

Regional Circulation

Coronary Circulation:

- Heart is supplied by the right and left coronary arteries.
- In a population, 50% individuals will have Right coronary artery dominant.
20% - left coronary artery dominant
30% - both are dominant or equal.
- Right Coronary Artery $\rightarrow$ Right Ventricle & Posterior part of left ventricle.
left Coronary $\rightarrow$ Anterior and lateral portions of left ventricle.
- Normal Coronary blood flow $\rightarrow$ 250 ml/min. (or) 70 ml/min/100g.
- Venous blood is drained into Right Atrium, in addition, it can also be drained into chambers through:
 - (1) thebesian vein
 - (2) Arteriosinusoidal vessels
 - (3) Arterioleuminal vessels.
- During exercise, the coronary blood flow $\uparrow$ by 3-4 folds as against cardiac output which $\uparrow$ by 4-7 folds.

Factors Influencing Coronary Circulation:

- (1) Phases of Cardiac Cycle $\rightarrow$
 - Blood vessels are compressed during systole thus myocardium & endocardium do not get blood during systole.
 - During diastole, the cardiac muscles relaxes and the blood vessels are no longer compressed, hence blood flows.
- (2) Chemical factors $\rightarrow$ During anaerobic metabolism, there is formation of adenosine from ATP and prostaglandins that cause increased blood flow due to vasodilation.
- Cardiac muscle is capable of extracting 70% of O_2 from coronary blood.

- Other factors known to produce local coronary vasodilation are
 - (a) O_2 lack
 - (b) CO_2 excess
 - (c) $\uparrow K^+$ concn.
 - (d) adenosine nucleotide accumulation
 - (e) intracoronary injection of cyanide.

(3) Autoregulation $\Rightarrow$ It is ability of vital organs such as heart, brain and kidney to regulate its own blood flow.

- This operates b/w Arterial BP of 60 and 160 mm Hg.

(4) Neural factor $\Rightarrow$ Stimulation of sympathetic nerves to heart increases heart rate and produces vasoconstriction.

Applied

(i) Ischemic Heart Disease: Due to insufficient coronary blood flow.

- Most common cause is Atherosclerosis.
- Acute coronary occlusion can occur due to formation of local blood clot over Atherosclerosis.
- The blood clot (thrombus) formed elsewhere can get dislodged and block the coronary artery as embolus.

(ii) Angina Pectoris: It is a severe constricting pain in the chest radiating from pericardium due to ischemia of cardiac muscles.

- In this condition, pain is produced due to hypoxia of myocardial tissue.
- Obstruction of about 75% to coronary artery produces Angina pectoris.
- Nitroglycerin $\Rightarrow$ Management of Pain during Angina pectoris

as it dilates the vessels by generating nitric oxide.

(iii) Myocardial Infarction : Death of Myocardial tissue.

- It is due to sudden stoppage of blood supply to an area of myocardium.
- Blood flow to myocardium is stopped due to :
 - (a) formation of thrombus
 - (b) spasm of coronary artery.
 - (c) platelets aggregation in sclerotic artery.
 - (d) rupture of atherosclerotic plaque
 - (e) hemorrhage into atherosclerotic plaque.

Cerebral Circulation :

- Two internal carotid and two vertebral arteries supply brain.
- Normal cerebral blood flow $\Rightarrow 750 \text{ ml/min (or) } 54 \text{ ml/min/100g}$.

Factors affecting Cerebral Circulation :

- (1) Autoregulation $\Rightarrow$ Brain maintains its blood flow in spite of variation in Arterial blood pressure.
- (2) Hypoxia $\Rightarrow$ Hypoxia to brain increases blood flow by vasodilation.
- (3) O_2 excess $\Rightarrow$ High O_2 conct. will produce vasoconstriction.
- (4) Hypercapnia $\Rightarrow$ produce Vasodilation.
- (5) Intracranial Pressure $\Rightarrow$ Decreases cerebral blood flow.
- (6) Perfusion Pressure $\Rightarrow$ The pressure difference between the arterial and venous systems to brain plays an important role in regulation of blood flow to brain.
- (7) Autonomic stimulation $\Rightarrow$ Sympathetic stimulation does not affect much.

Applied

(1) Stroke : A condition of paralysis produced due to lack of O_2 supply to brain.

- Neurons are sensitive to supply of O_2
- Anoxia of 3-4 min $\rightarrow$ Death of Neurons.

Two types of Strokes :

- (a) hemorrhagic stroke $\rightarrow$ Blood vessels to brain rupture.
- (b) ischemic stroke $\rightarrow$ Blood flow to brain is reduced / stopped.

Cutaneous Circulation :

- Circulation through skin
- Blood flow to skin is about 400-450 ml/min and can vary from 50 - 4500 ml/min.

Features

- Plays an important role in regulation of body temperature.
- It acts as reservoir for blood.
- Blood flow to skin is highly variable.

Factors influencing

- Sympathetic decreases the blood flow
- Increased body temp causes vasodilation and Blood flow $\uparrow$
- Epinephrine and Norepinephrine $\rightarrow$ Vasoconstriction
 $\downarrow$
Reducing blood flow
- Bradykinin and histamine causes vasodilation
 $\downarrow$
Increasing blood flow.

