EXTERIOR CONFIGURATION

I-INTRODUCTION

The heart is an intra-thoracic, unpaired, mixed-muscle, hollow organ that contracts rhythmically; its function is to ensure the flow of blood through the vessels that form the hub of the circulatory system.

II-DESCRIPTIVE ANATOMY

1-Location

The heart is situated in the thorax between the two lungs; it occupies the middle mediastinum of the lower mediastinal region and rests on the diaphragm (Figure 1).

2- Colour and consistency

The heart is firm and reddish in colour; its surface is dotted with fatty deposits.

3-Weight

The weight of the heart increases gradually with age; on average, it is 270 g in men and 260 g in women.

4- Shape

The heart is shaped like a triangular pyramid with its base at the back and its apex at the front left. Its long axis runs obliquely forwards, to the left and downwards, whilst its base lies towards the back and to the right.

1- Clavicle
2- Lung
3- Heart Rib
4- Spine
5- Diaphragm
6-

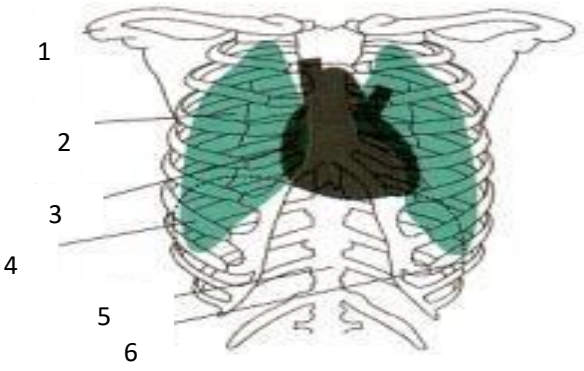


Figure 1. Location of the heart in the thorax

5-External configuration of the heart

Due to its triangular pyramid shape, the heart has three faces, three edges, a base and a apex.

A – The sulci of the heart

The sulci of the heart form the external boundaries of the cardiac chambers. The coronary arteries run through them, concealed by fatty tissue.

Three main sulci can be identified on the surface of the heart:

-The interatrial sulcus: this lies at the base of the heart and separates the right atrium from the left atrium.

- The interventricular sulcus: this lies in a vertical plane passing through the axis of the heart. It divides the anterior surface and the posterior diaphragmatic surface into two regions corresponding to the right and left ventricles. The interventricular vessels run through this sulcus.

-The atrioventricular sulcus: also known as the coronary sulcus, it lies in a plane perpendicular to the axis of the heart. It separates the atria from the ventricles. Posteriorly, it joins the interatrial and posterior interventricular sulci. Each surface is divided by the coronary sulcus into two segments: an anterior or ventricular segment, and a posterior or atrial segment.

B-The surfaces of the heart

Each of the heart's three surfaces is divided by the atrioventricular sulcus into two segments: one anterior (or ventricular) and the other posterior (or atrial).

a- The anterior surface of the heart

The anterior or sternocostal surface faces forwards and to the right.

1- The ventricular segment

Comprises two areas:

- **The arterial or posterior region**

The arterial zone is entirely occupied by the orifices of the two major arterial trunks emerging from the heart: the aortic orifice and the pulmonary artery orifice.

- **The ventricular area proper, or anterior area**

The ventricular zone proper is slightly convex and is divided into two fields by the anterior interventricular sulcus: the left ventricle and the right ventricle.

2- The atrial segment

The atrial segment lies above the arterial zone of the ventricular segment and features a broad, trough-like depression open at the front, the concavity of which accommodates the aorta and the pulmonary artery. The base of the trough corresponds to the septum separating the two atria (ear-like chambers). Each atrium has a transversely flattened extension at the front, with an irregularly serrated outline. These extensions are the right and left auricles (Figure 2).

1- Aorta
2- Pulmonary artery
3- Left ventricle
4- Right ventricle
5- Right atrium
6- Left atrium

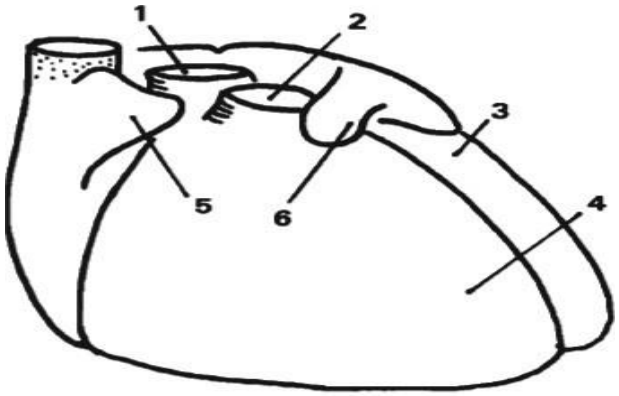


Figure 2. Anterior view of the heart

b- The underside of the heart

This surface, also known as the diaphragmatic surface, is slightly convex and slants downwards and forwards.

1- The ventricular segment

The ventricular segment is broad and is subdivided by the inferior interventricular sulcus (posterior interventricular sulcus) into two unequal fields: a broad right field, corresponding to the right ventricle, and a narrow left field, corresponding to the left ventricle.

2- The atrial segment

The atrial segment is narrower and merges with the large orifice of the inferior vena cava (Figure 3).

c- The left lateral surface of the heart

This surface, also known as the pulmonary surface, is convex from top to bottom, facing backwards and to the left; it is divided into two segments by the left part of the coronary sulcus:

- the anterior or ventricular segment: this is the lateral surface of the left ventricle
- the posterior or atrial segment: narrower, corresponding to the left atrium **(**Figure 4).

1- Right ventricle
2- Left ventricle
3- Interatrial sulcus
4- Opening of the VCI

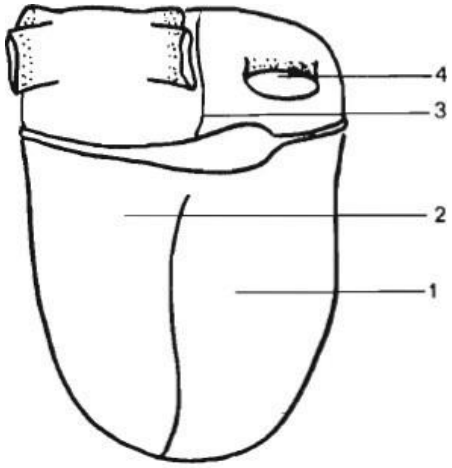


Figure 3. Posterior view of the heart

1-Left ventricle 2- Left atrium

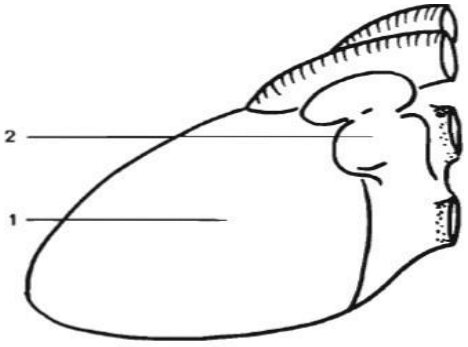


Figure 4. Left lateral view of the heart

C – The borders

The three surfaces of the heart are separated from one another by three borders: one on the right and two on the left. The right border lies between the anterior and inferior surfaces of the heart. The left borders are rounded and separate the left lateral surface from the anterior and inferior surfaces. One is superior, the other inferior. All the borders of the heart converge towards the apex (Figure 1). **D- The base**

The base is posterior, facing backwards and to the right. It consists solely of the atria and is divided into two segments by the interatrial sulcus: to the left of this lies the ostium of the four pulmonary veins; On the right, the crista terminalis divides the atrium into two fields: the left (the junction between the superior and inferior vena cavae (SVC and IVC)) and the right (Figure 5).

E- The apex

The apex, or tip, of the heart belongs to the left ventricle and occupies the very top of the heart (Figure 2).

1- **Pulmonary veins**
2- **Crista terminalis**
3- **Right portion**
4- **Left portion**
5- **Junction between the VCS and VCI**

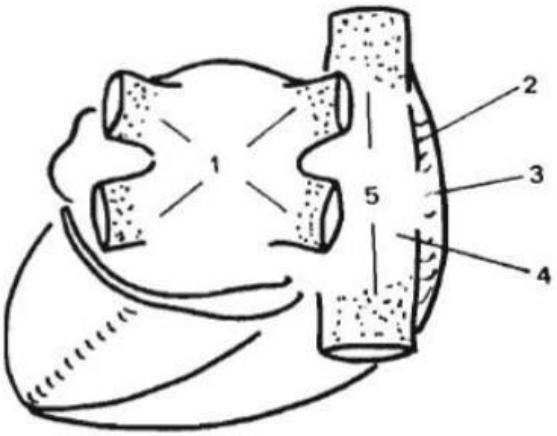


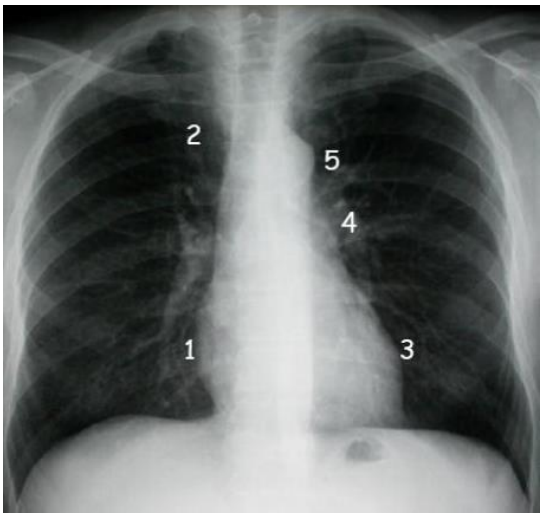
Figure 5. The base of the heart

III – Practical significance

Cardiac outline and radiological features: Analysis of a chest X-ray includes:
- assessment of the size of the heart (not exceeding 0.5. A value above 0.55 is considered pathological and is referred to as cardiomegaly).
- and the identification of the arcs of the cardiac silhouette.

The cardiac silhouette has two margins:
The left margin: Comprises:
- The upper left arc (5): the aortic knob or aortic arch.
- The left middle arc (4): this is the trunk of the pulmonary artery and the left atrium.
- The lower left arc (3): this corresponds to the left ventricle. The

right edge: comprises:
- The upper right arc (2): this is the superior vena cava (SVC).
- The lower right arc (1): this corresponds to the right atrium and the inferior vena cava.



Watch the video on this YouTube link:
https://youtu.be/WbeA9JeiVDY?si=GOpz1zXVrBHs02ha

INTERNAL STRUCTURE OF THE HEART

I-I INTRODUCTION

Internally, the heart comprises four chambers: the right atrium, the right ventricle, the left atrium and the left ventricle.
The right chambers of the heart are separated from the left chambers by two septa: the interatrial septum and the interventricular septum, such that the heart appears to consist of two independent halves: the right heart and the left heart
In the heart, the atria communicate with the ventricles via the atrioventricular ostia, which are equipped with atrioventricular valves designed to close the openings during ventricular contractions. The inner surface of the heart is irregular due to the presence of muscular projections (Figure 1).

1- **Right atrium**
2- **Left atrium**
3- **Left ventricle**
4- **Right ventricle**
5- **Left atrioventricular ostia**
6- **Right atrioventricular ostia**

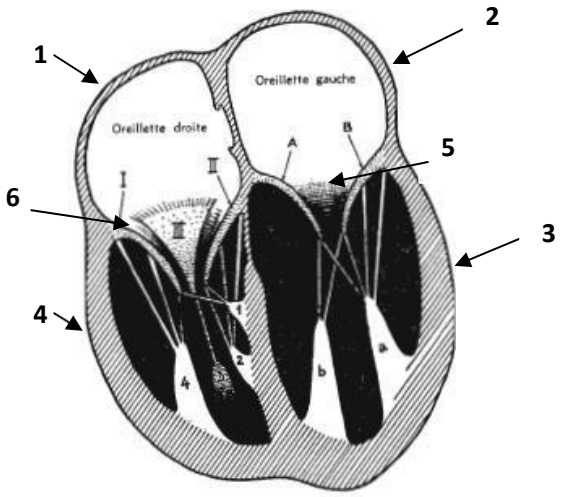


Figure 1. Frontal section of the heart

II- DESCRIPTIVE ANATOMY

A – THE RIGHT HEART

The right heart consists of the right ventricle and the right atrium

1- Right ventricle

The right ventricle is cone-shaped with three walls, a base and an apex (Figure 2).

a- Walls

-Anterior wall: corresponds to the sternocostal surface of the heart.
- Inferior wall: corresponds to the diaphragmatic surface.
-Internal wall: corresponds to the interventricular septum.
These three walls feature numerous muscular projections, known as the fleshy columns, of which there are three types:
-First-order fleshy columns, or pillars of the heart; also known as papillary muscles, are conical in shape and are attached at their base to the ventricular wall. From their apexes extend small tendinous cords which terminate at the edges and on the parietal surface of the atrioventricular valve.

- Second-order fleshy columns are attached to the ventricular walls at both ends and are free along the rest of their length.
- Fleshy columns of the^{third}order adhere to the wall along their entire length (Figure 3).

1- **Anterior pillar**
2- **Posterior-external pillar**
3- **Multiple pillars**
4- **Tendinous cords**
5- **Fleshy column of the 2nd order**
6- **Apex of the ventricle**

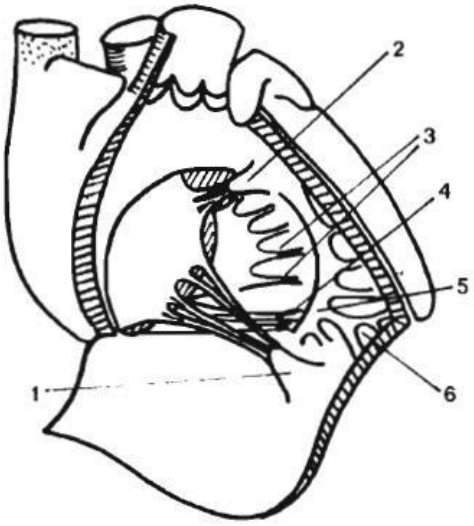


Figure 2. Anterior view of the right ventricle

I- **Fleshy columns of the^{first}order**
II- **Fleshy columns of the^{second}order**
III- **Fleshy columns of the^{third}order**

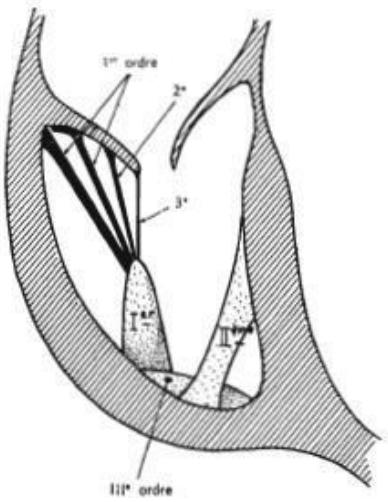


Figure 3. The fleshy columns of the heart

b- Base

The base of the heart has two openings: the atrioventricular opening and the pulmonary arterial opening.

-Atrioventricular orifice*:*

The atrioventricular orifice connects the atrium and the ventricle. It is circular, with a circumference of 110–120 mm. It comprises a valve apparatus known as the tricuspid valve, which is funnel-shaped and consists of three leaflets: the anterior, inferior and internal leaflets. Each leaflet is attached to tendinous cords extending from a fleshy column of the first order in the corresponding wall.

-Arterial orifice:
This is the opening of the pulmonary artery. It is circular and has three sigmoid valves: one anterior and two posterior (right and left).

2- Right atrium
The right atrium is irregularly cubic in shape and has six walls:
-Anterior: corresponds to the right atrioventricular orifice.
-External: features fleshy columns of the third order.
The right atrium opens via a large orifice situated above the right atrioventricular ostium at the junction of the anterior and external walls.
-Posterior: between the two openings of the two venae cavae, it features a protrusion known as Lower's tubercle.
-Internal: formed by the interatrial septum, it features a rounded depression, the foramen ovale, which is bounded by a protruding ring, Vieussens' ring (a remnant of the Botallus duct, which has closed).
-Superior: features the orifice of the valveless superior vena cava.
-Inferior: has two openings; the opening of the inferior vena cava, which contains Eustachi's valve, and the opening of the coronary sinus, which contains Thebesius's valve (Figure 4).

1- Lateral wall
2- Oval fossa
3- Opening of the superior vena cava
4- Opening of the inferior vena cava
5- Eustachi valve
6- Coronary sinus orifice
7- Thebesus valve
8- Lower's tubercle

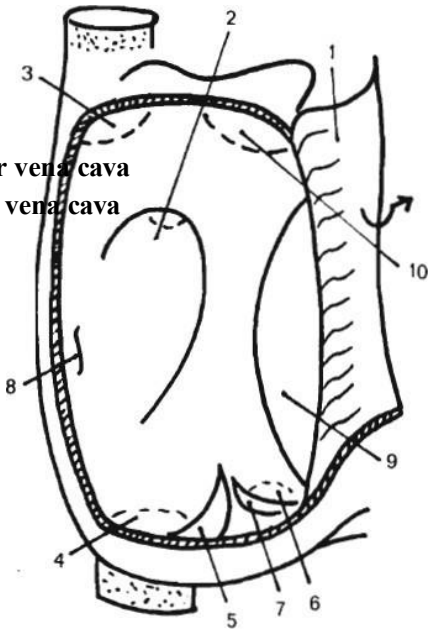


Figure 4. External view of the right atrium

B – THE LEFT HEART
The left heart consists of the left ventricle and the left atrium.

1- Left ventricle
The left ventricle is conical in shape and has two distinct walls: an outer wall and an inner wall, a base and an apex (Figure 4).

a- The walls
Both the inner and outer walls feature fleshy columns. The right wall corresponds to the interventricular septum.
The left wall corresponds to the left lateral surface of the heart

b- Base

It has two openings: the left atrioventricular opening and the aortic opening.
-Left atrioventricular orifice: circular, with a circumference of 90–110 mm,
equipped with a valve apparatus known as the mitral valve, which is funnel-shaped and comprises two leaflets: the large (or right) leaflet and the small (or left) leaflet.
-Aortic orifice:
Its valvular apparatus comprises three sigmoid leaflets: two anterior leaflets (right and left) and one posterior leaflet.

1- Left lateral wall
2- Left atrioventricular valve
3- Anterior papillary muscle
4- Posterior papillary muscle

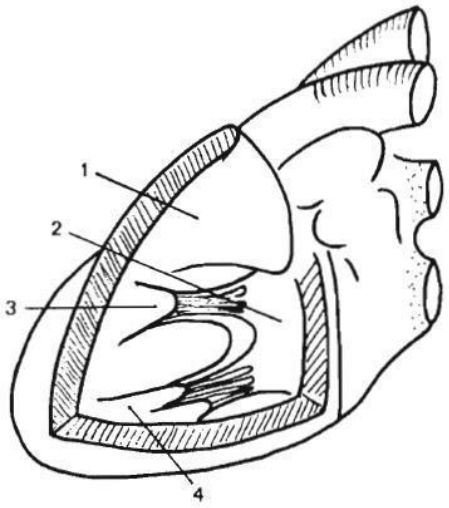


Figure 5. Left lateral view of the left ventricle

2-Left atrium
It has six walls:
-The lateral outer wall contains the opening of the left atrium.
-The medial inner wall is formed by the interatrial septum
-The upper and lower walls
-The posterior wall contains the openings of the four pulmonary veins.
-The anterior wall opens into the left atrioventricular orifice (Figure 6).

1- Opening of the left atrium
2- Remnant of the foramen of Botallus
3- Openings of the pulmonary veins
4- Mitral orifice

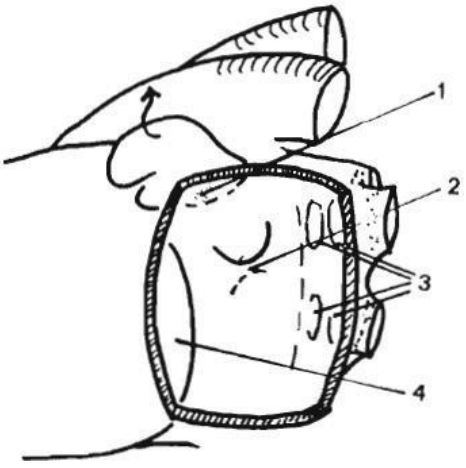
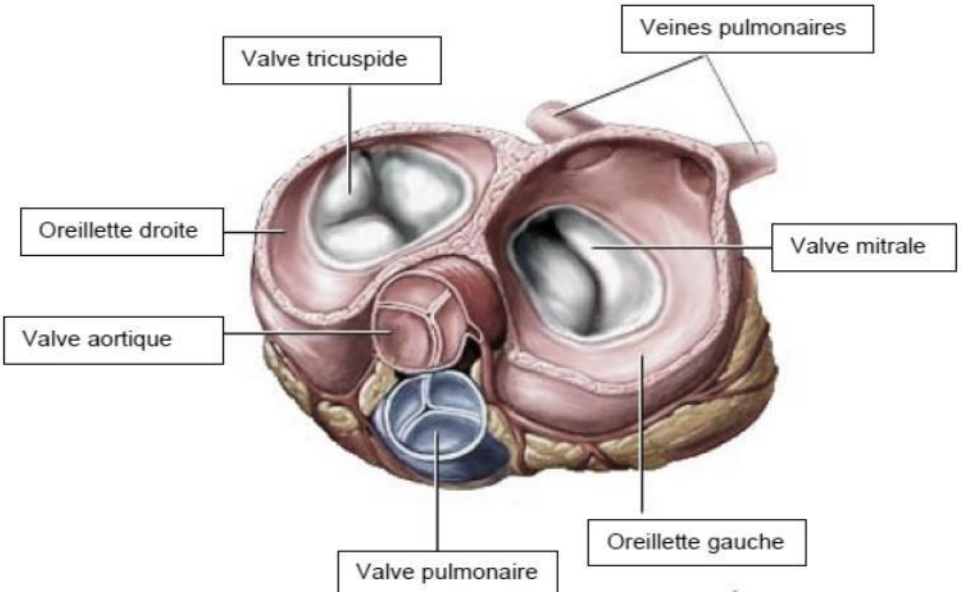


Figure 6. Left lateral view of the left atrium



Superior view of the sectioned atria and arterial orifices

Stethacoustic projection

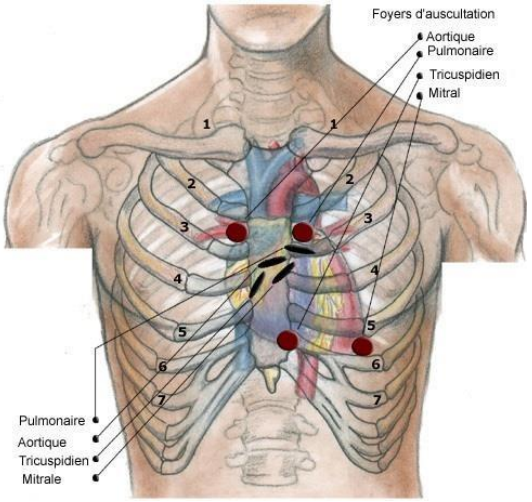
These are the clinical auscultation sites

The pulmonary focus: is situated in the 2nd left intercostal space.

The aortic focus: is situated in the second right intercostal space, symmetrical to the pulmonary focus.

The tricuspid focus: situated at the base of the xiphoid process.

The mitral focus: located in the 5th left intercostal space, on the mid-clavicular line.



Stethacoustic projection

III- CONCLUSION

The heart, an essential organ of the circulatory system, is divided by the interatrial septum and the interventricular septum into two chambers: the right chamber, which carries oxygen-poor blood, and the left chamber, which carries oxygen-rich blood.