge of the coronary blood supply helps us understand the consequences of arterial obstruction, particularly myocardial ischemia and myocardial infarction.

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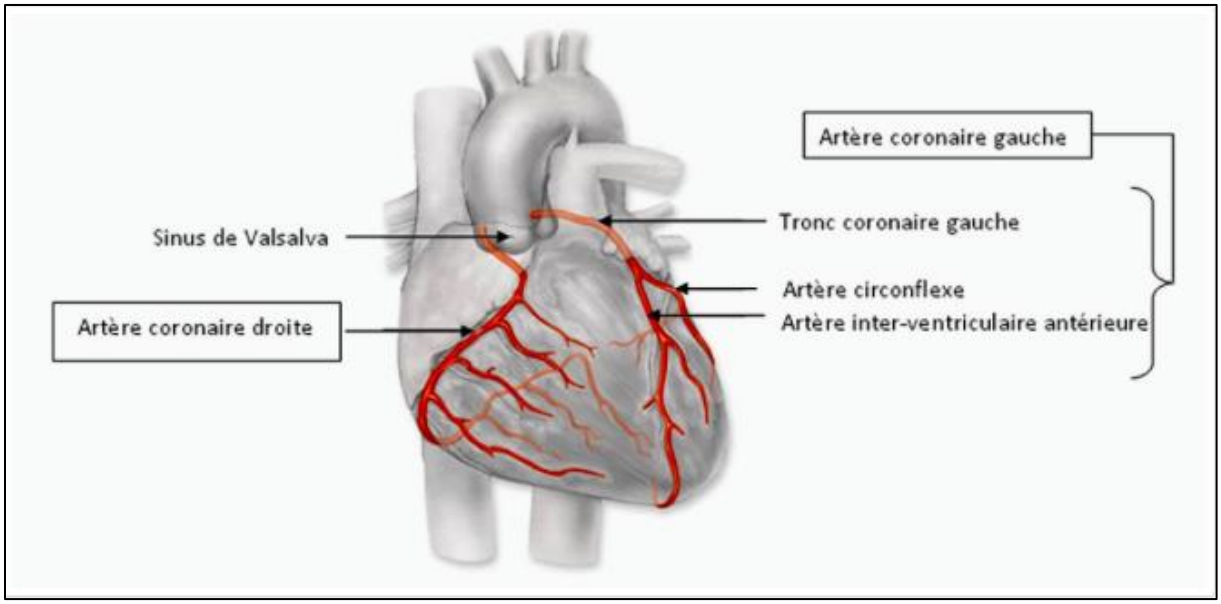


Figure 01: Arteries of the heart (ventral view)

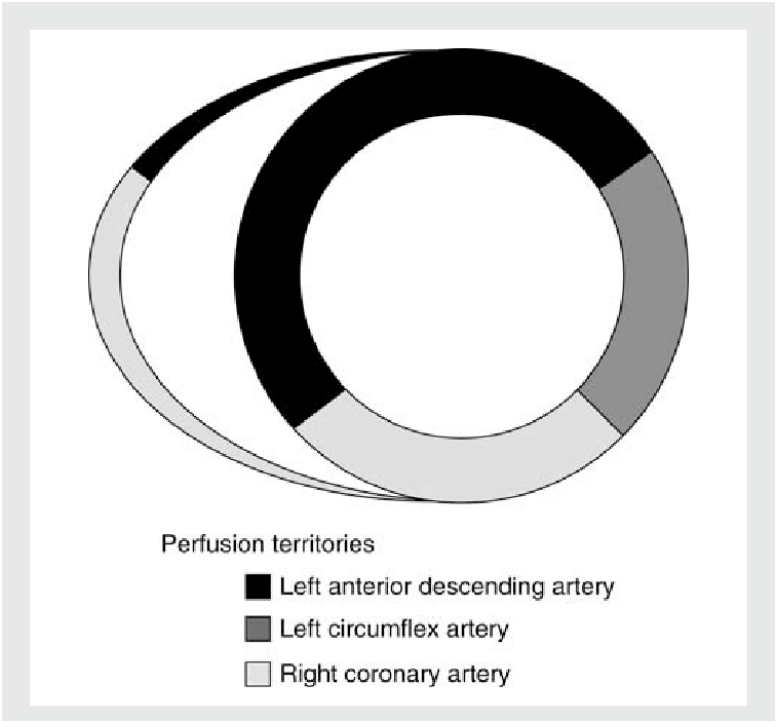
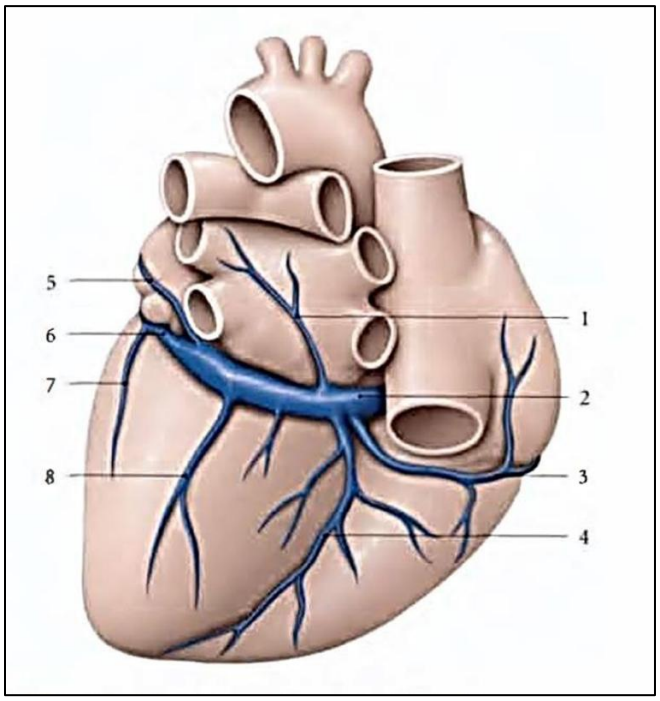
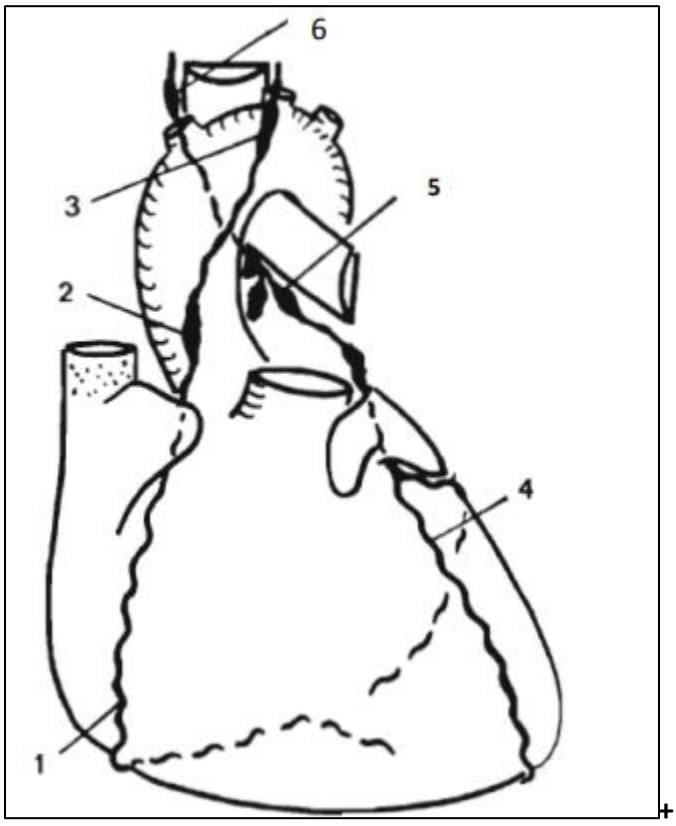


Figure 02: Vascular territories (schematic transverse section of the heart).



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

Figure 03: Veins of the heart (inferior view of the heart)



1. **Right accessory collector**
2. **Pre-aortic lymph node**
3. **Precarotid lymph node**
4. **Left main collector**
5. **Intertracheobronchial lymph node**
6. **Nodes of the right paratracheal chain**

Figure 04: Lymphatic vessels of the heart
(Ventral view)