Lec 6

Heart diseases

HEART FAILURE

DEFINITION

Heart failure is defined as the pathophysiologic state in which impaired cardiac function is unable to maintain an adequate circulation for the metabolic needs of the tissues of the body. It may be acute or chronic. The term congestive heart failure (CHF) is used for the chronic form of heart failure in which the patient has evidence of congestion of peripheral circulation and of lungs.

ETIOLOGY

1. INTRINSIC PUMP FAILURE The most common and most important cause of heart failure is weakening of the ventricular muscle due to disease so that the heart fails to act as an efficient pump.

i) Ischaemic heart disease ii) Myocarditis iii) Cardiomyopathies iv) Metabolic

disorders v) Disorders of the rhythm e.g. atrial fibrillation and flutter.

2. INCREASED WORKLOAD ON THE HEART Increased mechanical load on the heart results in increased myocardial demand resulting in myocardial failure.

i) Increased pressure load:

a) Systemic and pulmonary arterial hypertension.

b) Valvular disease e.g. mitral stenosis, aortic stenosis, pulmonary stenosis.

c) Chronic lung diseases.

ii) Increased volume load:

a) Valvular insufficiency b) Severe anaemia
c) Thyrotoxicosis d) Arteriovenous shunts e) Hypoxia due to lung diseases.

3. IMPAIRED FILLING OF CARDIAC CHAMBERS

Decreased cardiac output and cardiac failure may result from extra-cardiac causes or defect in filling of the heart:

a) Cardiac tamponade b) Constrictive pericarditis

TYPES OF HEART FAILURE

Heart failure may be acute or chronic, right-sided or left-sided, and forward or backward failure.

ACUTE AND CHRONIC HEART FAILURE

Depending upon whether the heart failure develops rapidly or slowly, it may be acute or chronic.

Acute heart failure Sudden and rapid development of heart failure occurs in the following conditions: i) Larger myocardial infarction ii) Valve rupture iii) Cardiac tamponade iv) Massive pulmonary embolism v) Acute viral myocarditis vi) Acute bacterial toxaemia.

Chronic heart failure More often, heart failure develops slowly as observed in the following states: i) Myocardial ischaemia from atherosclerotic coronary artery disease ii) Multivalvular heart disease iii) Systemic arterial hypertension

iv) Chronic lung diseases resulting in hypoxia and pulmonary arterial hypertension v) Progression of acute into chronic failure.

Congenital Heart Disease

Congenital heart diseases are abnormalities of the heart or great vessels that are present at birth. They account for 20% to 30% of all birth defects and include a broad spectrum of malformations, ranging from severe anomalies

incompatible with intrauterine or perinatal survival, to lesions that produce few or no symptoms, such that they may go unrecognized during life.

Pathogenesis. Congenital heart disease most commonly arises from faulty embryogenesis during gestational weeks 3 through 8, when major cardiovascular structures develop. The cause is unknown in almost 90% of cases.

The mechanisms specific for congenital heart disease are also not known.

The following risk factors have been identified:

1• Prematurity

2• Family history

3• Maternal conditions such as diabetes, hypertension, obesity,phenylketonuria, thyroid disorders, and systemic connective tissue disorders;

maternal exposure to therapeutic drugs taken during pregnancy such as phenytoin and retinoic acid as well as smoking and alcohol ingestion

4• Assisted reproductive technology such as in vitro fertilization

5• In utero infections caused by rubella, cytomegalovirus , herpes simplex, andtoxoplasmosis

CLASSIFICATION Congenital anomalies of the heart may be either shunts (left to-right or right-to-left), or defects causing obstructions to flow. However,complex anomalies involving combinations of shunts and obstructions are also often present.

I. MALPOSITIONS OF THE HEART

Dextrocardia is the condition when the apex of the heart points to the right side of the chest.

II. SHUNTS (CYANOTIC CONGENITAL HEART DISEASE)

A. LEFT-TO-RIGHT SHUNTS (ACYANOTIC OR LATE CYANOTIC GROUP)

In conditions where there is shunting of blood from left-to-right side of the heart, there is volume overload on the right heart producing pulmonary hypertension and right ventricular hypertrophy.

1.VENTRICULAR SEPTAL DEFECT (VSD) VSD is the most common congenital anomaly of the heart and comprises about 30% of all congenital heart diseases.

2.ATRIAL SEPTAL DEFECT (ASD) Isolated ASD comprises about 10% of congenital heart diseases.

3.PATENT DUCTUS ARTERIOSUS (PDA) Normally, the ductus closes functionally within the first or second day of life. Its persistence after 3 months of age is considered abnormal.

B. RIGHT-TO-LEFT SHUNTS (CYANOTIC GROUP)

In conditions where there is shunting of blood from right side to the left side of the heart, there is entry of poorly-oxygenated blood into systemic circulation resulting in early cyanosis.

1.TETRALOGY OF FALLOT Tetralogy of Fallot is the most common cyanotic congenital heart disease, found in about 10% of children with anomalies of the heart. The four features of tetralogy are as under:

i) Ventricular septal defect (VSD) (‘shunt’). ii) Displacement of the aorta to right

iii) Pulmonary stenosis (‘obstruction’). iv) Right ventricular hypertrophy.

2.TRANSPOSITION OF GREAT ARTERIES The term transposition is used for complex malformations as regards position of the aorta, pulmonary trunk, atrioventricular orifices and the position of atria in relation to ventricles

III. OBSTRUCTIONS (OBSTRUCTIVE CONGENITAL HEART DISEASE)

Congenital obstruction to blood flow may result from obstruction in the aorta due to narrowing (coarctation of aorta), obstruction to outflow from the left ventricle (aortic stenosis and atresia), and obstruction to outflow from the right ventricle (pulmonary stenosis and atresia).

1.COARCTATION OF AORTA , it is localised narrowing in any part of aorta, but the constriction is more often just distal to ductus arteriosus (postductal or

adult), or occasionally proximal to the ductus arteriosus (preductal or infantile type) in the region of transverse aorta .

2.AORTIC STENOSIS AND ATRESIA

3.PULMONARY STENOSIS AND ATRESIA.

ISCHAEMIC HEART DISEASE

Ischaemic heart disease (IHD) is defined as acute or chronic form of cardiac disability arising from imbalance between the myocardial supply and demand for oxygenated blood. Alternate term ‘coronary artery disease (CAD)’ is used synonymously with IHD.

ETIOPATHOGENESIS

IHD is invariably caused by disease affecting the coronary arteries, the most prevalent being atherosclerosis accounting for more than 90% cases, while other causes are responsible for less than 10% cases of IHD.

I. CORONARY ATHEROSCLEROSIS

Coronary atherosclerosis resulting in ‘fixed’ obstruction is the major cause of IHD in more than 90% cases.

II. SUPERADDED CHANGES IN CORONARY ATHEROSCLEROSIS

The attacks of acute coronary syndromes, which include acute myocardial infarction, unstable angina and sudden ischaemic death, are precipitated by certain changes superimposed on a pre-existing fixed coronary atheromatous plaque.

III. NON-ATHEROSCLEROTIC CAUSES

Several other coronary lesions may cause IHD in less than 10% of cases.

1. Vasospasm 2. Stenosis of coronary ostia 3. Arteritis 4. Embolism 5. Thrombotic diseases 6. Trauma 7.Aneurysms 8. Compression

EFFECTS OF MYOCARDIAL ISCHAEMIA

Depending upon the suddenness of onset, duration, degree, location and extent of the area affected by myocardial ischaemia, the range of changes and clinical features may range from an asymptomatic state at one extreme to immediate mortality at another:

A. Asymptomatic state

B. Angina pectoris (AP)

C. Acute myocardial infarction (MI) Acute myocardial infarction (MI) is the most important and feared consequence of coronary artery disease. A significant factor that may prevent or diminish the myocardial damage is the development

of collateral circulation through anastomotic channels over a period of time.

ETIOPATHOGENESIS The etiologic role of severe coronary atherosclerosis (more than 75% compromise of lumen) of one or more of the three major coronary arterial trunks in the pathogenesis of about 90% cases of acute MI is well

documented by autopsy studies as well as by coronary angiographic studies

D. Chronic ischaemic heart disease \ Myocardial fibrosis

E. Sudden cardiac death

The term acute coronary syndromes include a triad of acute myocardialinfarction, unstable angina and sudden cardiac death.

HYPERTENSIVE HEART DISEASE

Hypertensive heart disease or hypertensive cardiomyopathy is the disease of the heart resulting from systemic hypertension of prolonged duration and manifesting by left ventricular hypertrophy. Even mild hypertension (blood pressure higher than 140/90 mmHg) of sufficient duration may induce hypertensive heart disease. It is the second most common form of heart disease after IHD. hypertension predisposes to atherosclerosis.

PATHOGENESIS Stimulus to LVH is pressure overload in systemic hypertension. Both genetic and haemodynamic factors contribute to LVH. The stress of pressure on the ventricular wall causes increased production of myofilaments,myofibrils, other cell organelles and nuclear enlargement. .

G/A The most significant finding is marked hypertrophy of the heart, chiefly of the left ventricle. The thickness of the left ventricular Wall increases from its normal 13 to 15 mm up to 20 mm or more.M/E The changes include enlargement and degeneration of myocardial fibres with focal areas of myocardial fibrosis

VALVULAR DISEASES AND DEFORMITIES

Valvular diseases are various forms of congenital and acquired diseases which cause valvular deformities. Many of them result in cardiac failure.

Rheumatic heart disease is the most common form of acquired valvular disease.Valves of the left side of the heart are involved much more frequently than those of the right side of the heart. The mitral valve is affected most often,followed in descending frequency, by the aortic valve, and combined mitral and aortic valves. The valvular deformities may be of 2 types: stenosis and insufficiency:

Stenosis is the term used for failure of a valve to open completely during diastole resulting in obstruction to the forward flow of the blood.

Insufficiency or incompetence or regurgitation is the failure of a valve to close completely during systole resulting in back flow or regurgitation of the blood.

Various acquired valvular diseases that may deform the heart valves are listedbelow:

- 1. RHD, the commonest cause 2. Infective endocarditis 3. Non-bacterial
- thrombotic endocarditis 4. Calcific aortic valve stenosis .

CARDIOMYOPATHY

Cardiomyopathy literally means disease of the heart muscle but the term was originally coined to restrict its usage to myocardial disease of unknown cause, commonly called primary cardiomyopathy. The WHO definition of cardiomyopathy also excludes heart muscle diseases of known etiologies which are termed secondary cardiomyopathies.

A. PRIMARY CARDIOMYOPATHY

This is a group of myocardial diseases of unknown cause. It is subdivided into the following 3 pathophysiologic categories:

1.IDIOPATHIC DILATED (CONGESTIVE) CARDIOMYOPATHY This type of

cardiomyopathy is characterised by gradually Progressive cardiac failure along

with dilatation of all the four chambers of the heart. The condition occurs more

often in adults and the average survival from onset to death is less than 5 years.

2.IDIOPATHIC HYPERTROPHIC CARDIOMYOPATHY

3.IDIOPATHIC RESTRICTIVE CARDIOMYOPATHY

B. SECONDARY CARDIOMYOPATHY

This is a group of myocardial diseases of known etiologies or having clinical associations. This, however, excludes well-defined entities such as ischaemic,

hypertensive, valvular, pericardial, congenital and inflammatory involvements of the heart. The main entities included in this group are:

1. Nutritional disorders 2. Toxic chemicals 3. Drugs 4. Metabolic diseases 5. Neuromuscular diseases

6. Connective tissue diseases.

PERICARDITIS

Pericarditis is the inflammation of the pericardial layers and is generally secondary to diseases in the heart or caused by systemic diseases. Based on the morphologic appearance, pericarditis is classified into acute and chronic types.

A. ACUTE PERICARDITIS

Acute bacterial and non-bacterial pericarditis are the most frequently

encountered forms of pericarditis. These may have the following subtypes:

1. SEROUS PERICARDITIS Its various causes are: i) Viral infection ii) Rheumatic fever. iii) Rheumatoid arthritis. iv) Systemic lupus erythematosus v) Involvement of the pericardium by malignant tumour in the vicinity

e.g. carcinoma lung, mesothelioma and mediastinal tumours.

vi) Tuberculous pericarditis in the early stage.

2. FIBRINOUS AND SEROFIBRINOUS PERICARDITIS
3. PURULENT OR FIBRINOPURULENT PERICARDITIS
4. HAEMORRHAGIC PERICARDITIS

B. CHRONIC PERICARDITIS

1. TUBERCULOUS PERICARDITIS Tuberculous pericarditis is the most frequent

form of granulomatous inflammation of the pericardium.

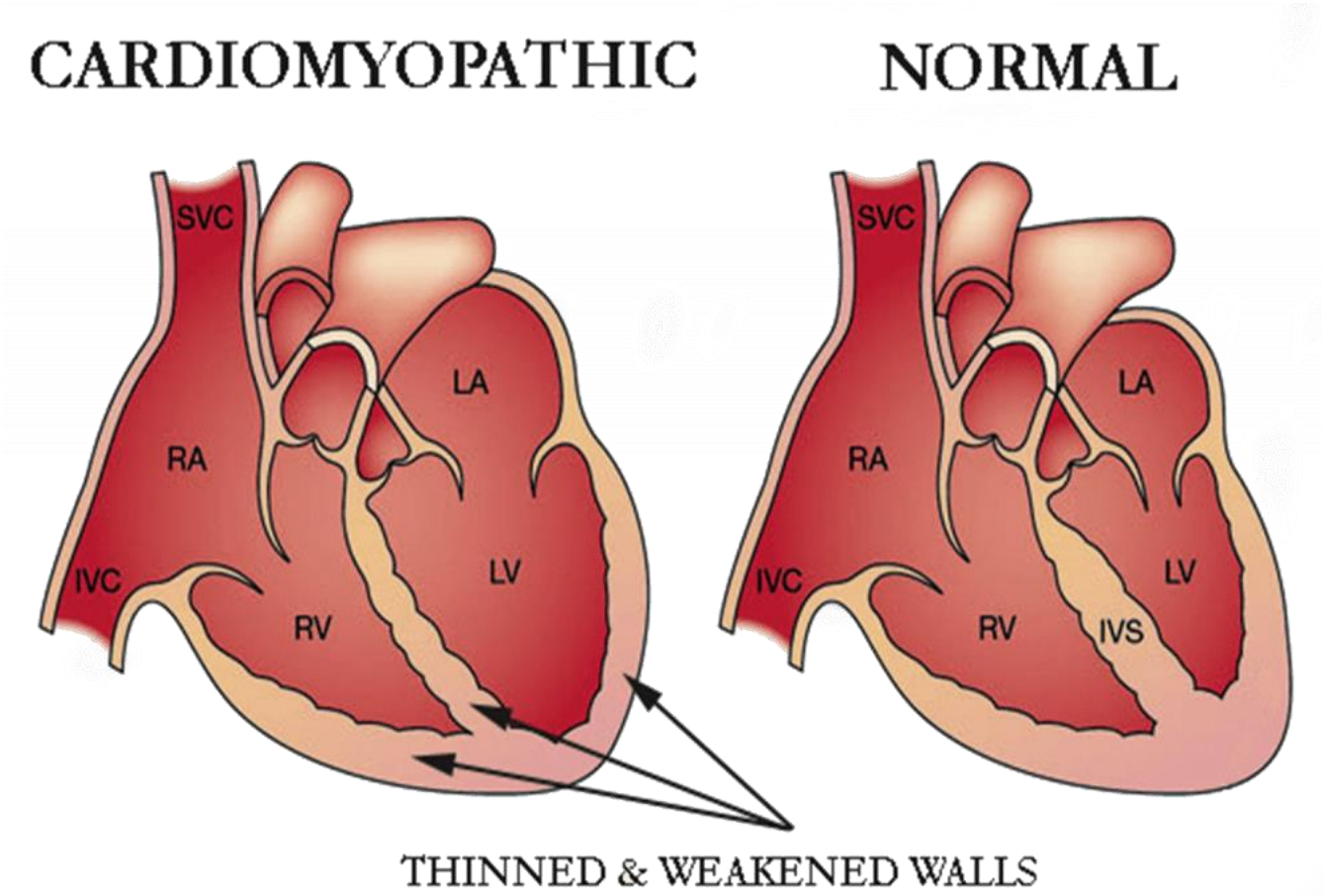
2. CHRONIC ADHESIVE PERICARDITIS .

3. CHRONIC CONSTRICTIVE PERICARDITIS

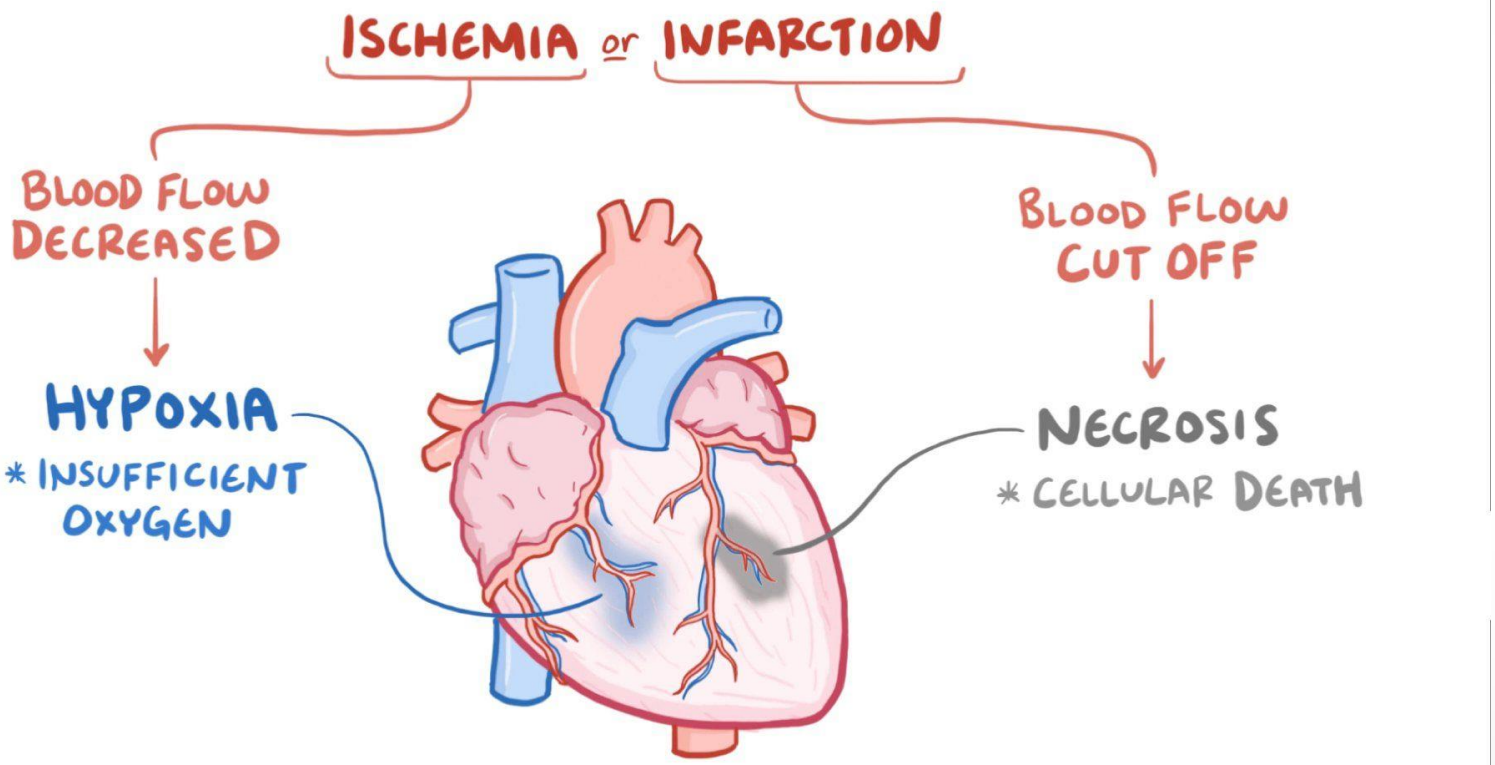
4. PERICARDIAL PLAQUES

- Practical part

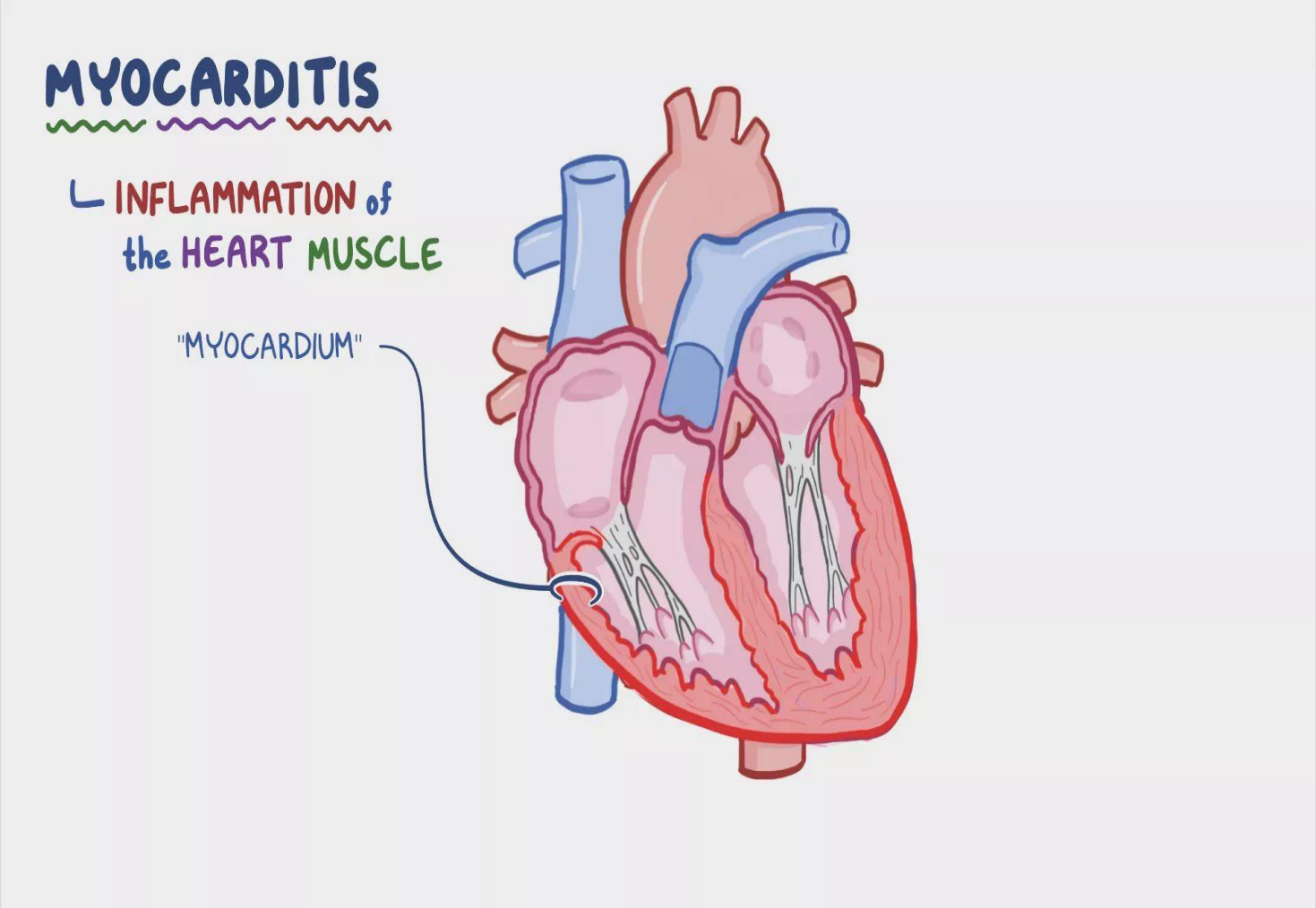
Cardiomayopathy(intrinsic pump failure)



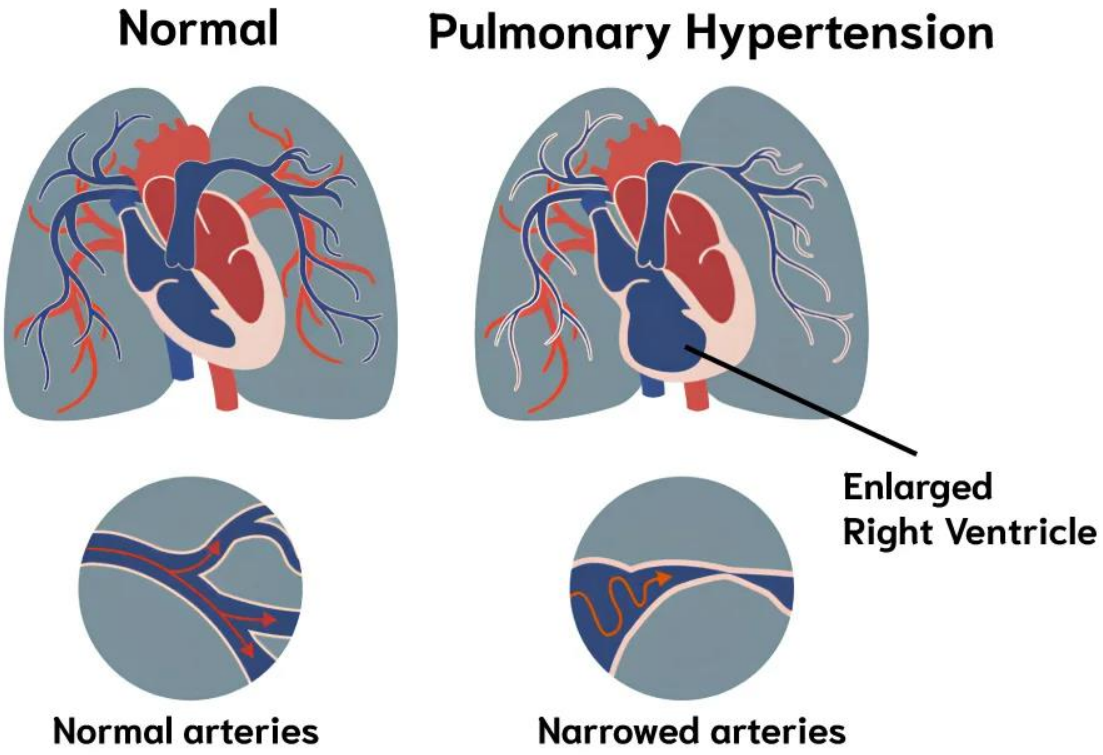
Ischemic heart disease



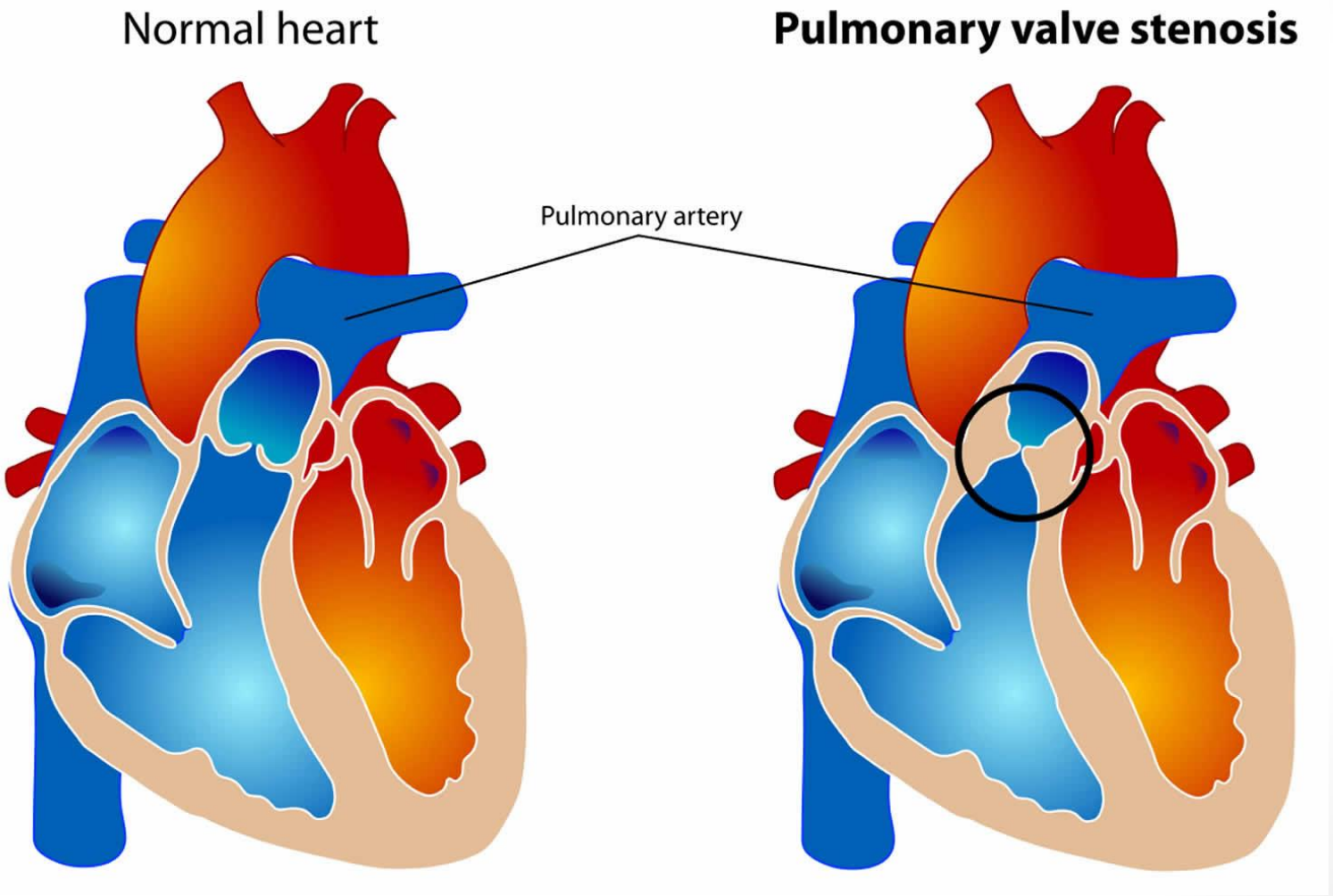
myocarditis



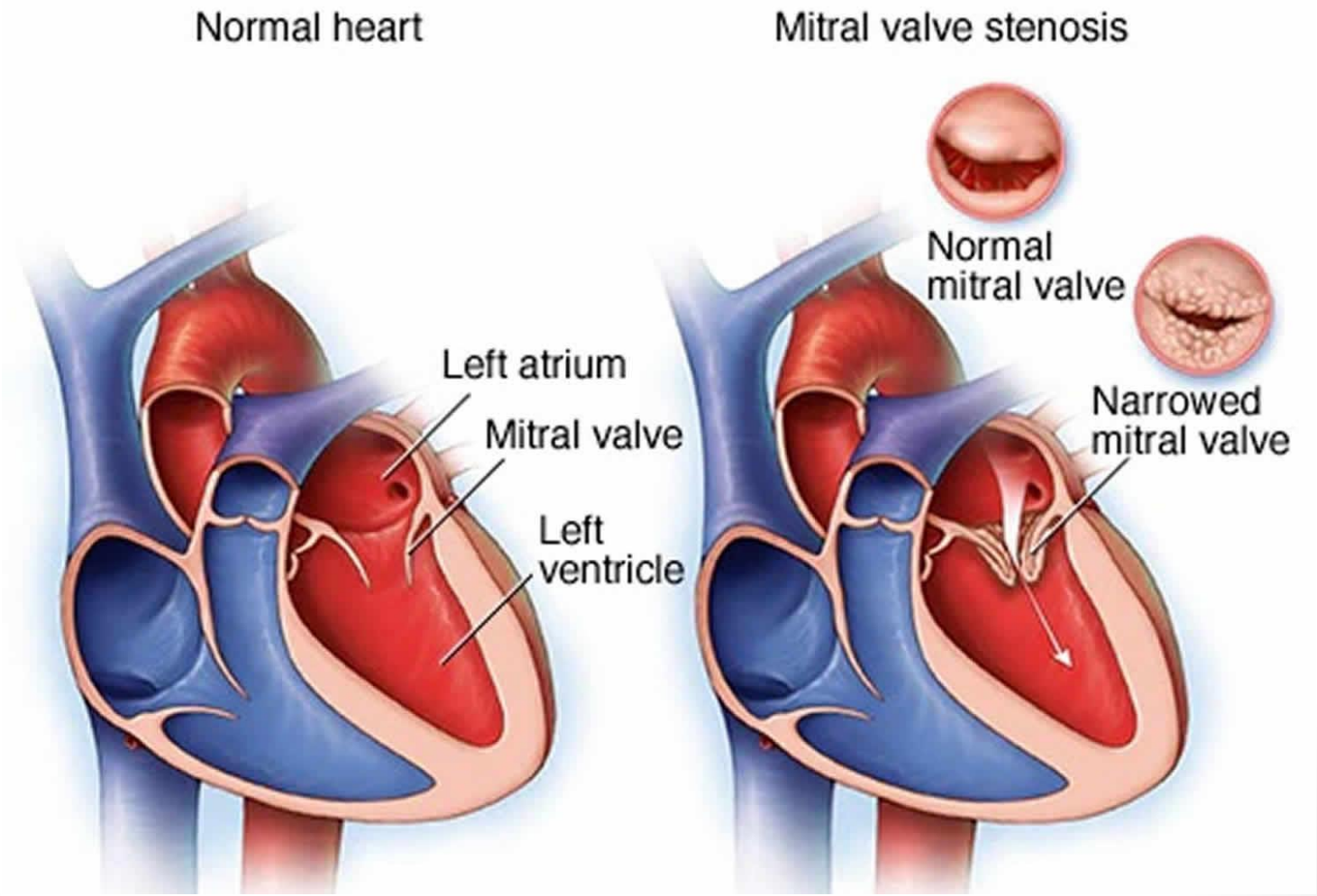
Increase work load\increase pressure\pulmonary hypertention



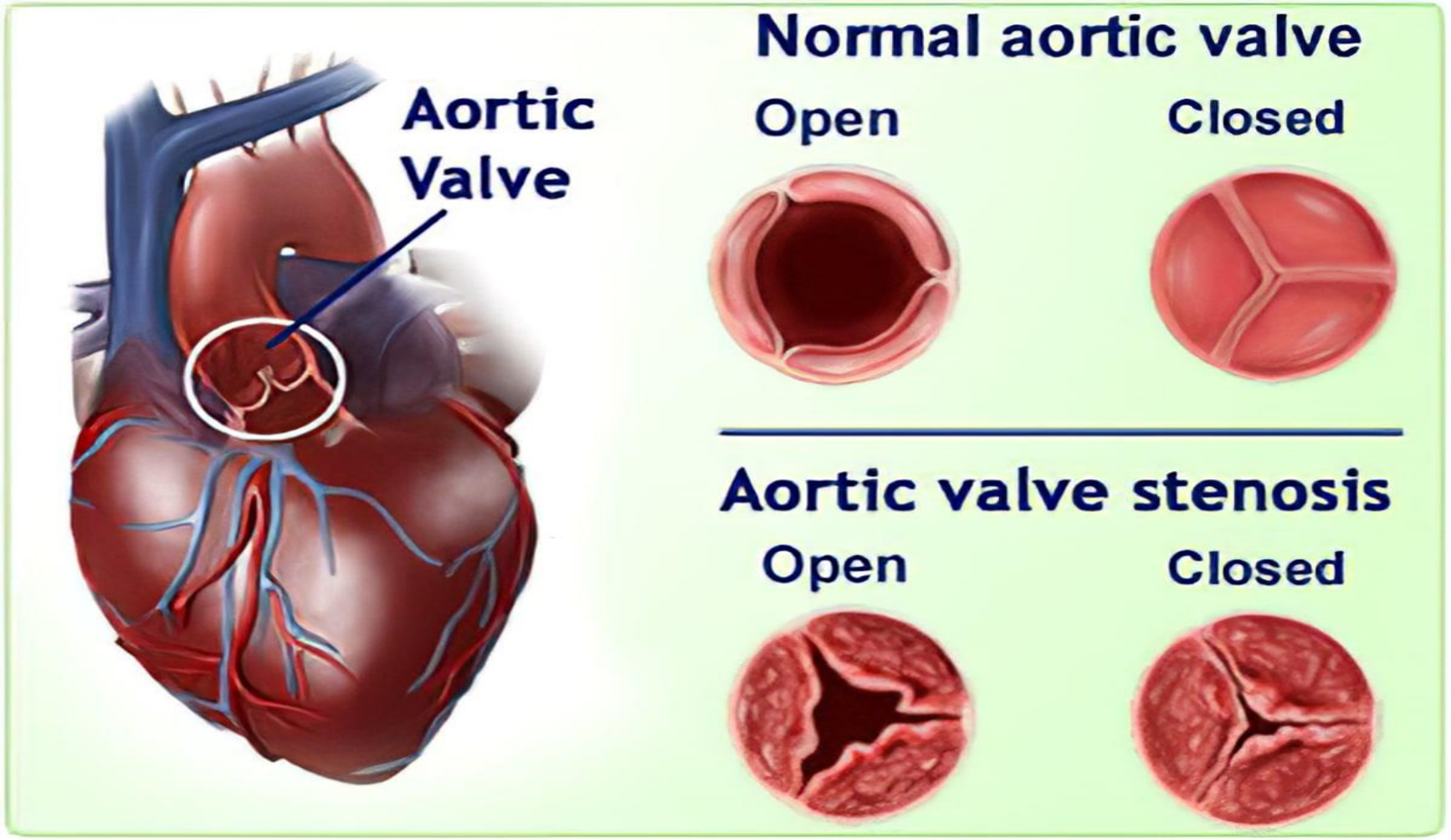
Pulmonary Stenosis



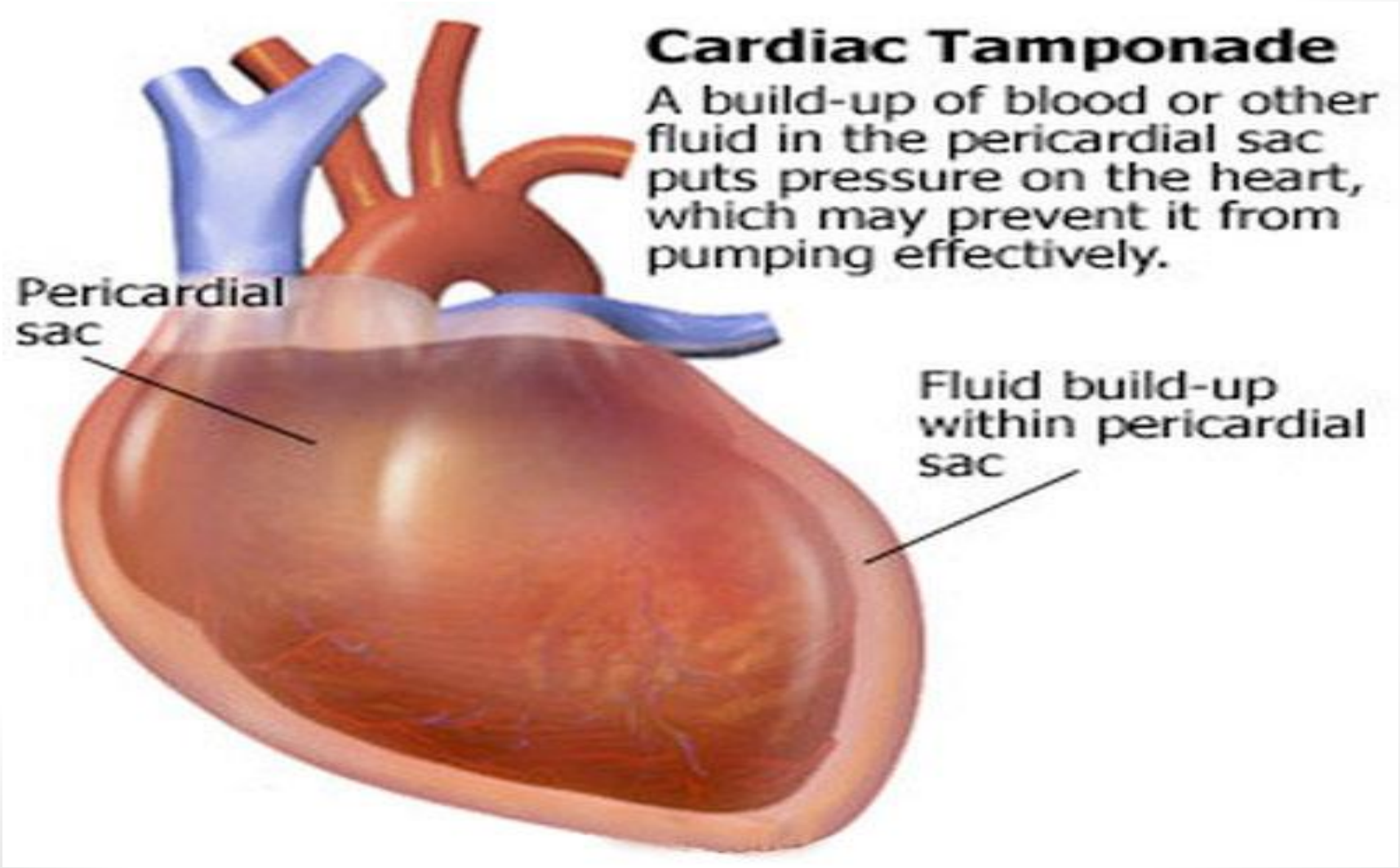
Mitral stenosis



Aortic stenosis

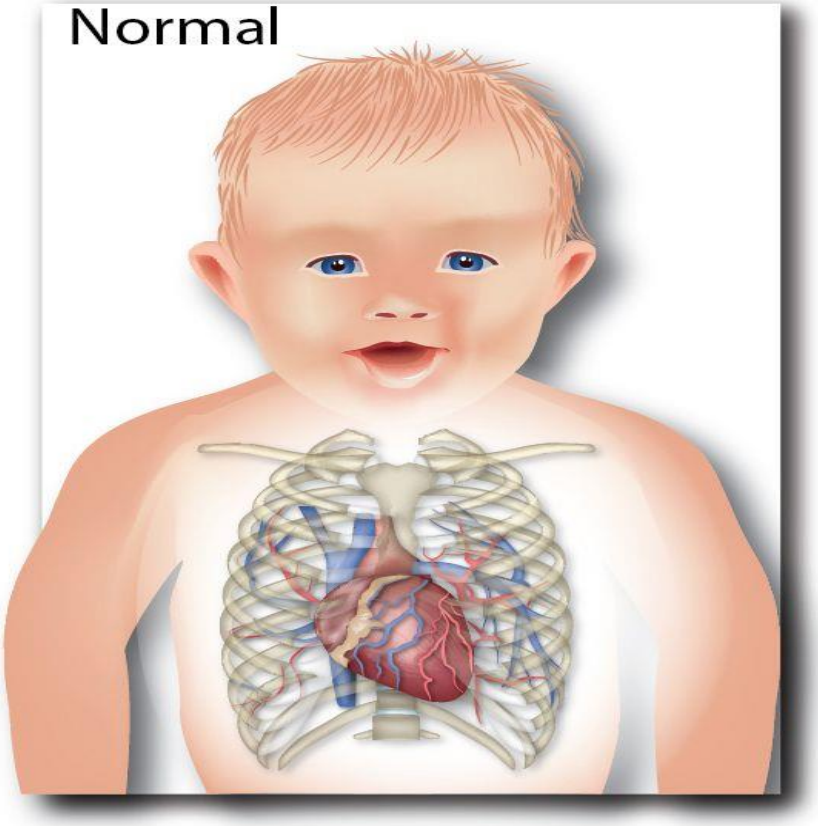


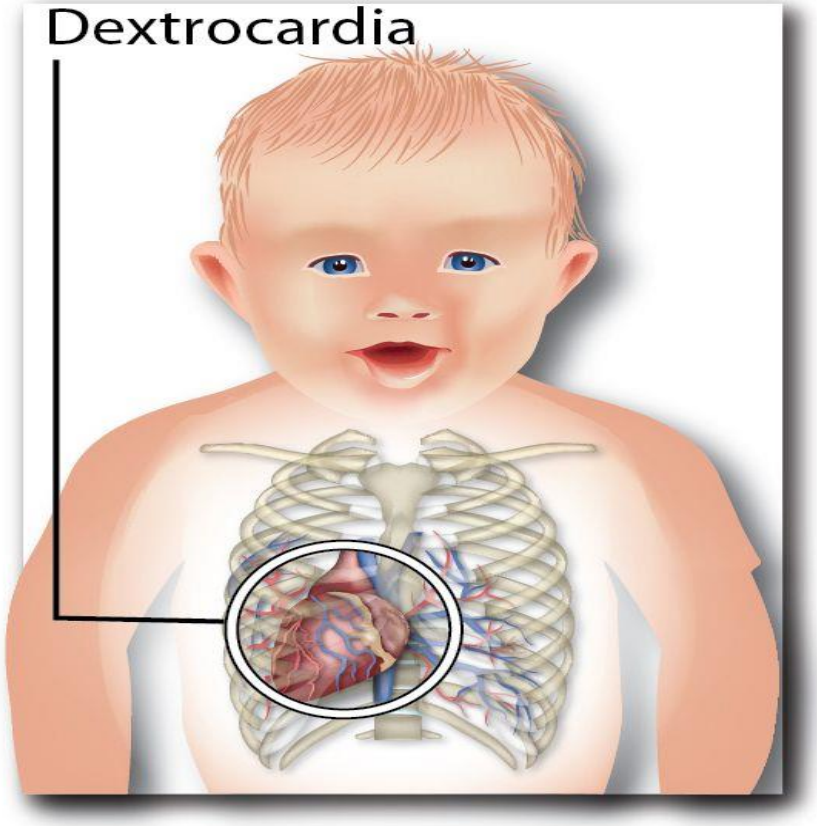
Impaired filling\cardiac temponade



Dextrocardia

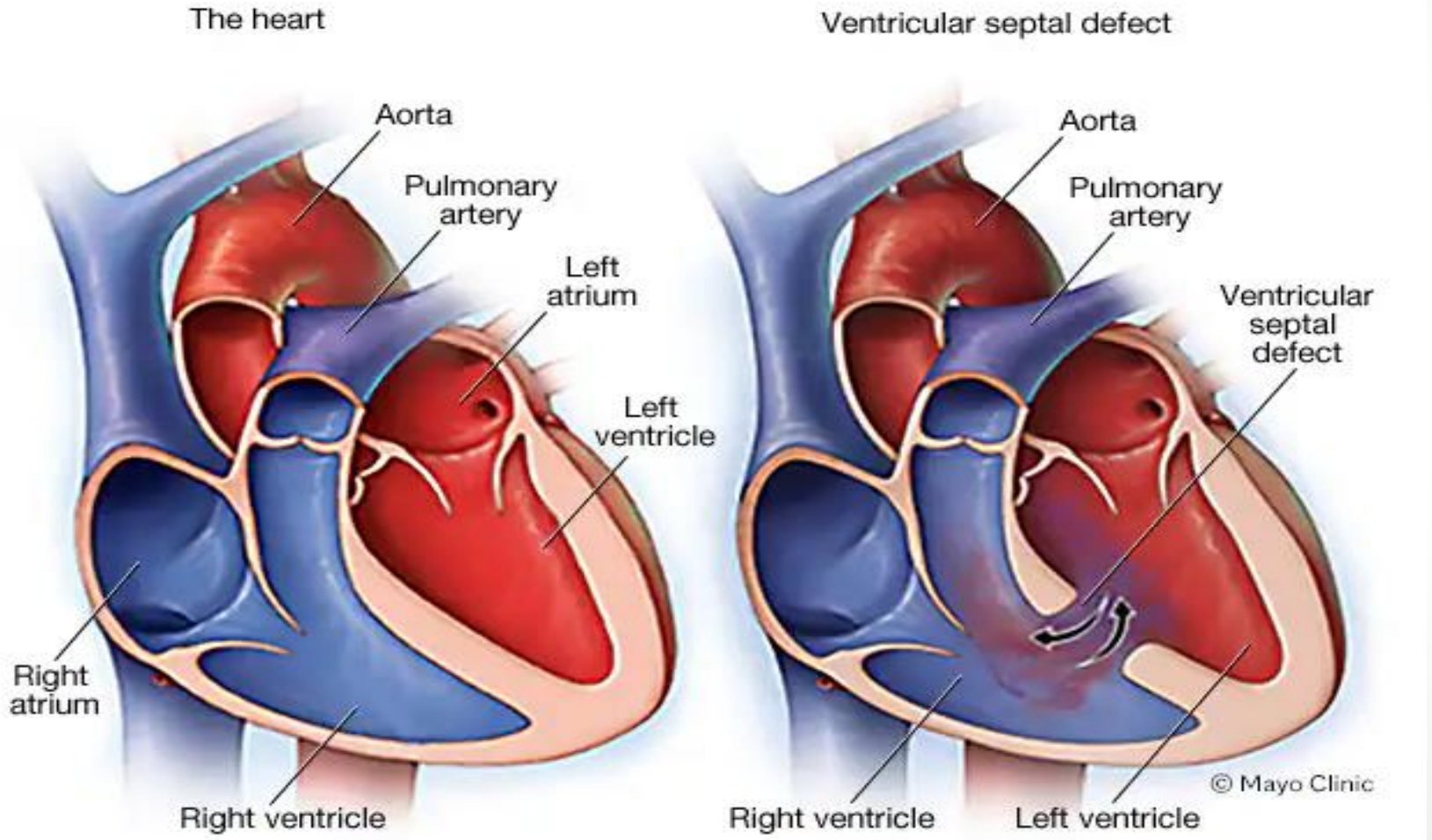
Heart location in the right side of the chest



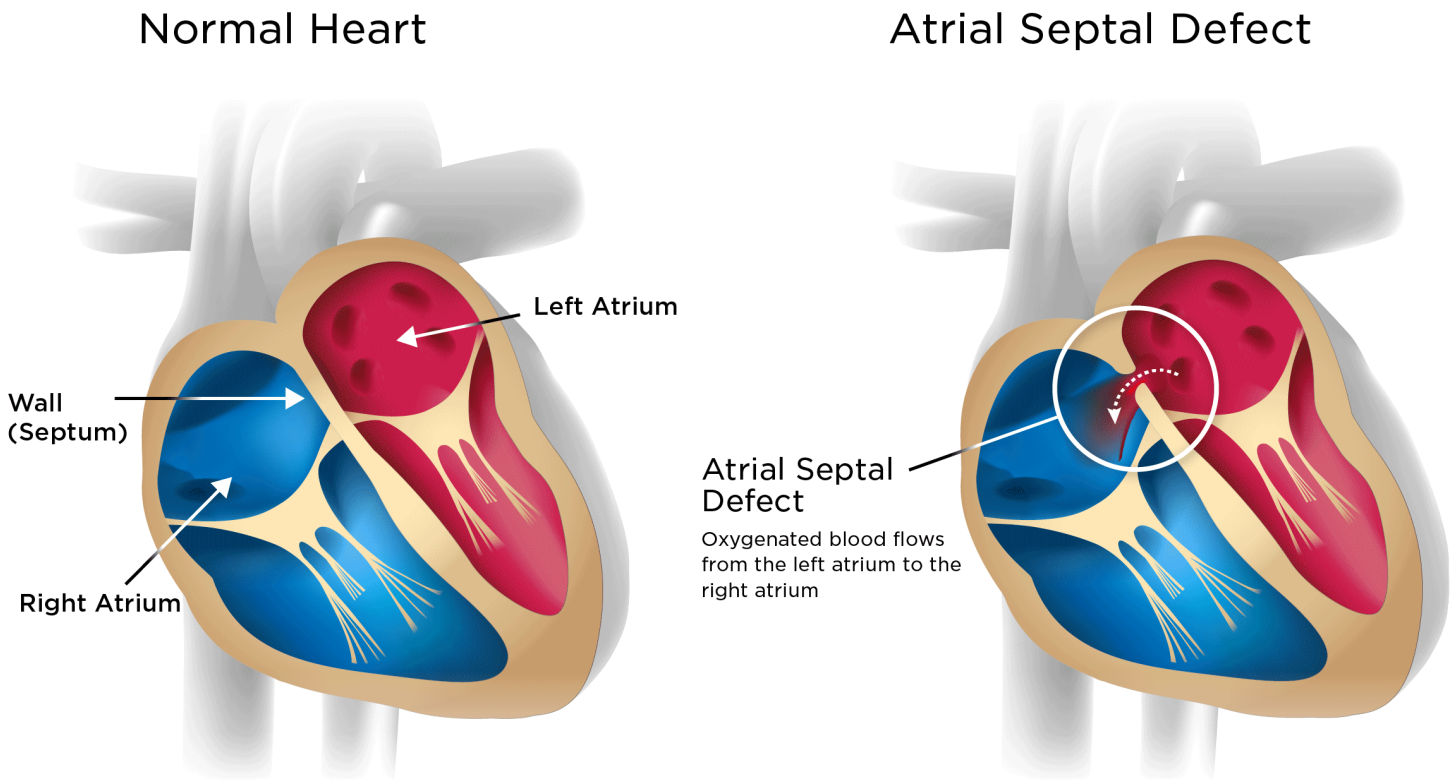


HELP
Health Education Library for People

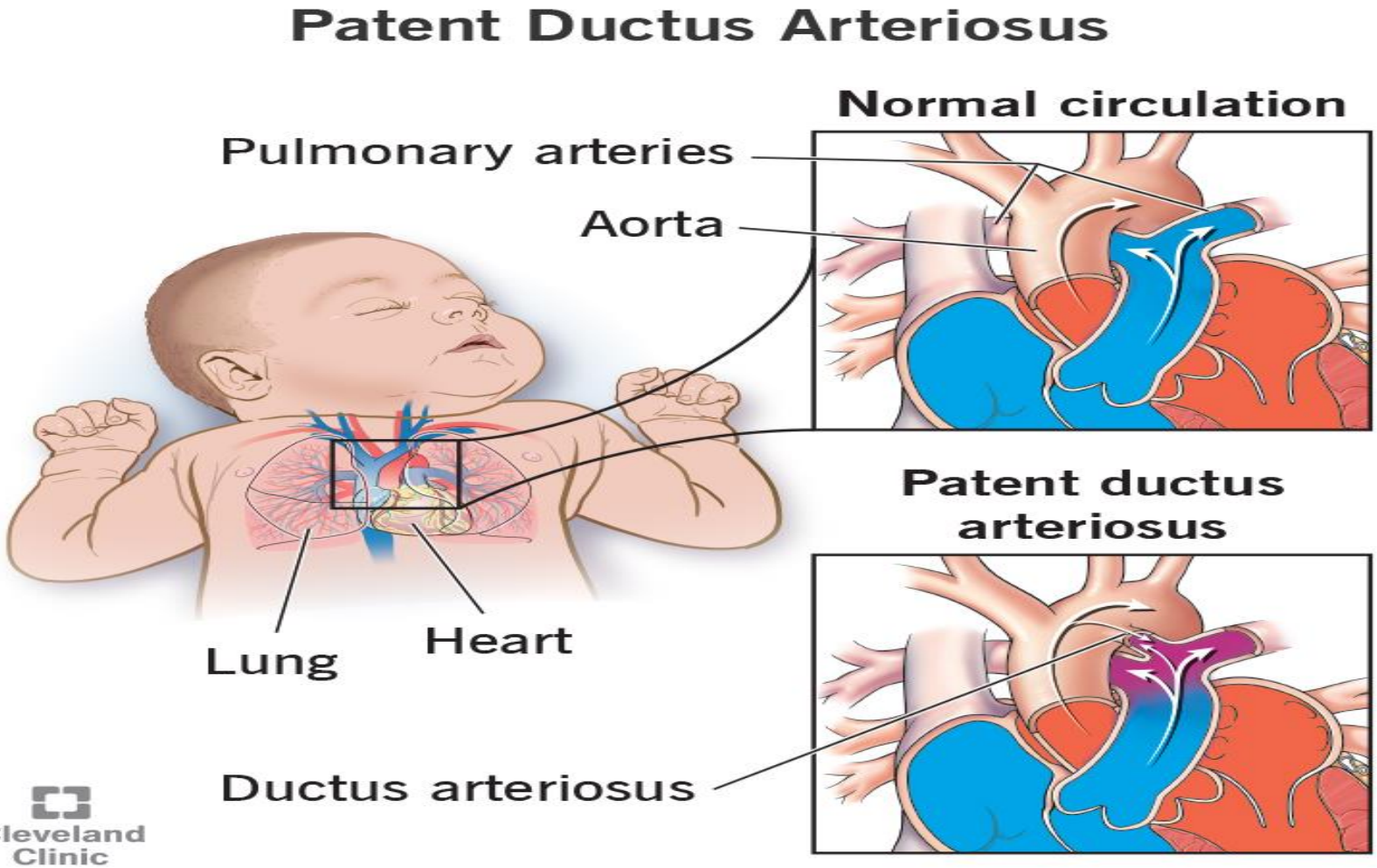
Left to right shunt\VSD



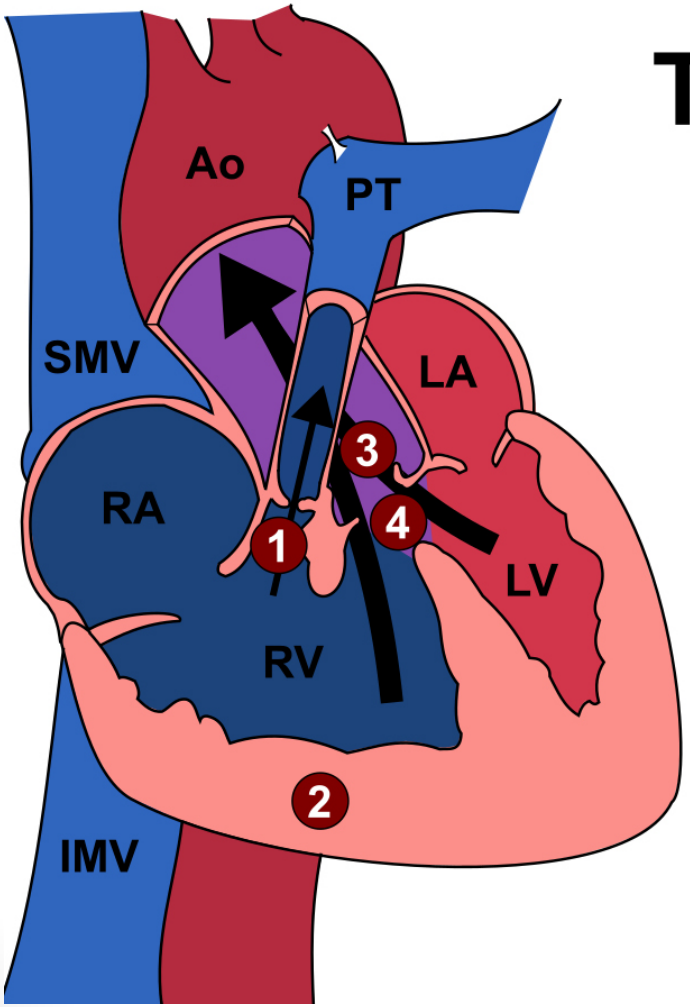
ASD


Normal Heart
Left Atrium
Wall
(Septum)
Right Atrium
Atrial Septal Defect
Atrial Septal
Defect
Oxygenated blood flows
from the left atrium to the
right atrium

PDA


Patent Ductus Arteriosus
Normal circulation
Pulmonary arteries
Aorta
Patent ductus arteriosus
Lung
Heart
Ductus arteriosus
Cleveland Clinic ©2022

RT to LT SHUNT\TOF

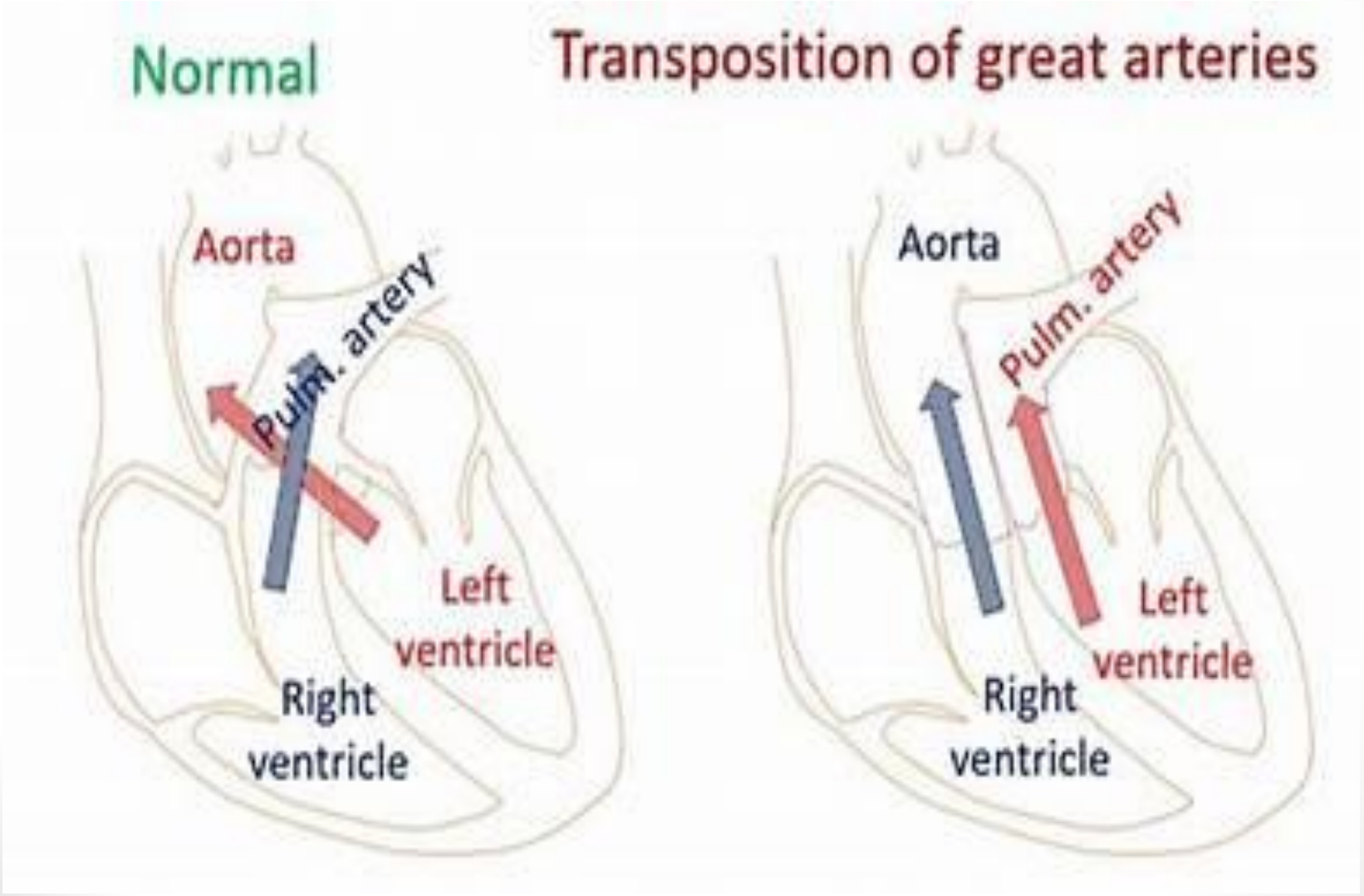


Tetralogy of Fallot

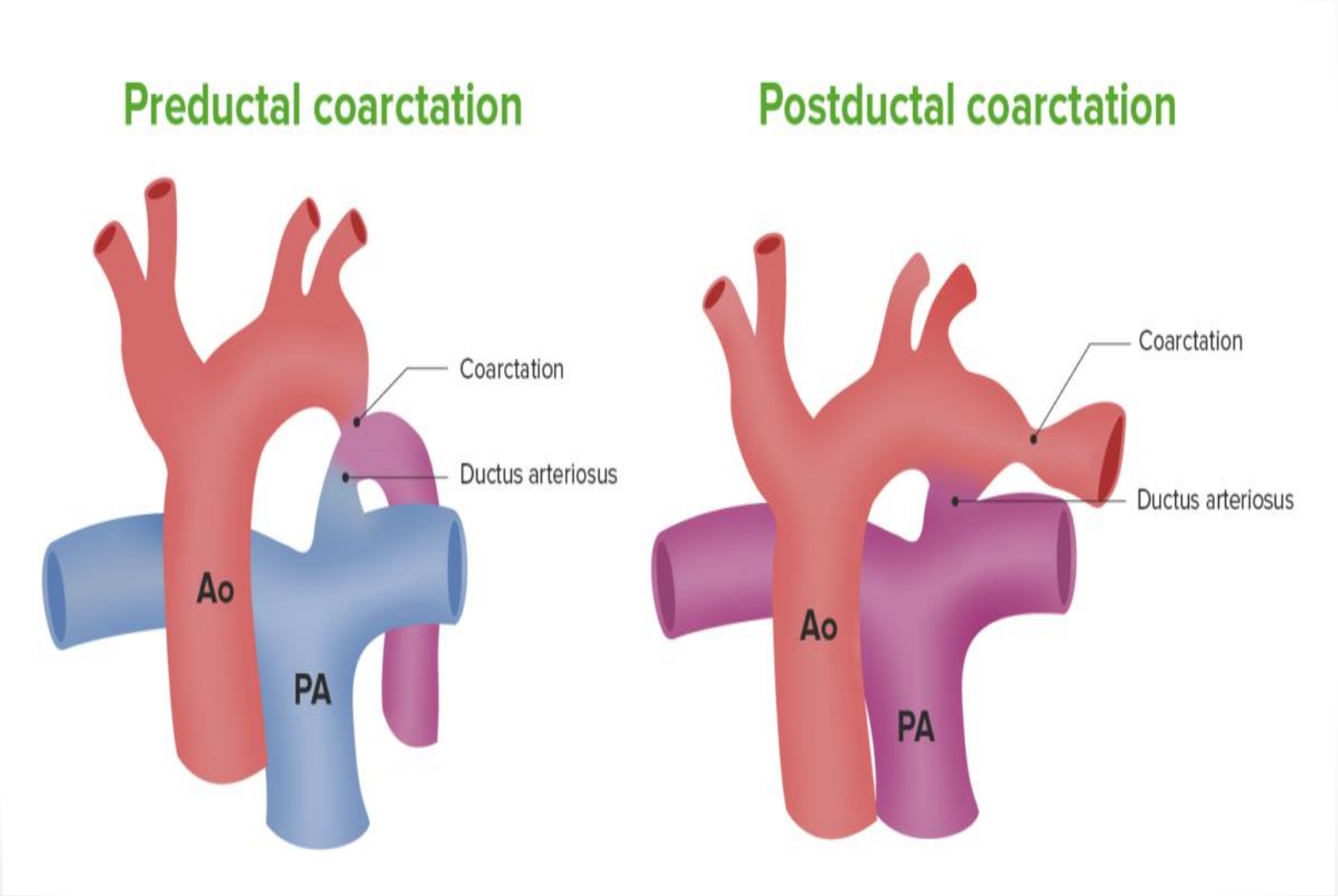
Major Defects

1. Pulmonary Stenosis
2. Right Ventricular Hypertrophy
3. Overriding Aorta
4. Ventricular Septal Defect

Transposition of great arteries



COA


Preductal coarctation
Coarctation
Ductus arteriosus
Ao
PA
Postductal coarctation
Coarctation
Ductus arteriosus
Ao
PA

pericarditis