SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)

Approved by AICTE & Affiliated to Anna University
Accredited by NBA & Accrediated by NAAC with 'A+' Grade,
Recognized by UGC saravanampatti (post), Coimbatore-641035.

Department of Biomedical Engineering

Vision Title 2 Vision Title 3

Course Name: 19BMT201 Anatomy & Physiology

II Year : III Semester

Unit III- Cardiovascular System

Topic : Heart Conduction system & Cardiac Cycle

-Blood circulation to the heart muscles is called coronary circulation

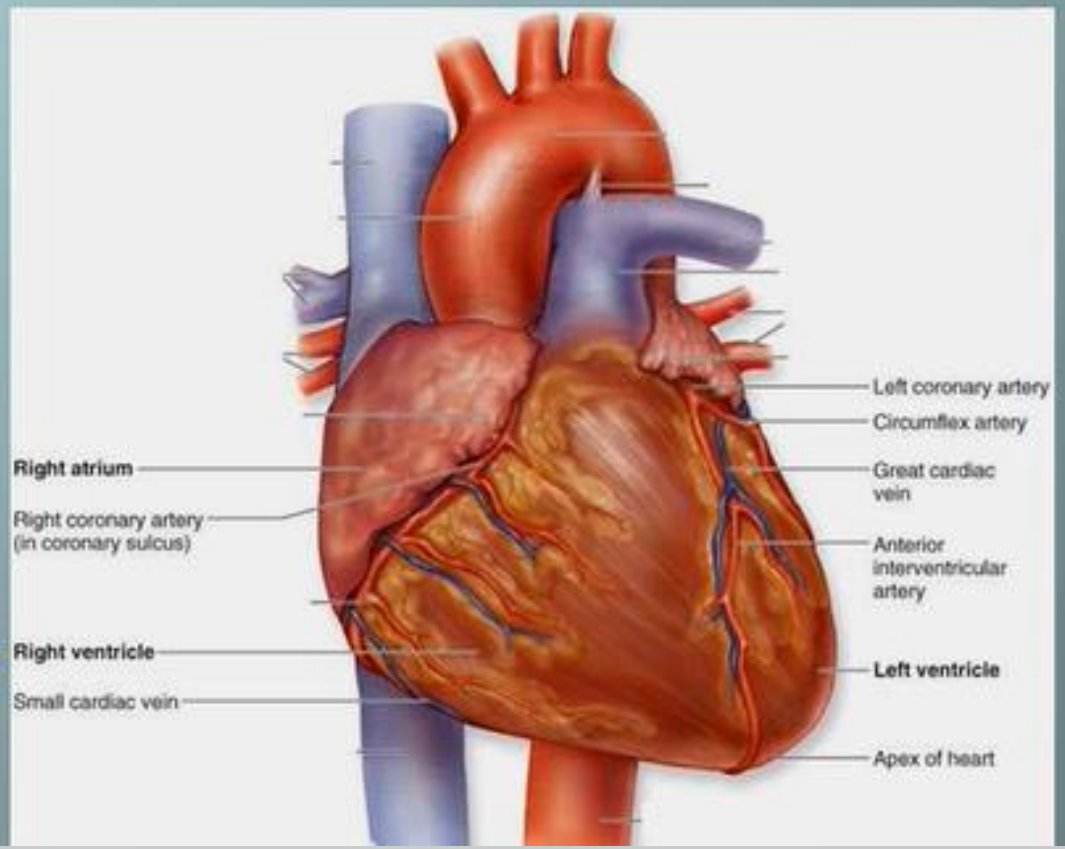
-through coronary vessels

I. ARTERIAL SUPPLY

-Two coronary arteries

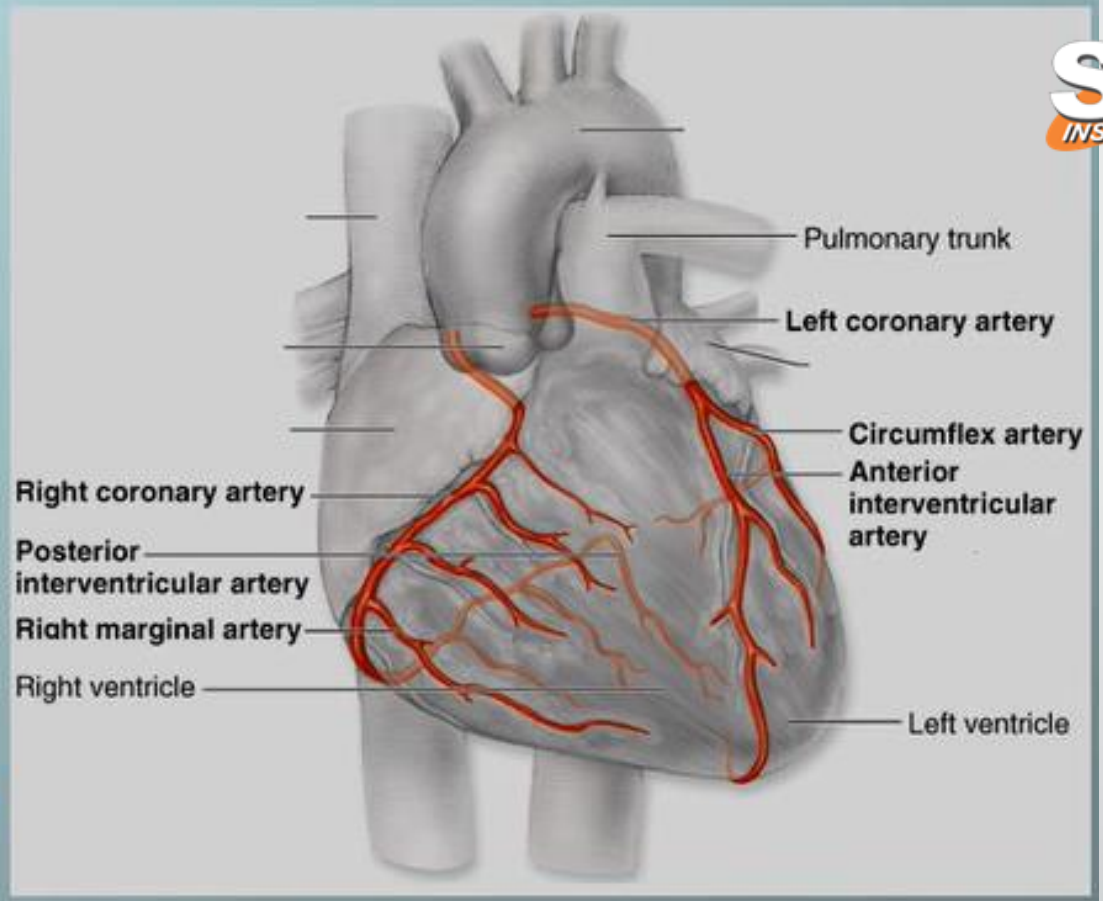
1. Right Coronary artery and
2. Left Coronary artery

-both arteries arise from the root of ascending aorta



1. Right Coronary artery

Traverses in the right AV sulcus, gives a marginal branch & runs to the posterior side & continues as posterior interventricular artery



Areas supplied:

-right atrium

-greater part of right ventricle

-small part of left ventricle

-posterior part of inter-ventricular septum

-major portion of conducting system including SA node

2. Left Coronary artery

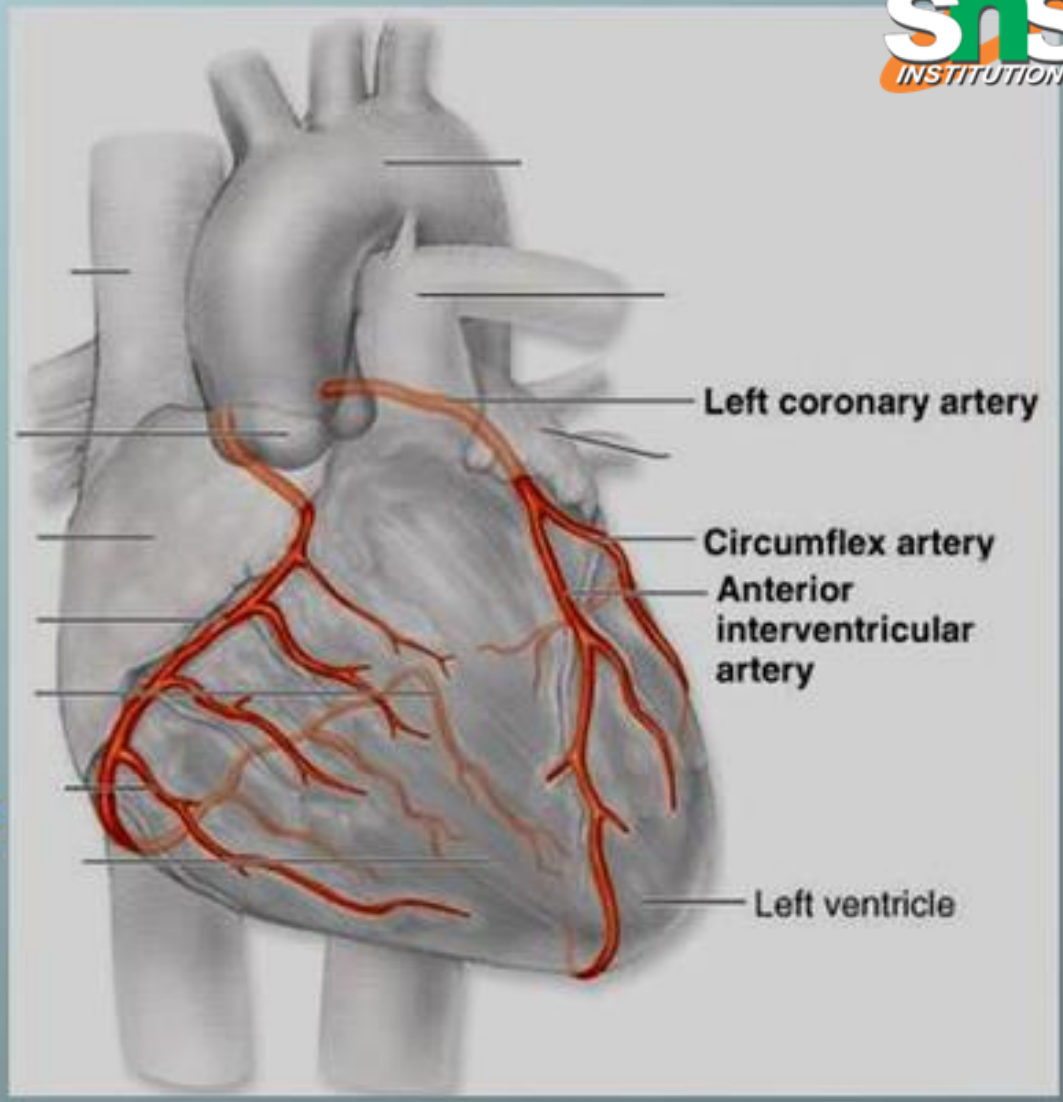
Divides into two main branches

i. Anterior descending branch or anterior interventricular artery

-reaches the apex of the heart.
-gives many septal branches

ii. Left circumflex branch

-runs in the A-V groove and proceeds as posterior descending branch



2. Left Coronary artery

Areas Supplied:

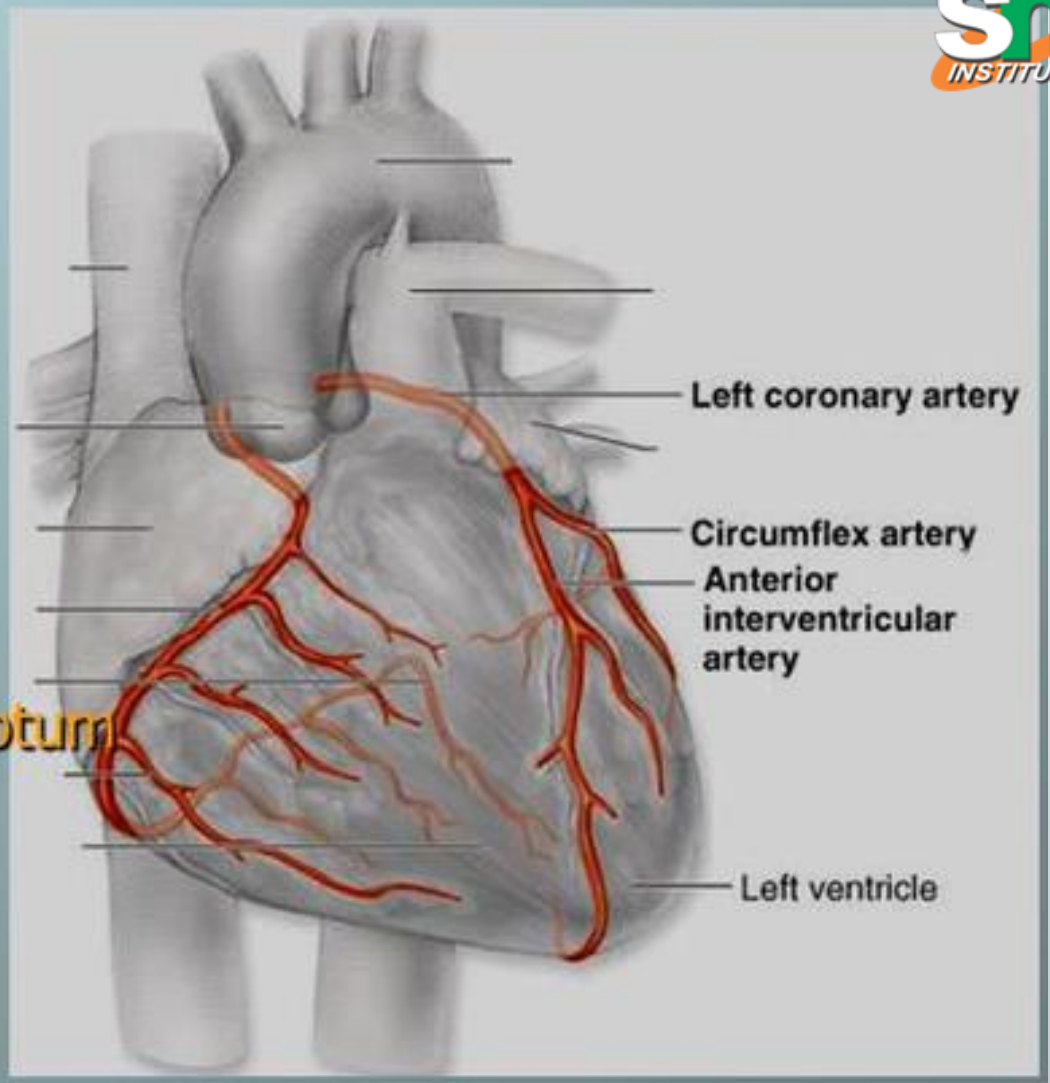
-left atrium

-greater part of left ventricle

-small part of right ventricle

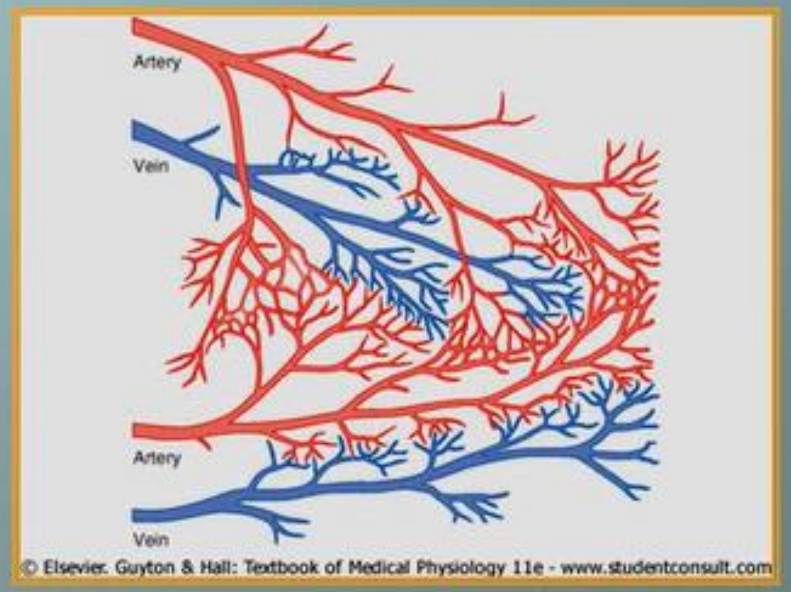
-anterior part of inter-ventricular septum

-part of bundle of His



- Normally coronary arteries do not overlap in supply
- Still functional anastomosis is present which becomes active in ischemic heart diseases

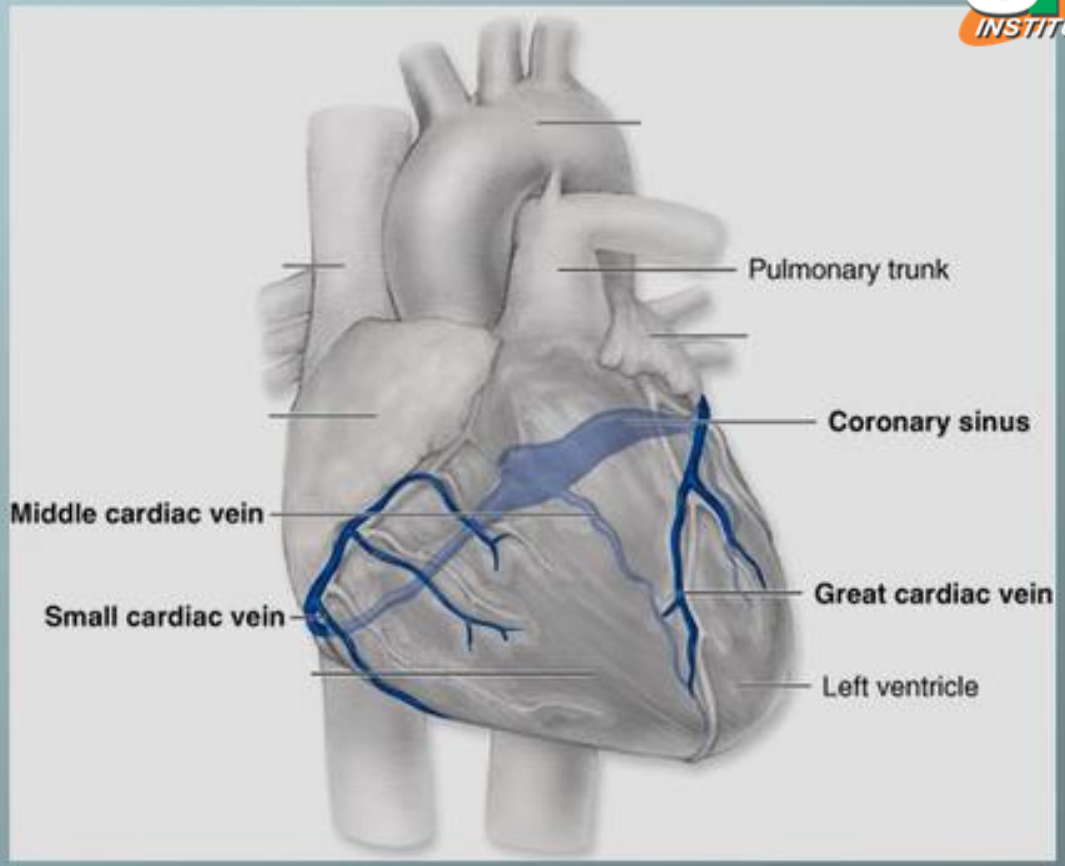
- Two types of anastomosis:
  - Cardiac anastomosis
    - coronary arteries & arteries or
    - coronary arteries & veins.
  - Extra cardiac anastomosis
    - anastomosis between coronary arteries and vessels outside the heart (eg: between coronary arteries & pulmonary arteries)



II. VENOUS DRAINAGE

- Venous drainage is by three types of veins

1. Coronary sinus
   - -largest vein draining 75% of coronary flow
   - -Great cardiac vein, Middle cardiac vein & Small cardiac vein
   - -opens into right atrium
2. Anterior coronary veins
   - -drain right of heart & open into right atrium
3. Thebesian veins (Venae Cordis Minimae)
   - -drains blood from myocardium into concerned chambers



Coronary sinus & tributaries

Normal coronary blood flow

- 200 – 250 ml/minute
- forms 4 to 5% of total cardiac output

Measurement of coronary blood flow

- Kety Method or Nitrous Oxide Technique
  - -based on Fick's Principle
- Doppler Flow Meter
- Coronary Angiography
  radio nucleotide die is injected

PHASIC CHANGES IN CORONARY BLOOD FLOW

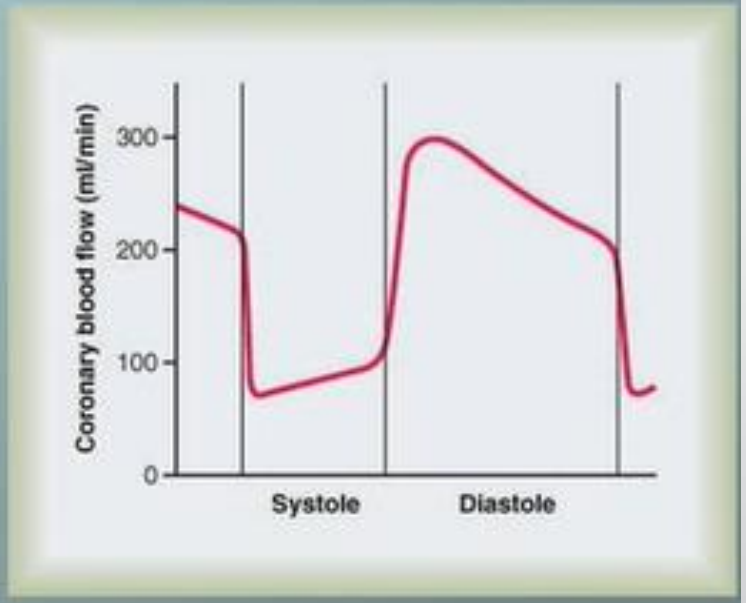
-*Effect of cardiac muscle compression*

Blood flow through coronary arteries is not constant
It decreases during systole & increases during diastole

During systole, arteries are compressed which decreases coronary blood flow

During diastole, compression is released which increases blood flow

↑ aortic pressure causes ↑ coronary blood flow



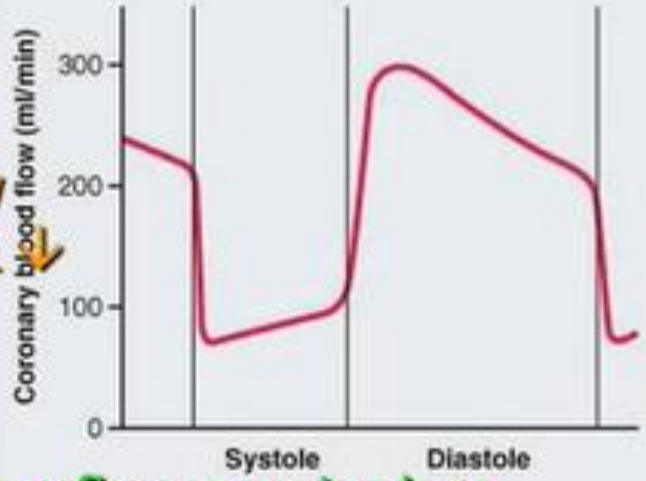
PHASIC CHANGES IN CORONARY BLOOD FLOW

-*Effect of cardiac muscle compression*

Blood flow in individual ventricles

1. Left Ventricle

During onset of isometric contraction, blood flow sharply declines due to ↑ myocardial pressure & ↓ aortic pressure



During ejection phase, aortic pressure ↑. Coronary flow remains less

During onset of diastole, blood flow ↑ due to ↓d myocardial pressure

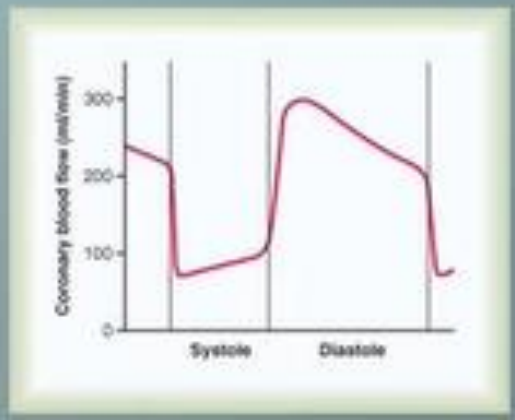
PHASIC CHANGES IN CORONARY BLOOD FLOW

-*Effect of cardiac muscle compression*

Blood flow in individual ventricles

2. Right Ventricle

Some flow occurs as force of contraction is not as severe as in left ventricle



Factors affecting Coronary Blood Flow

Autoregulation

Coronary blood flow is mainly dependent on vascular response

Regulated by the following factors:

1. Oxygen demand

- most important factor
- 70-80% of oxygen is absorbed from the blood

2. Metabolic factors

- release of metabolic products during hypoxia results in vasodilatation
- metabolic products:
    - mainly adenosine (ATP → ADP → Adenosine)
    - K^+, H^+, CO_2, adenosine phosphate compounds

3. Neural regulation

DIRECT EFFECT

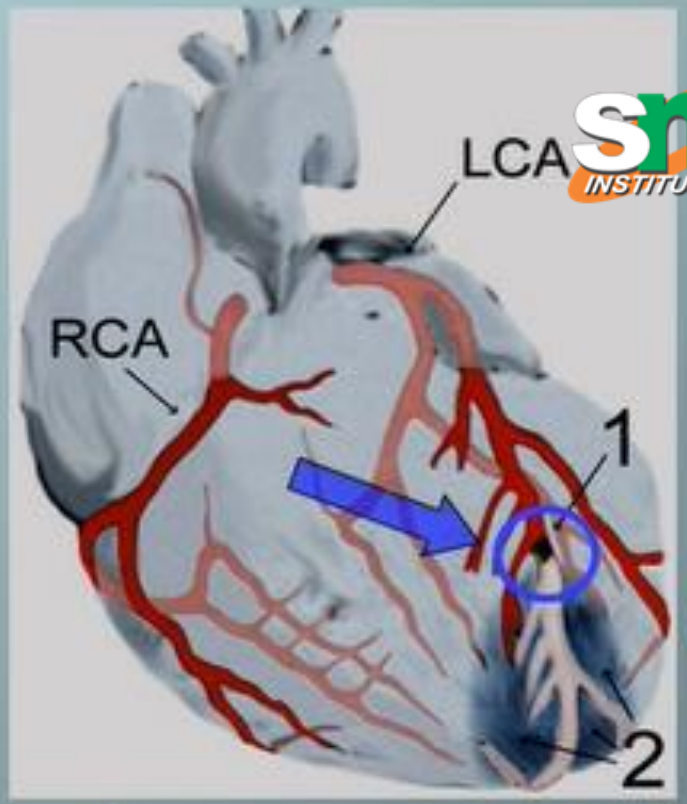
Coronary vessels have autonomic innervation. Epinephrine or Nor-epinephrine ↑s or ↓s blood flow

INDIRECT EFFECT

Sympathetic stimulation causes ↑d cardiac activity, causing ↑d metabolic products, resulting in vasodilatation. And vice-versa.

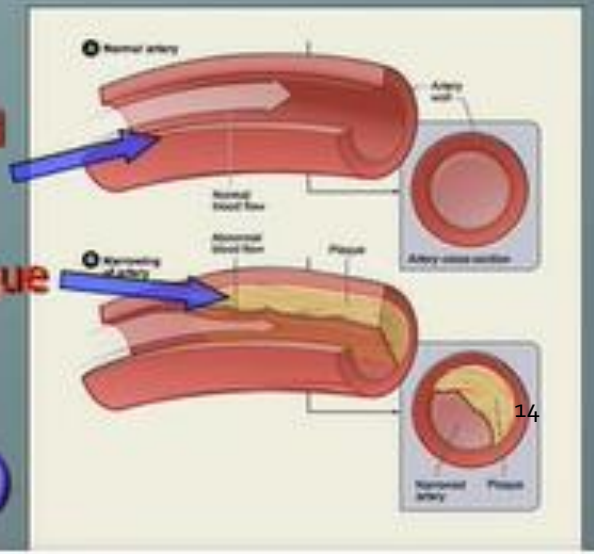
Coronary Occlusion

-obstruction of coronary arteries
-due to atherosclerosis
-atherosclerosis occurs due to deposition of cholesterol
(cholesterol→ fibrous tissues→ calcification→ atherosclerotic plaques)
-plaques common nearer to aorta
-obstruction of 3/4th of lumen causes myocardial ischemia



Myocardial Infarction

-muscle becomes unable to sustain cardiac muscle function due to lack of blood
Myocardial infarction can result in cardiac shock



Angina Pectoris

-the pain felt due to myocardial ischemia
-hot pressing, constricting pain
-radiates to left arm, shoulder & left neck(referred pain)

Treatment of Angina Pectoris

With drugs:

-vasodilators during acute pain relieves pain (nitroglycerin, other nitrate drugs)

-beta blockers for prolonged treatment

-blocks beta receptors, preventing sympathetic enhancement of heart rate

SURGICAL TREATMENT OF CORONARY DISEASES

-Aortic-coronary bypass surgery

anastomosis between aorta & artery beyond occlusion

-Coronary angioplasty.

balloon tipped catheter is introduced & inflated.

-Laser angioplasty

laser beams dissolves occlusion