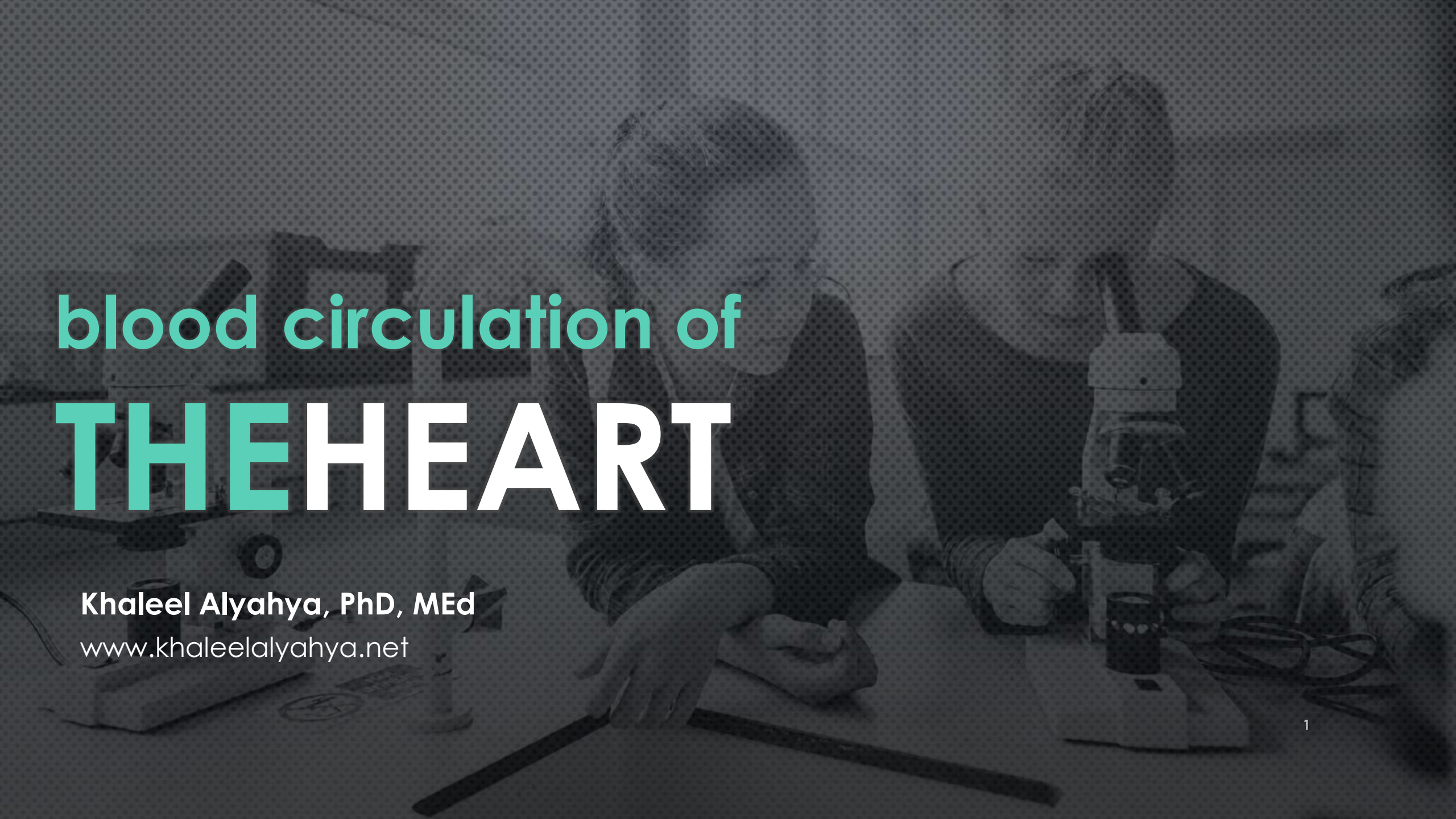

blood circulation of THE HEART

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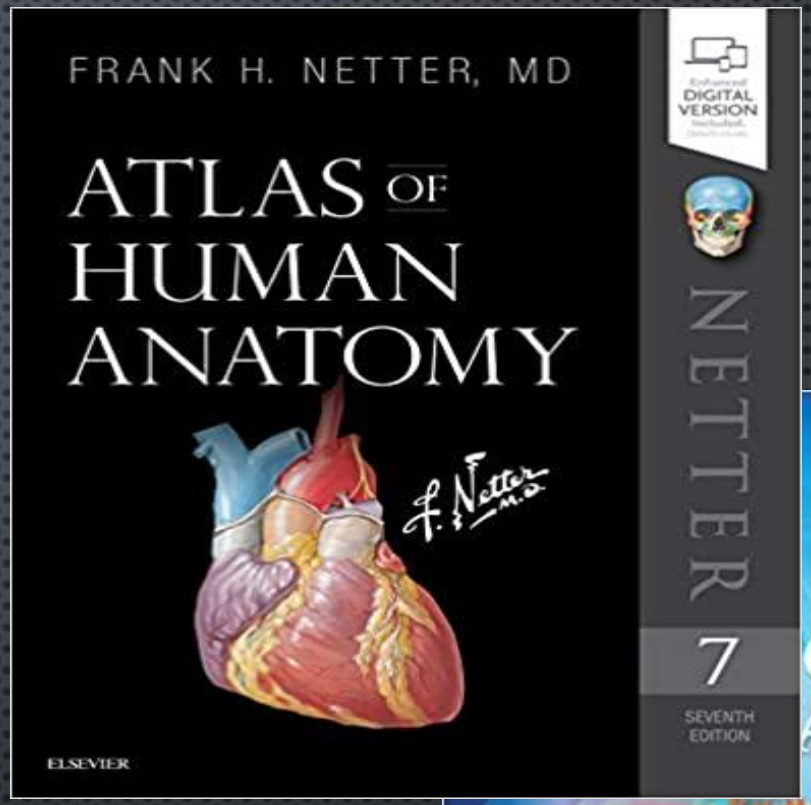
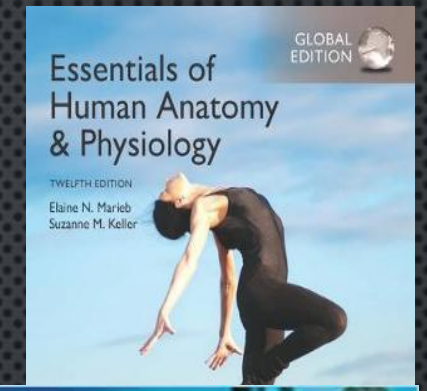
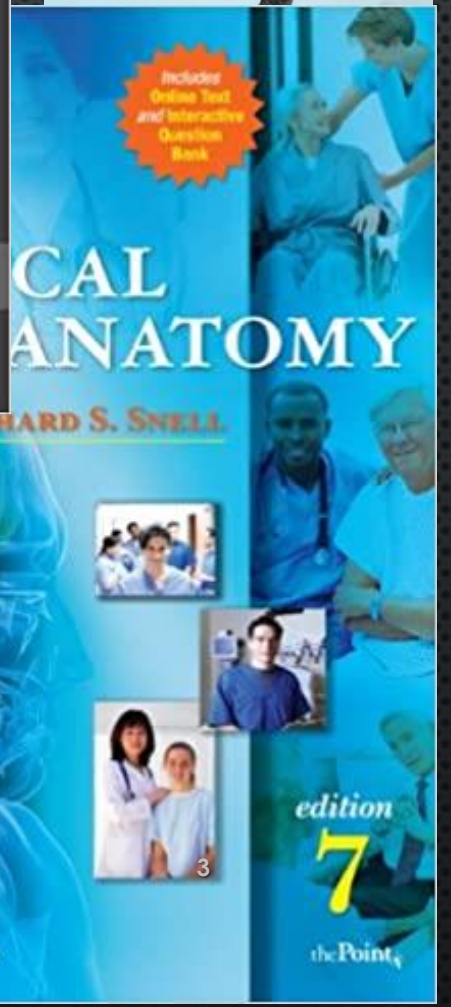
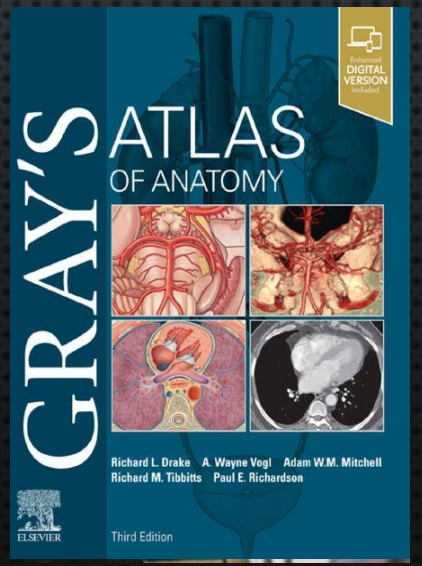
RESOURCES

- Essential of Human Anatomy & Physiology
- Atlas of Human Anatomy
- GRAY'S Atlas







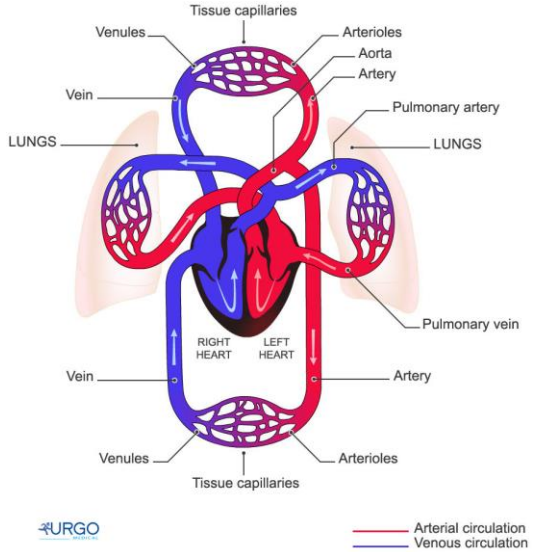


Objectives

- The arterial supply of the cardiac muscle regarding (origin, course, distribution and branches).
- The coronary anastomosis.
- The arterial supply to the conducting system of the heart.
- The venous drainage of the heart regarding (origin, tributaries and termination).
- Coronary artery disease, diagnoses and treatment.

Introduction

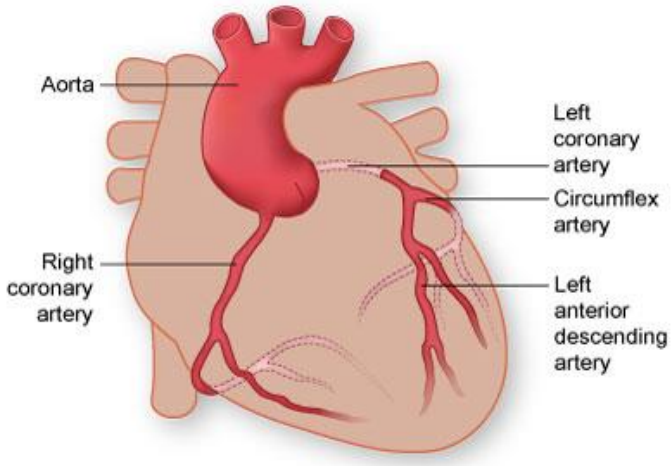
- The human heart is an organ that **pumps** blood throughout the body via the circulatory system.
- The blood **carries** oxygen, nutrients, cell wastes, hormones and many other substances vital for body homeostasis.
- The heart provides **forces** to move the blood around the body by the beating Heart.
- The coronary circulation refers to the vessels that **supply** and **drain** the heart.
- Coronary arteries are named due to the way they encircle the heart, much like a **crown**.



Arterial Supply

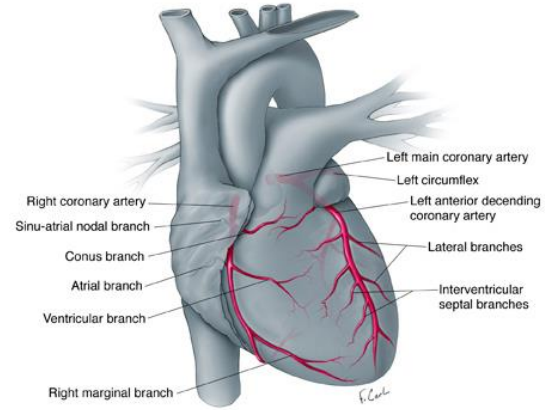
Introduction

- The arterial supply of the heart is provided by Two Coronary Arteries:
  - Right Coronary artery &
  - Left Coronary artery
- They are distributed over the cardiac surface, within the subepicardial connective tissue.
- They arise from the initial part of the ascending aorta (aortic sinuses), immediately above the aortic valve.
- The aortic sinuses are small openings found within the aorta behind the left and right flaps of the aortic valve.
- The aortic valve has three semilunar cusps, also known as the **sinuses of Valsalva**
- When the heart is relaxed, the back-flow of blood fills these valve pockets, therefore allowing blood to enter the coronary arteries.



Right Coronary Artery

- Arises from the **anterior aortic cusp** of the ascending aorta.
- Descends in the **right atrioventricular groove** between the right auricle and the pulmonary trunk.
- At the inferior border of the heart, it continues posteriorly to anastomose with the **left coronary**.
- It supplies the followings:
  - Right atrium
  - Right ventricle
  - Part of left atrium
  - Left ventricle and atrioventricular septum
  - Most of conducting system



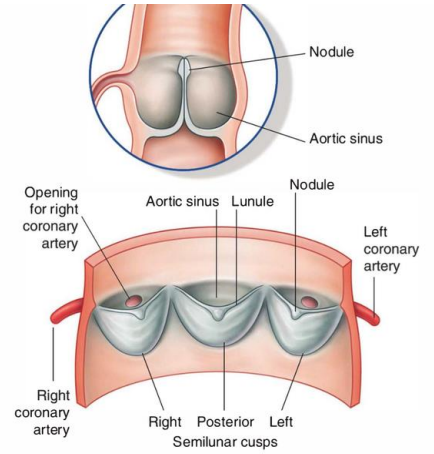
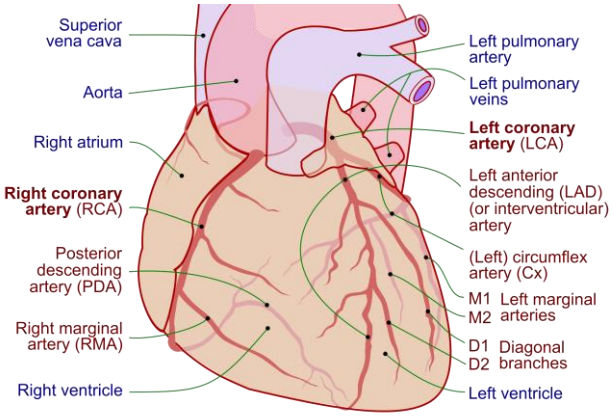
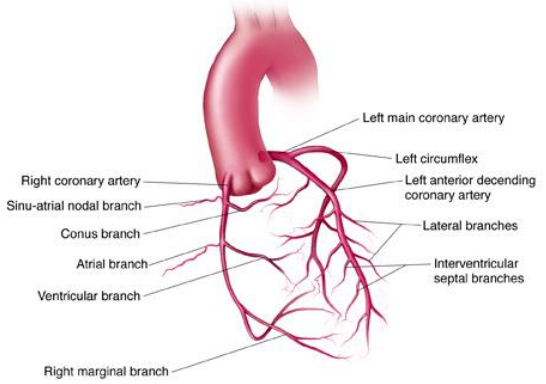


Fig. 3.68 Anterior view of the aortic valve.

Branches of RCA

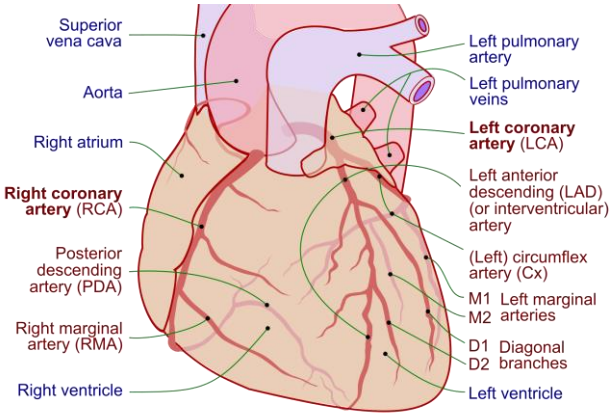
- Right Conus artery
  - Sometimes, it is called conus arteriosus branch
  - For infundibulum and upper part of anterior wall of the right ventricle.
- Right anterior ventricular branches
  - 2-3 branches supply anterior surface of the right ventricle.
- Atrial branch
  - Supply anterior and lateral surfaces of the right atrium.
  - One branch supplies posterior surface of both atria.
- Right marginal artery
  - It is the largest branch, runs along the lower margin of the sternocostal surface.
  - It is accompanied by the Small Cardiac vein.

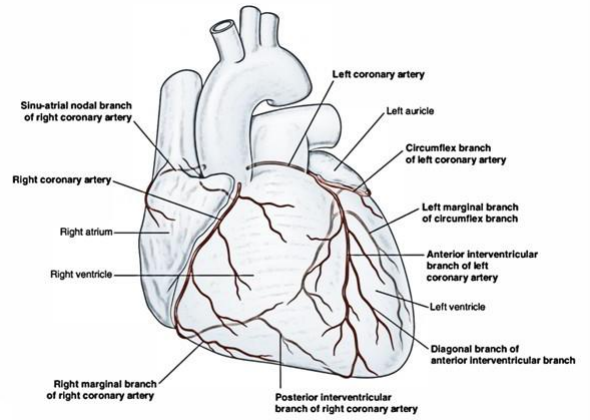




Branches of RCA

- Artery of the Sinoatrial Node
  - Supplies the SAN and both atria.
  - In 35% it arises from the left coronary.
- Posterior ventricular branches
  - About 2 supply the diaphragmatic surface of the right ventricle.
- Posterior Interventricular (descending) artery
  - Accompanied by middle cardiac vein.
  - Lies in the posterior interventricular groove.
  - It supplies the right and left ventricles, including their inferior wall, posterior part of ventricular septum.





Left Coronary Artery

- The largest of the two coronary arteries.
- Arises from the left **posterior aortic cusp** of the ascending aorta.
- Descends:
  - Between the pulmonary trunk and the left auricle.
  - Run in the atrioventricular groove and then down to the apex of the heart.
  - Divides into two terminal branches:
    - Anterior Interventricular artery.
    - Circumflex artery.
    - Left Marginal artery

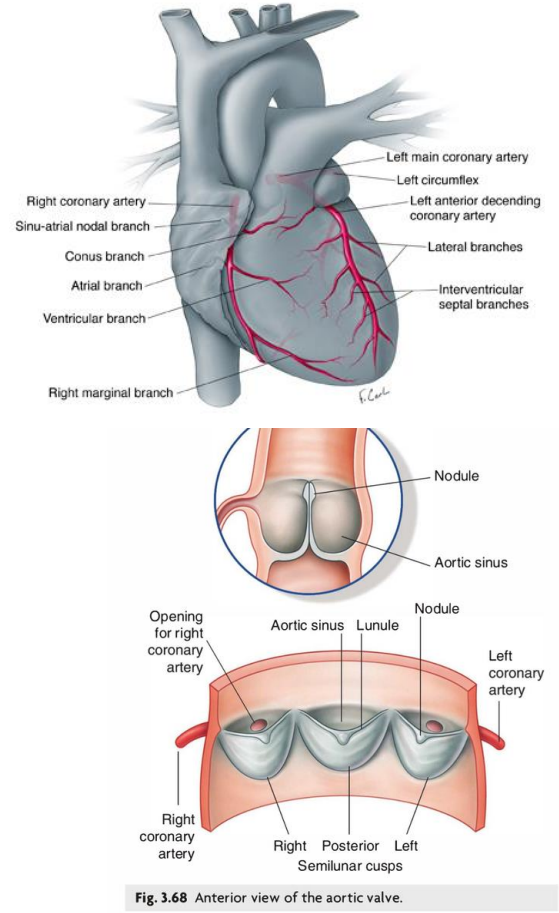
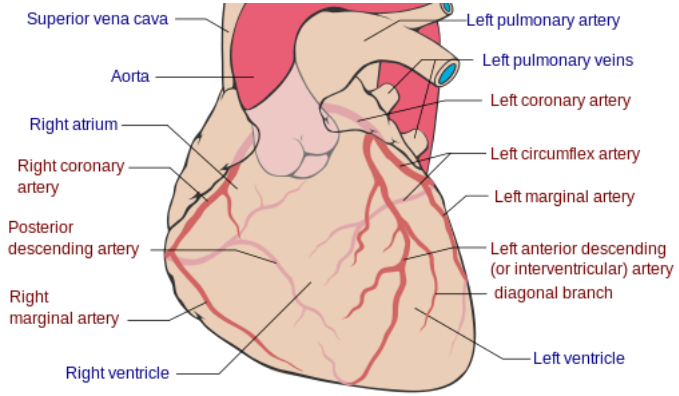
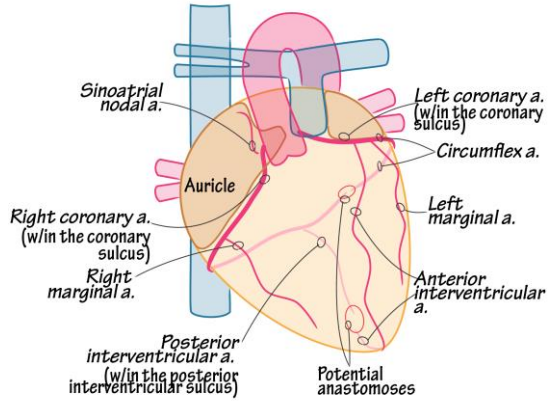


Fig. 3.68 Anterior view of the aortic valve.

Branches of LCA

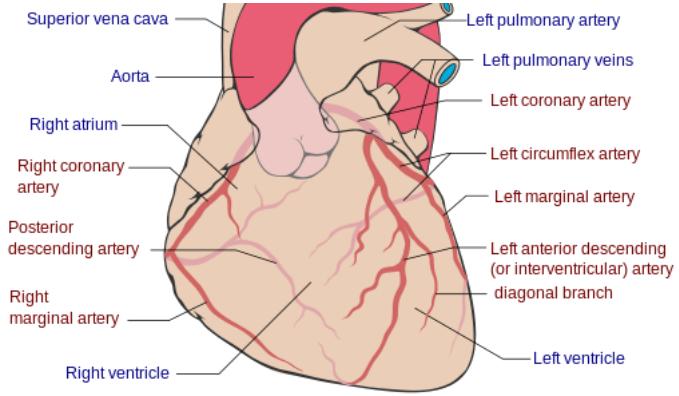
- **Anterior Interventricular Artery**
  - Descends in the anterior interventricular groove to the apex of the heart (accompanied by the great cardiac vein).
  - In most individuals, it passes around the apex to anastomose with terminal branches of the right coronary.
  - It supplies the right and left ventricles and anterior part of ventricular septum.
  - It gives:
    1. Left conus artery for pulmonary conus.
    2. Anterior ventricular and posterior ventricular.
       - Supply left ventricle.
    3. Atrial branches.
       - Supply greater part of left atrium.
    4. Left diagonal artery
       - One of the ventricular branches or may arises from left coronary.

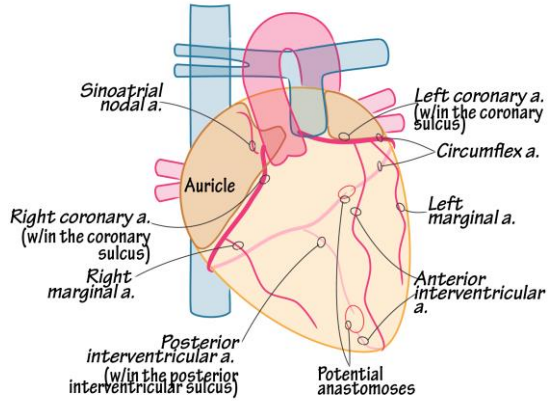




Branches of LCA

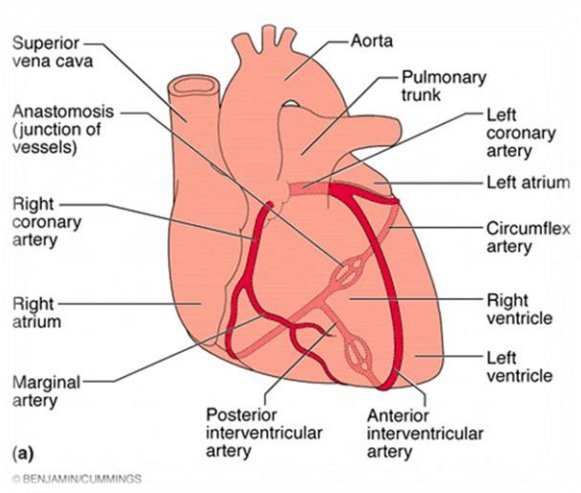
- **Circumflex Artery**
  - Winds around the left margin of the heart in the atrioventricular groove.
- **Left Marginal artery**
  - Supplies the left margin of the left ventricle down to the apex.





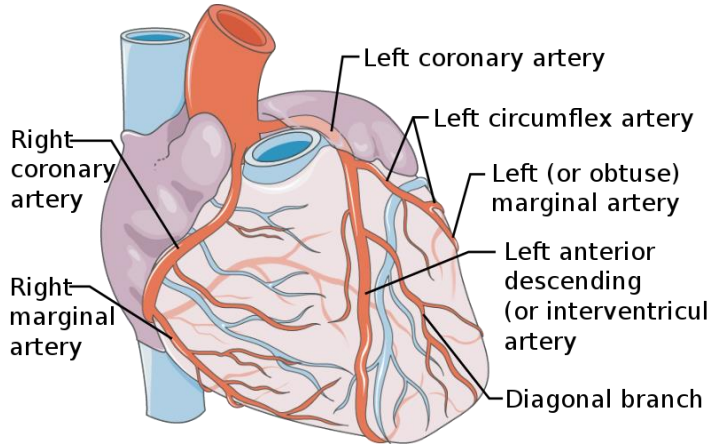
Variations of the Coronary Arteries

- Right Dominance:
  - In (90%) of population, the **posterior interventricular artery** is a branch of the **right coronary artery**.
- Left Dominance:
  - In the rest (10%), the **posterior interventricular artery** arises from the **circumflex branch** of the **left coronary artery.**



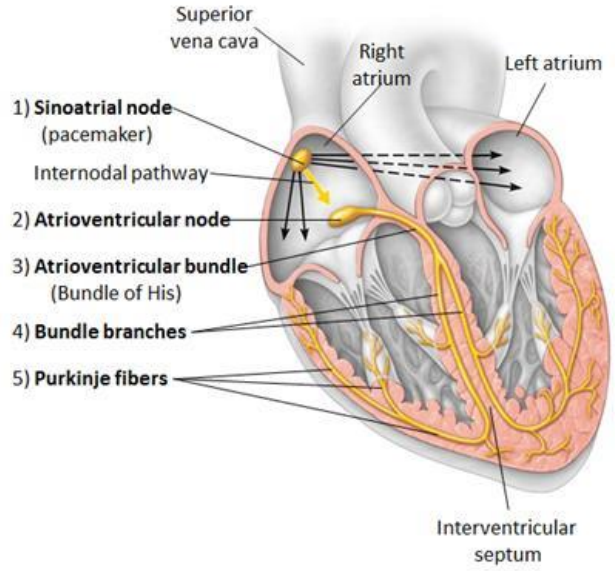
Variations of the Coronary Arteries

- In most people, the terminal branches of the right and left coronaries anastomose in the posterior part of the **interventricular groove**.
- However, this anastomoses is not large enough to provide adequate blood supply in case of **coronary occlusion.**



Arterial Supply of Conducting System

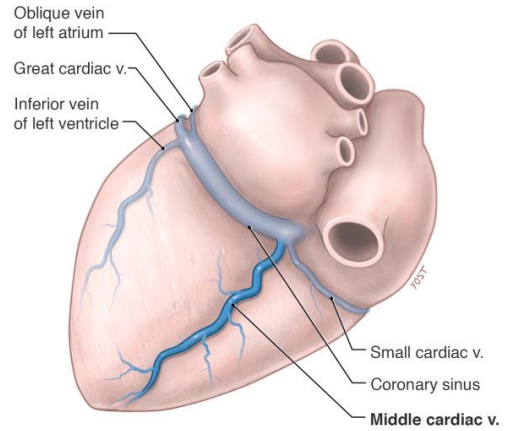
- Sinoatrial node (SAN), atrioventricular node (AVN) and atrioventricular bundles (AVB) are usually supplied by **right coronary**.
- Right bundle branch (RBB) of atrioventricular bundles is supplied by **left coronary**.
- Left bundle branch (LBB) of atrioventricular bundles is supplied by both **right** and **left coronary arteries**.

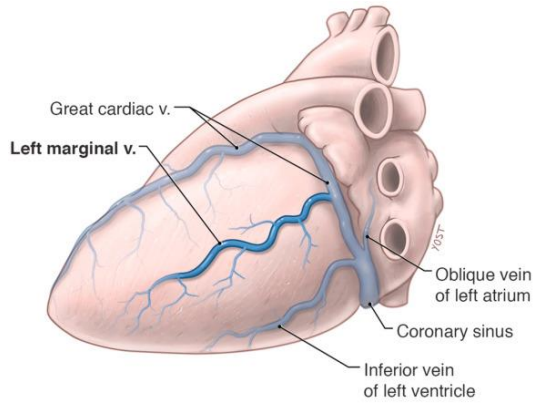


Venous Drainage

Coronary Sinus

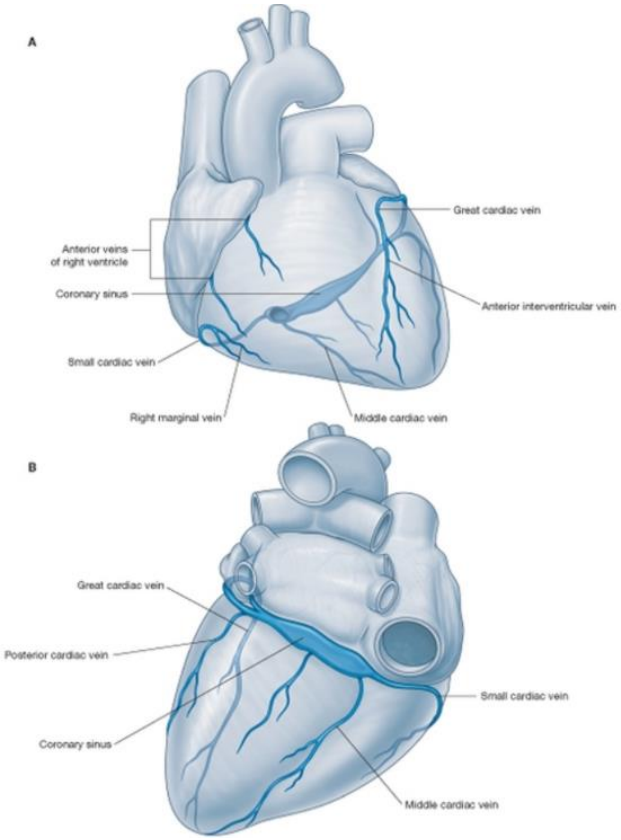
- The main vein of the heart.
- It lies in the posterior part of the **atrioventricular groove**.
- Drains most of the venous blood of the heart.
- Origin:
  - It is the direct continuation of the Great Cardiac Vein.
- Tributaries:
  - Great cardiac vein
  - Middle cardiac vein
  - Small cardiac vein
  - Oblique vein of left atrium (vein of Marshall).
- Termination:
  - It empties into right atrium.
  - Its opening is inferior and to the left of the IVC opening.
  - It is guarded by a valve.





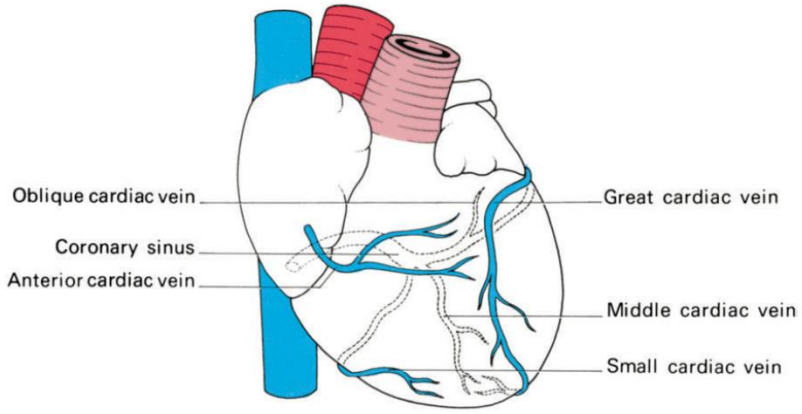
Cardiac Veins

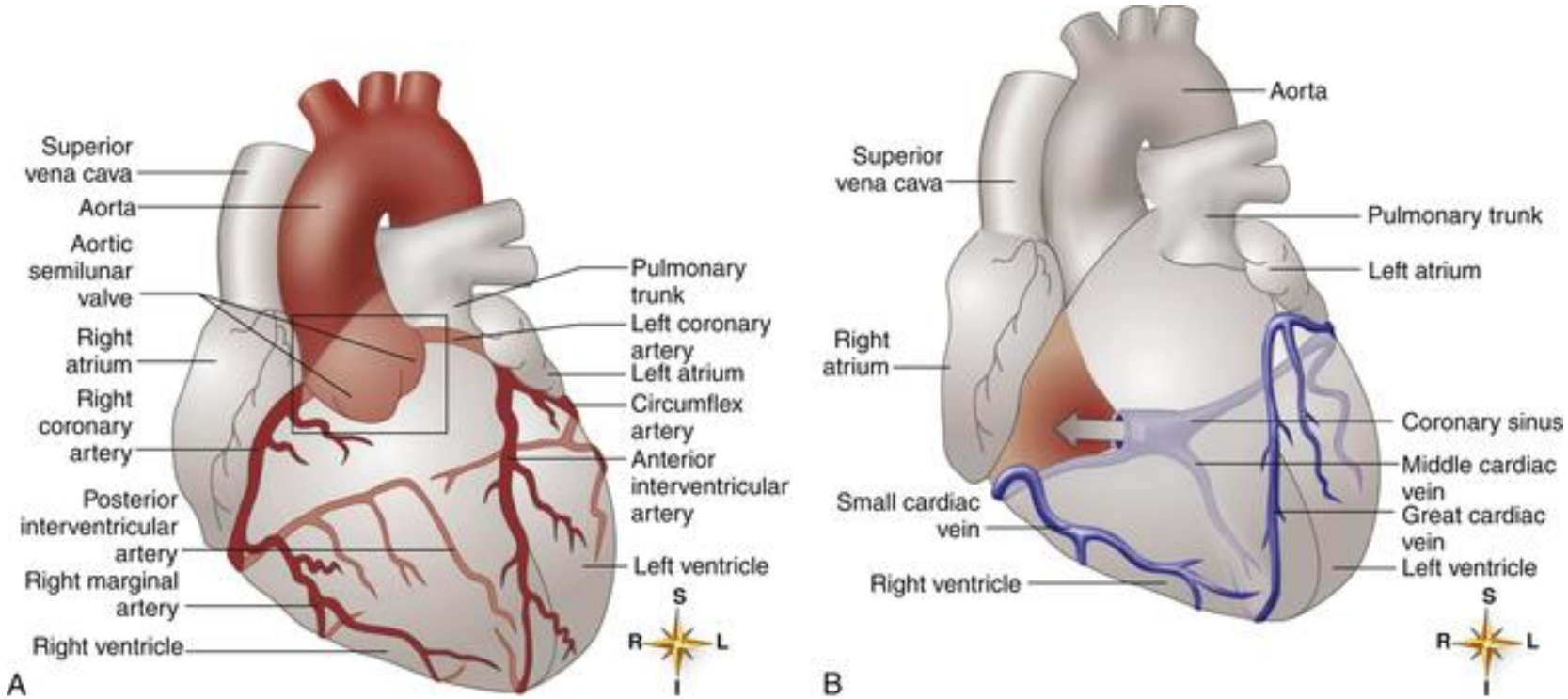
- Great cardiac vein
  - The main tributary of coronary sinus.
  - It originates at the apex of the heart and follows the anterior interventricular groove into the coronary sulcus and around the left side of the heart to join the coronary sinus.
- Middle cardiac vein
  - Located on the posterior surface of the heart.
  - Drains the right side of the heart.
- Small cardiac vein
  - Located on the anterior surface of the heart.
  - It passes around the right side of the heart to join the coronary sinus.
- The final two cardiac veins
  - Left marginal vein on the left posterior side.
  - Left posterior ventricular vein which runs along the posterior interventricular sulcus to join the coronary sinus.



Veins Draining Outside Coronary Sinus

- Anterior cardiac veins
  - Open directly into the right atrium.
- Venae Cordis minime (small cardiac veins)
  - Open into the heart chambers.

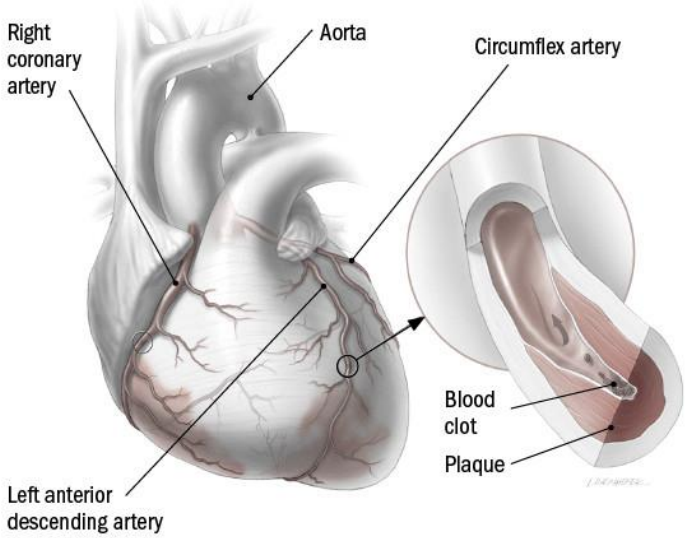



Superior vena cava
Aorta
Aortic semilunar valve
Right atrium
Right coronary artery
Posterior interventricular artery
Right marginal artery
Right ventricle
Pulmonary trunk
Left coronary artery
Left atrium
Circumflex artery
Anterior interventricular artery
Left ventricle
S
R
L
I
A
Aorta
Superior vena cava
Pulmonary trunk
Left atrium
Right atrium
Coronary sinus
Middle cardiac vein
Small cardiac vein
Great cardiac vein
Left ventricle
Right ventricle
S
R
L
I
B


Clinical Notes

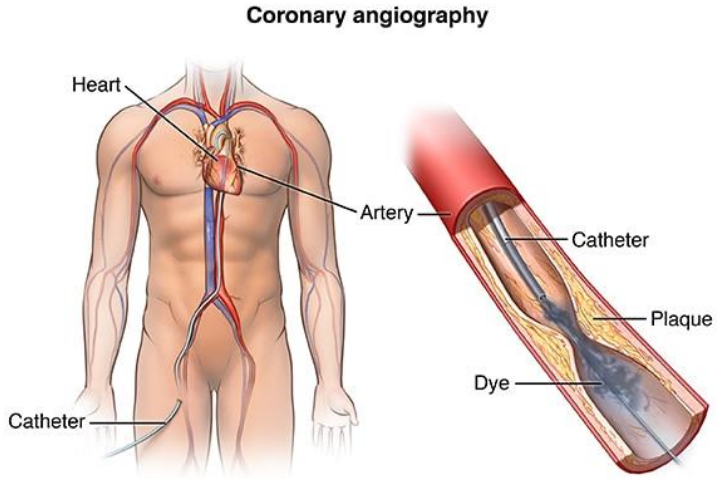
Coronary Artery Disease

- It is also called **coronary heart disease**
- It occurs when the arteries that supply blood to heart muscle (the coronary arteries) become hardened and narrowed.
- This is due to **atherosclerosis** which is the buildup of cholesterol-rich **plaque** on the inner walls of the vessels.
- Hardened plaque narrows the coronary arteries and reduces the flow of oxygen-rich blood to the heart.
- This reduced blood supply to the heart muscle is called **ischemia**.
- When the heart muscle doesn't get enough blood, chest pain known as **angina** may occur.
- Angina is the most common symptom of CAD.
- As the disease progresses, CAD can lead to ischemic heart disease.
- CAD may also result in **myocardial infarction.**



Diagnose and Treatment

- A blockage in a coronary artery can be rapidly identified by performing a coronary **angiogram**.
- The imaging modality involves the insertion of a **catheter** into the aorta via the femoral artery.
- A contrast dye is injected into the coronary arteries and x-ray based imaging is then used to visualise the coronary arteries and any blockage that may be present.
- Immediate treatment of a blockage can be performed by way of a coronary angioplasty, which involves the inflation of a balloon within the affected artery.
- The balloon pushes aside the atherosclerotic plaque and restores the blood flow to the myocardium.
- The artery may then be supported by the addition of an intravascular stent to maintain its volume.



QUESTIONS?

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