

# Cardiac Wall Arrangement

## *Cardiac wall arrangement, cardiac skeleton, chambers (draw section through ventricles)*

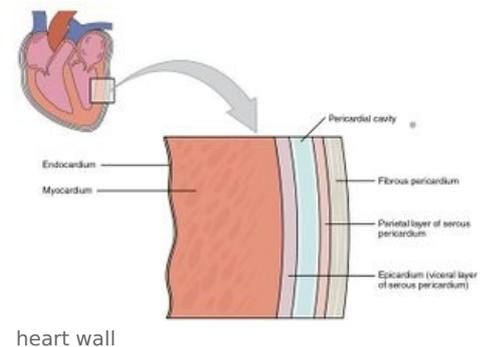
### Layers of heart wall:

The heart wall consists of three main layers: the endocardium, myocardium, and epicardium. The thickness of the heart wall is primarily determined by the myocardium, which varies in thickness depending on functional demands. For instance, the walls of the atria contain less muscle and are therefore thinner than those of the ventricles.

The epicardium is the thin outer layer of the heart wall, formed by the visceral layer of the serous pericardium. It is composed of mesothelium, a thin layer of connective tissue, and lines the outer surface of the myocardium. The subepicardial layer connects the epicardium to the myocardium.

The myocardium is the thick middle layer of the heart wall, consisting of cardiac muscle tissue responsible for pumping blood throughout the body. The subendocardial layer lies between and connects the endocardium to the myocardium. It consists of loose fibrous connective tissue containing vessels and nerves of the heart's conducting system.

The endocardium is the thin internal layer of the heart wall, composed of connective tissue and simple squamous epithelium (endothelium) that lines the inner surface of the myocardium.



### Cardiac skeleton (annulus fibrosus)

The cardiac skeleton, also known as the annulus fibrosus, provides structural support for the heart chambers. It is composed of dense connective tissue and consists of four rings: the left fibrous ring encircling the bicuspid valve, the right fibrous ring encircling the tricuspid valve, the pulmonary ring encircling the pulmonary valves, and the aortic ring encircling the aortic valve. Additionally, there are two trigones (right and left) and one ligament, which contribute to the overall structural integrity of the heart.

-4 main functions:

- 1.) Anchors the heart valve cusps to the interior walls of the heart, stabilising them, preventing them from malfunctioning
- 2.) Keeps the atrioventricular valves and semilunar valves open, without allowing them to distend (swell), preventing tears and backflow
- 3.) Provides a point of insertion for the bundles of the heart muscles
- 4.) Acts as an electrical insulator by preventing electrical radiating signals from passing from the atria to the ventricles, preventing a singular contraction

### Chambers of the heart

#### Right atrium-

##### Structures:

- *Right auricle* - outpocketing appendage of right atrium (here we see a large number of the pectinate muscles (comb like muscle fascicles))
- *Interatrial septum* - thin barrier separating the atria. We see the oval fossa here which is a remnant of the septum primum and secundum that merge after birth closing the interatrial shunt. And we see an elevated ridge (limbus of fossa ovalis) around the margin of oval fossa
- *Atrioventricular septum* - fibrous barrier between right atrium and outflow tract of left ventricle
- *Crista terminalis* - muscular crest in right atrium separating the sinus of vena cava from proper right atrium
- *Sulcus terminalis cordis* - groove on external surface of right atrium corresponding to crista terminalis
- *Intravenous tubercle* - elevated ridge between superior and inferior vena cava directing blood from superior vena cava to right ventricle

- *Triangle of Koch* – location of atrioventricular node bordered by septal cusp of tricuspid, tendon of valve of inferior vena cava (tendon of Todaro) and opening of coronary sinus

### **Openings of the right atrium:**

- *Sinus of vena cavae* – posterior part of right atrium where the superior and inferior vena cava enter. The inferior vena cava has its own valve (eustachian valve) which is a semilunar fold at opening of IVC directing blood through foramen ovale to left atrium in prenatal life
- *Opening of coronary sinus* – opening of the main vein draining the blood from heart and this has its own valve (thebesian valve)
- *Opening of smallest cardiac veins*
- *Right atrioventricular orifice* – opening between right atrium and right ventricle covered by tricuspid valve

### **Right ventricle**

– consists of the trabecular inflow tract composed of the trabeculae carnae and the smooth outflow tract (conus arteriosus)

- **Inflow tract** – consists of
  - *Right atrioventricular orifice*
  - *Tricuspid valve* – prevents retrograde flow from right ventricle to right atrium
    - o Anterior cusp – anchored to anterior and septal papillary muscles
    - o Posterior cusp – anchored to posterior and septal papillary muscles
    - o Septal cusp – anchored to posterior and septal papillary muscles
  - *Papillary muscles* – originate from myocardium and are covered by endocardium attaching to cusps of tricuspid via chordae tendineae
  - *Trabeculae carnae* – thick muscular bundles in right ventricular inflow tract
- **Outflow tract** – consists of:
  - *Septomarginal trabeculae/moderator band* – muscular bundle connecting interventricular septum with anterior papillary, the right bundle branch of conducting system runs through here
  - *Supraventricular crest* – divides right ventricle into inflow and outflow tracts
  - *Opening of pulmonary trunk*
  - *Pulmonary valve* – consists of the anterior, right and left semilunar cusps
  - *Interventricular septum* – muscular part and membranous part

### **Left atrium**

#### **Structures**

- *Left auricle* – outpocketing appendage just like right atrium with the pectinate muscles coming from here
- *Interatrial septum*
- *Valve of foramen ovale* – the original valve that covers foramen ovale present here, this postnatally merges with primary interatrial septum and hence can be found on opposite side of oval fossa
- *Mitral valve* – with anterior and posterior cusps

#### **Openings:**

- Opening of pulmonary veins
- Openings of smallest cardiac veins
- Left atrioventricular orifice

### **Left ventricle**

#### **Inflow tract**

- *Left atrioventricular orifice*
- *Mitral valve* – prevents retrograde flow from left ventricle to left atrium consists of

- o Anterior cusp – anchored to anterior and posterior papillary muscles
- o Posterior cusp – anchored to posterior and anterior papillary muscles
- *Papillary muscles* – valve muscles originating from myocardium and covered with endocardium attached to mitral valve by chordae tendineae

### Outflow tract

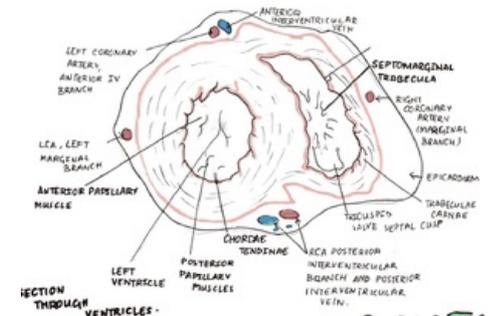
- *Aortic vestibule* – smooth part of left ventricle below aortic valve
- *Aortic orifice* – left ventricular opening to ascending aorta containing aortic valve
- *Aortic valve* – composed of 3 semilunar cusp

o Left semilunar cusp – contains the left coronary aortic sinus of Valsalva, which is a dilation of aortic wall behind left semilunar cusp where left coronary artery arises

o Right semilunar cusp – contains the right coronary aortic sinus of Valsalva – dilation of aortic wall behind right semilunar cusp where right coronary artery arises

o Posterior semilunar cusp – contains the posterior noncoronary aortic sinus of Valsalva

- *Interventricular septum* – membranous and muscular part



section through ventricles

## References

- HUDÁK, Radovan – KACHLÍK, David. *Memorix anatomie*. 2. edition. Triton, 2013. ISBN 978-80-7387-712-5.