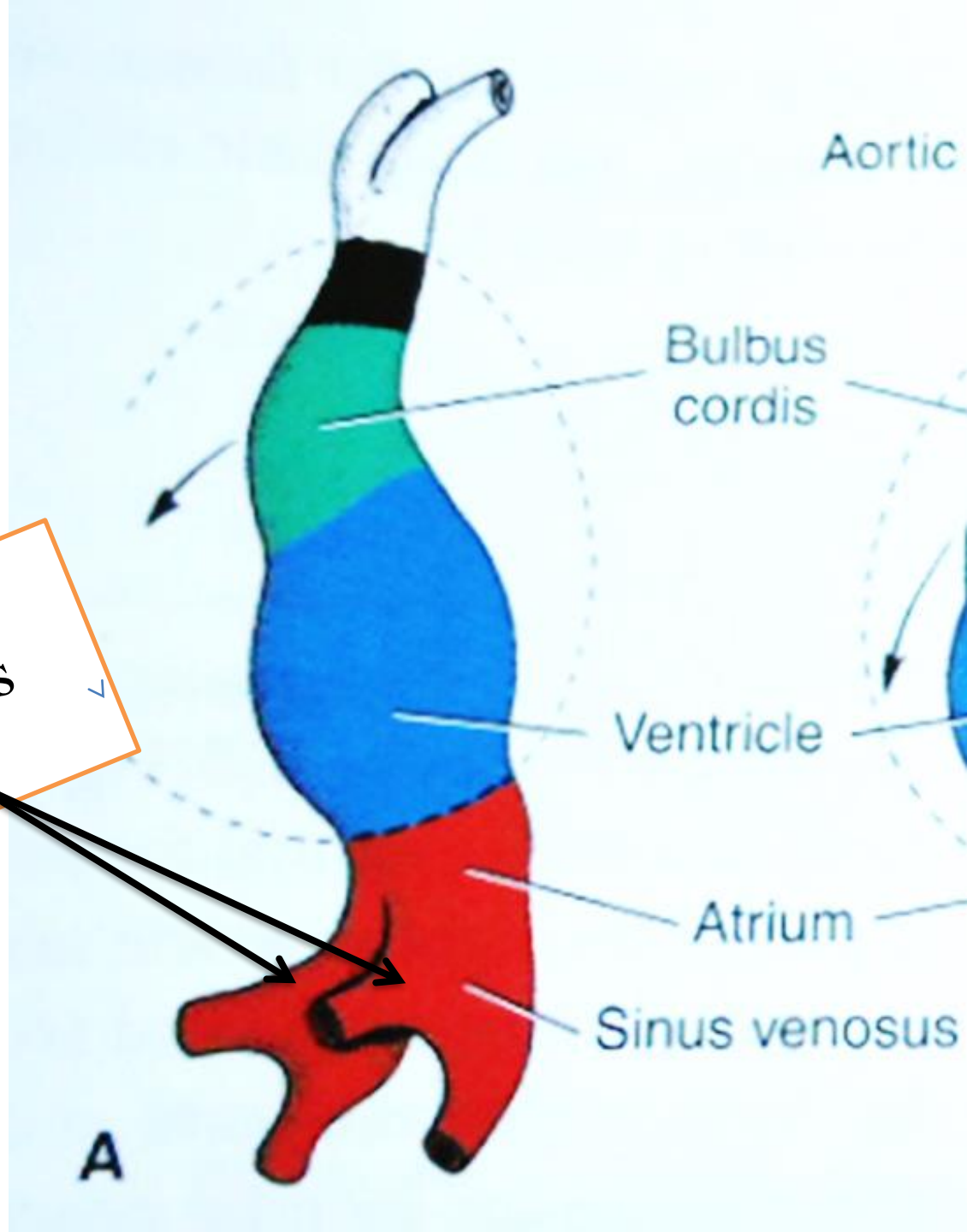


# Development of Major Blood Vessels

## Venous system

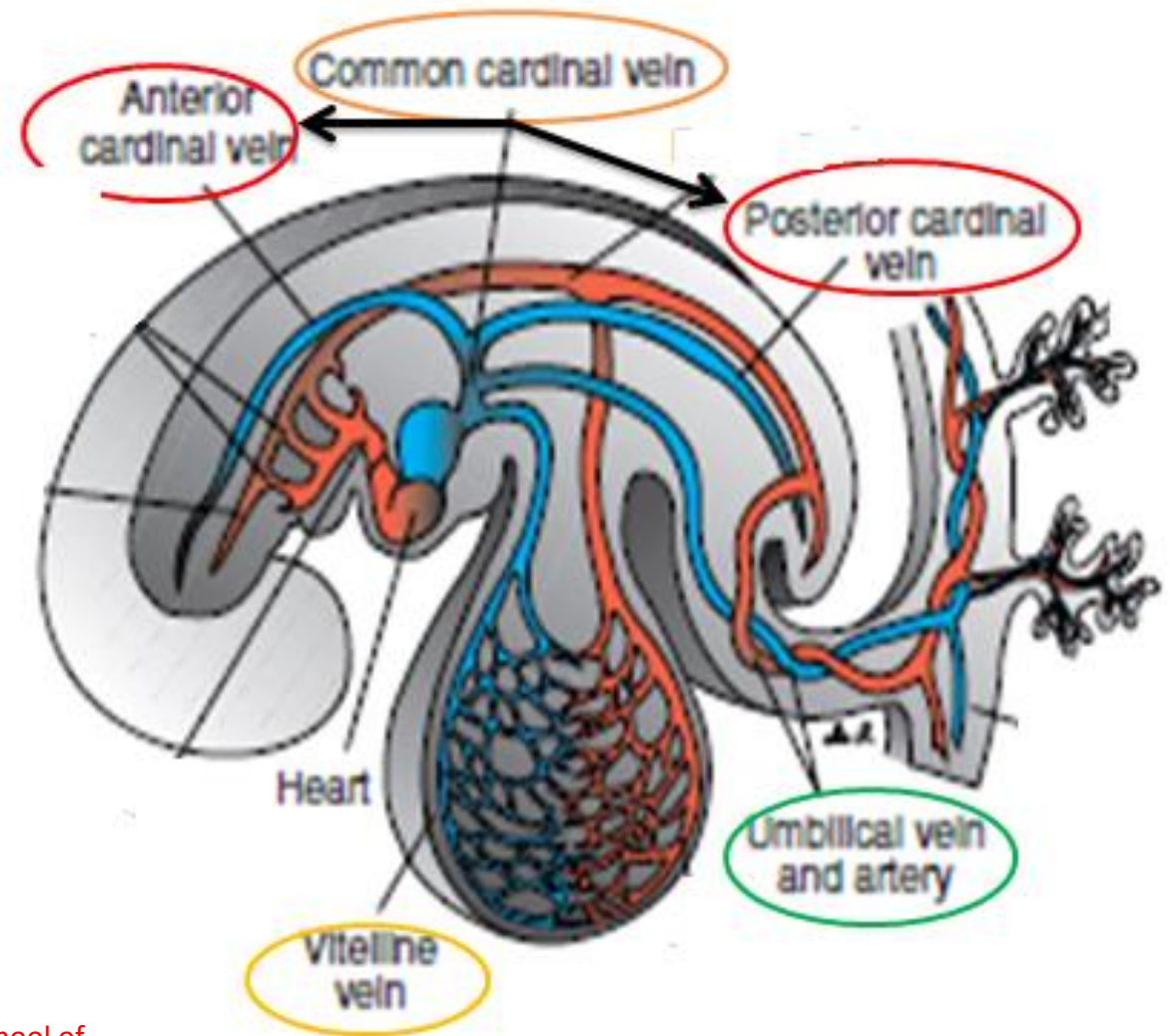
Remember that the sinus venosus has two horns



**The sinus venosus represent the venous end of the heart**

It receives 3 veins:

- 1- Common cardinal vein → body wall**
- 2- Umbilical vein → from placenta**
- 3- Vitelline vein → from yolk sac**



However!!!!

The **left sinus horn** of the sinus venosus is losing its importance and blood from the left side is rechanneled toward the right

Why the left sinus horn loses  
Its importance????

Due to

## left-to-right shunts of blood



**1-The first left-to-right shunt is a result of the transformation of both vitelline and umbilical veins**



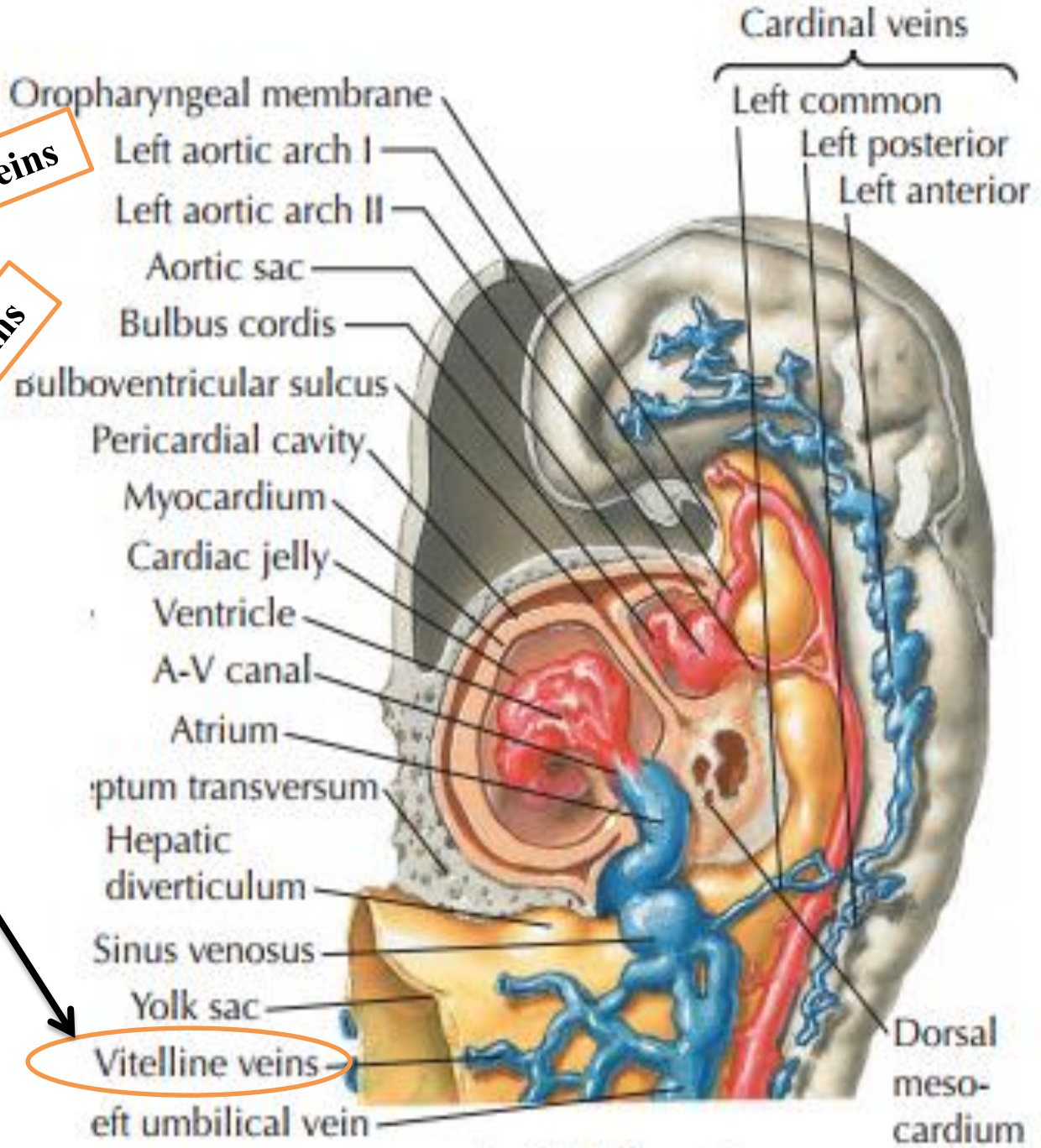
**2-The second left-to-right shunt occurs when the left anterior cardinal vein becomes connected To the right anterior cardinal vein by an oblique anastomosis**

?????????



**Transformation of the vitelline veins**

**A-Vitelline Veins (omphalomesenteric) veins**



**Sagittal dissection**

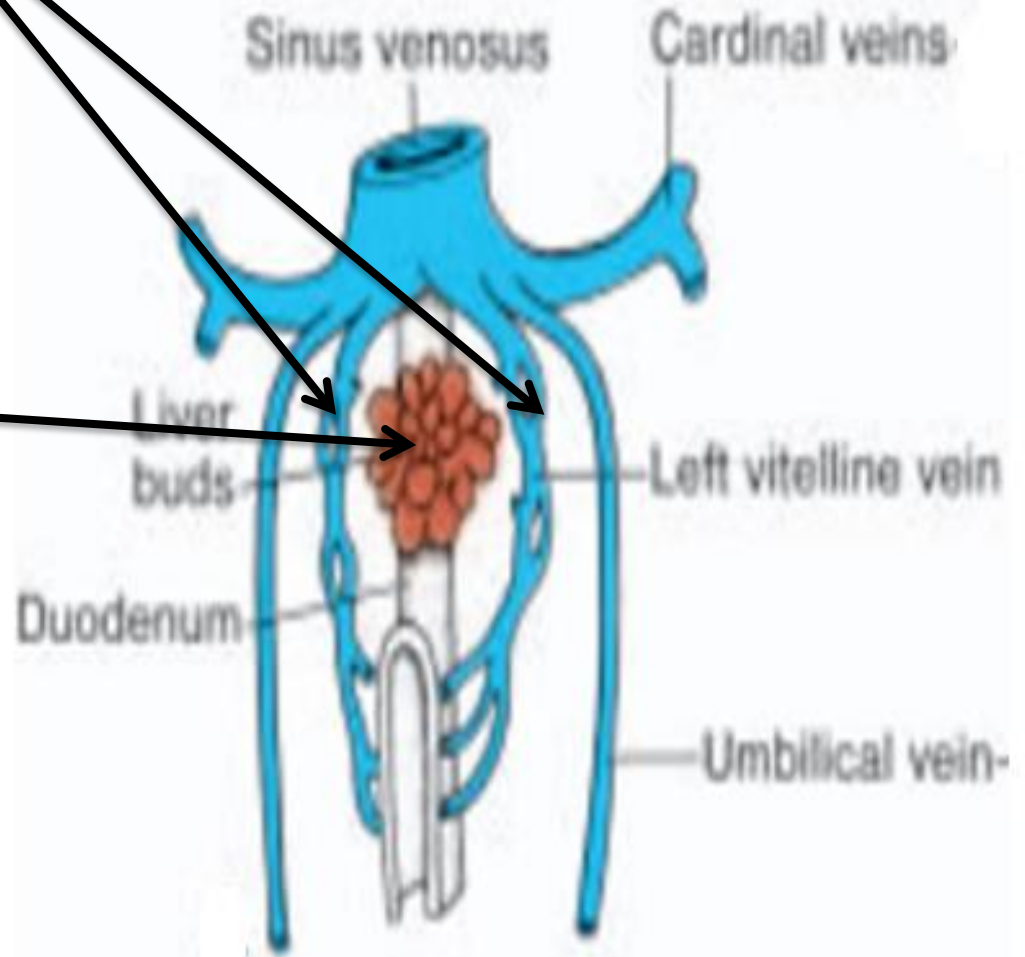
## Vitelline Veins (omphalomesenteric) veins

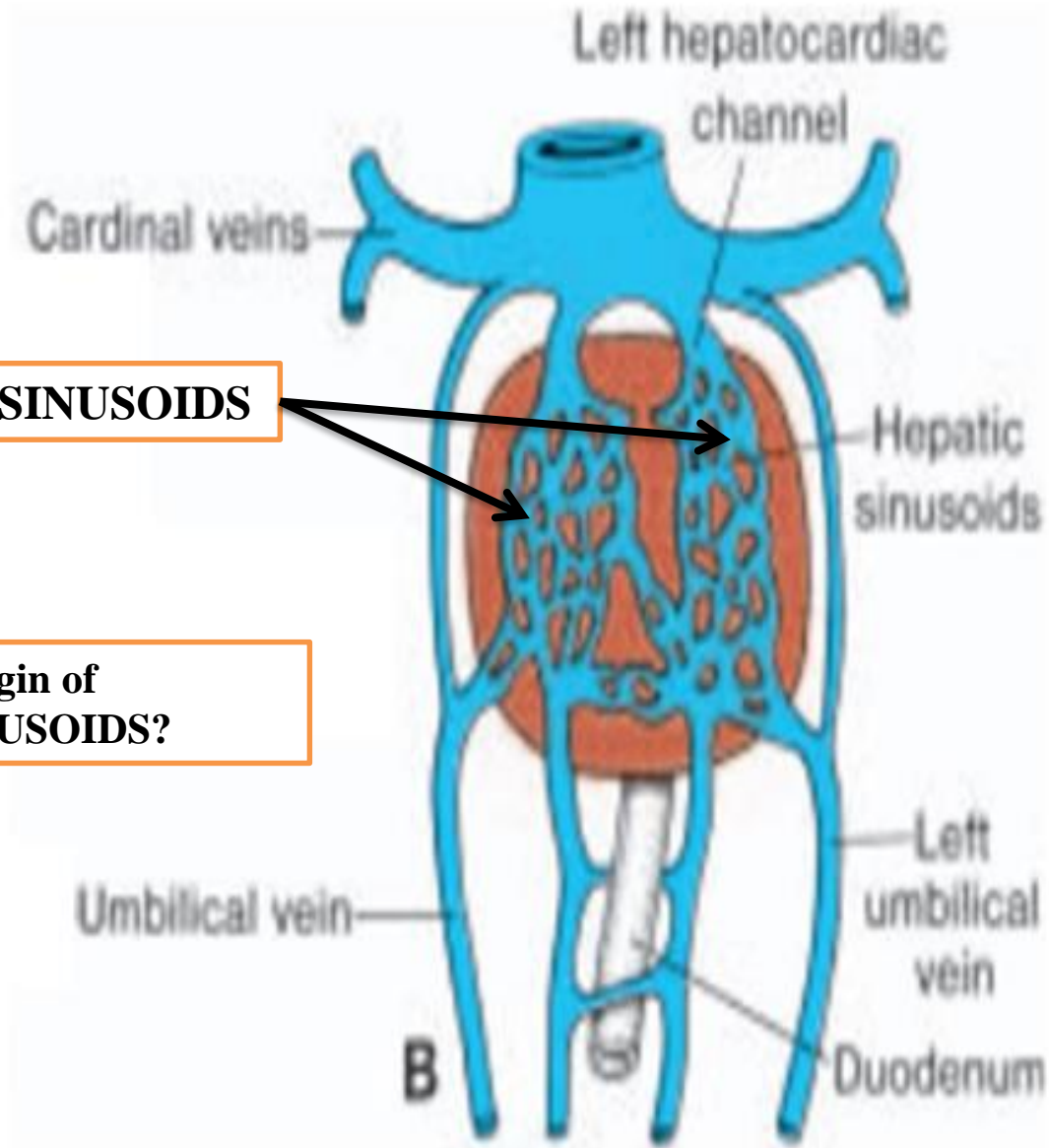
1-The vitelline veins form a plexus around the developing duodenum then it enters **the sinus venosus**

2-The growing liver cords interrupt the course of the vitelline veins, and form an extensive vascular network

Called

**THE HEPATIC SINUSOIDS**





## THE HEPATIC SINUSOIDS

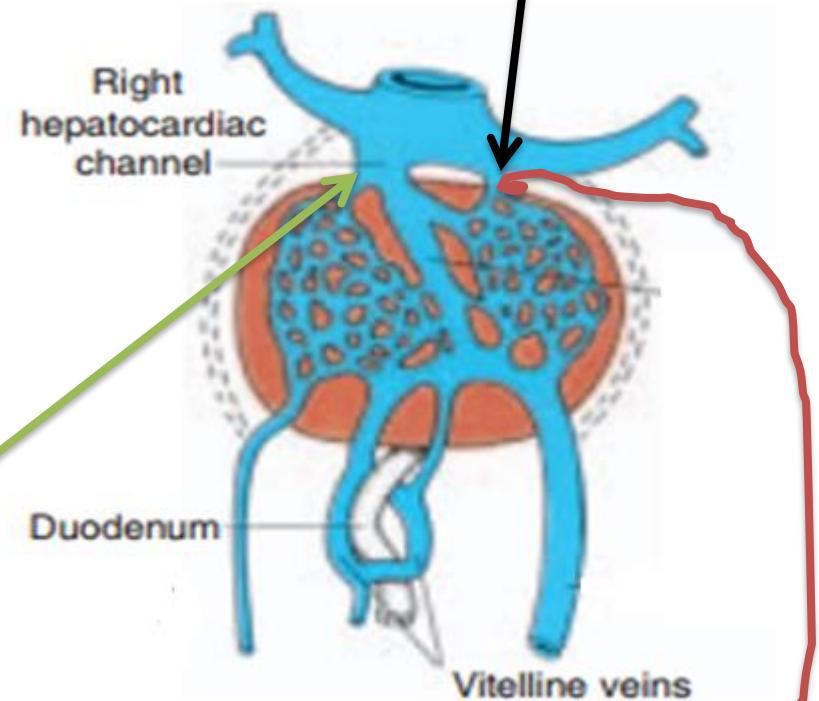
What is the origin of the HEPATIC SINUSOIDS?



It should be noted that at this time **the left sinus horn** of the sinus venosus is losing its importance and blood from the left side of the liver is rechanneled toward the right, resulting in an enlargement of the right vitelline vein

Also called  
**(right hepatocardiac channel)**

Notice how the left vitelline vein is redirected to the right vitelline vein which is in its turn getting bigger



3-The right hepatocardiac channel forms the hepatocardiac portion of

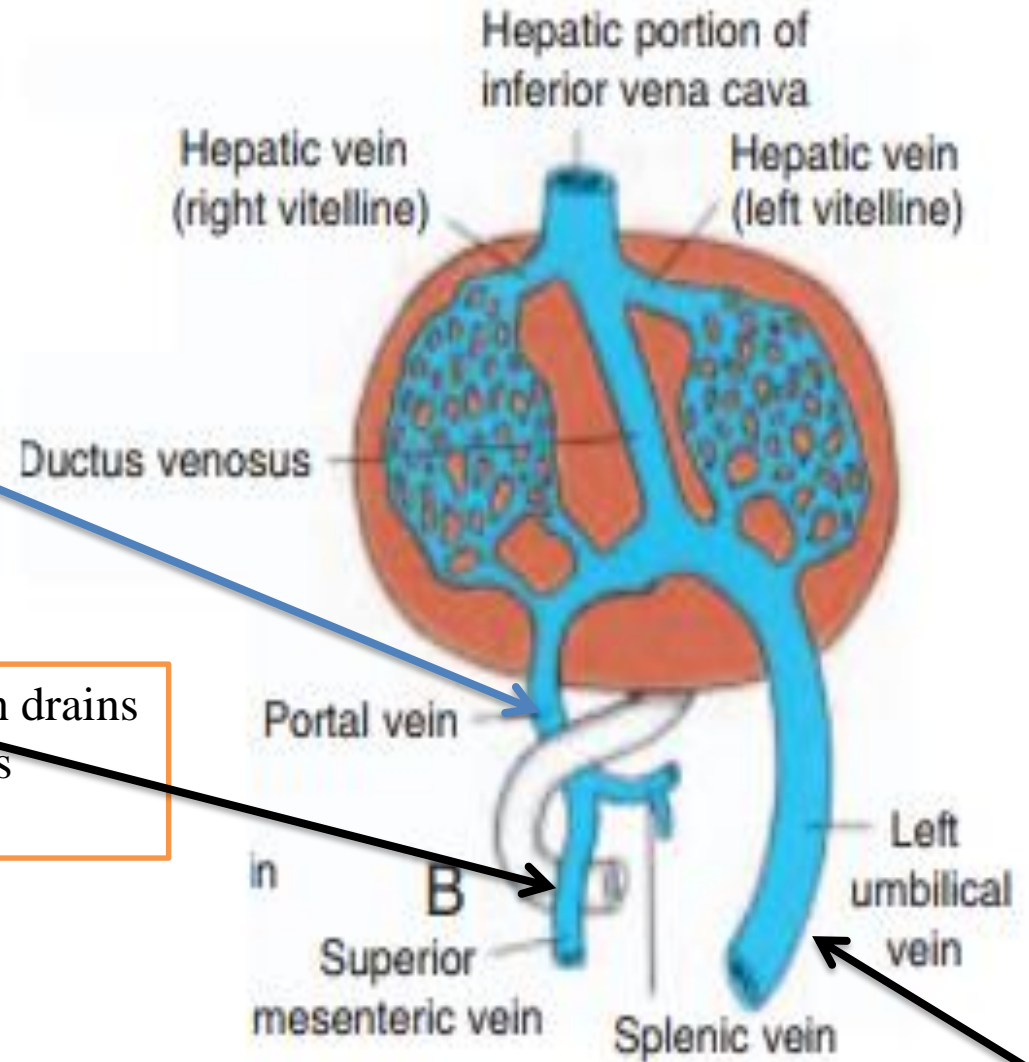
**The inferior vena cava**

4-The proximal part of the left vitelline vein disappears

5- The anastomotic network around the duodenum develops into a single vessel,

**The portal vein**

6- The **superior mesenteric vein**, which drains the primary intestinal loop, derives from the **right vitelline vein**



7- The distal portion of the left vitelline vein also disappear

# Right vitelline vein

You should know by now;  
1-the origin of all of the following:

**THE HEPATIC SINUSOIDS**

The hepatocardiac portion  
of **the inferior vena cava**

**The portal vein**

**The superior mesenteric vein**

2- what is the fate of the left vitelline vein

The proximal part of the left vitelline vein disappear

The distal portion of the left vitelline vein also disappear

Left vitelline vein

**Transformation of the umbilical veins**

**B-Umbilical Veins**

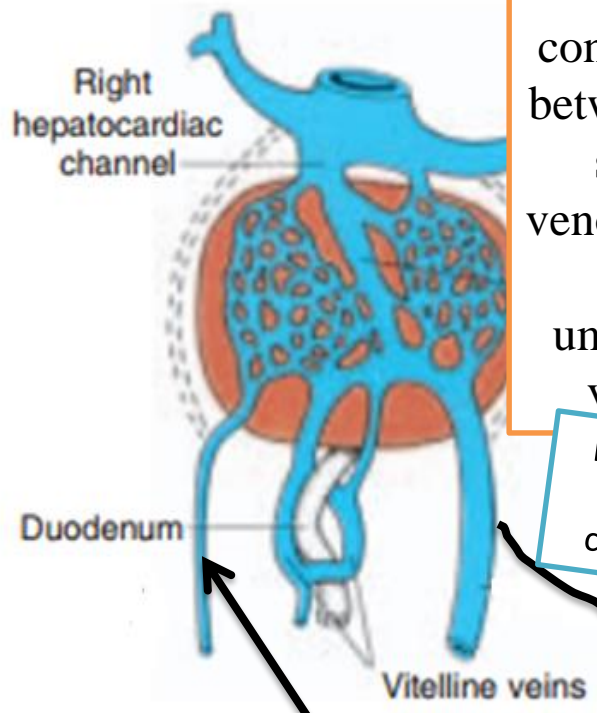
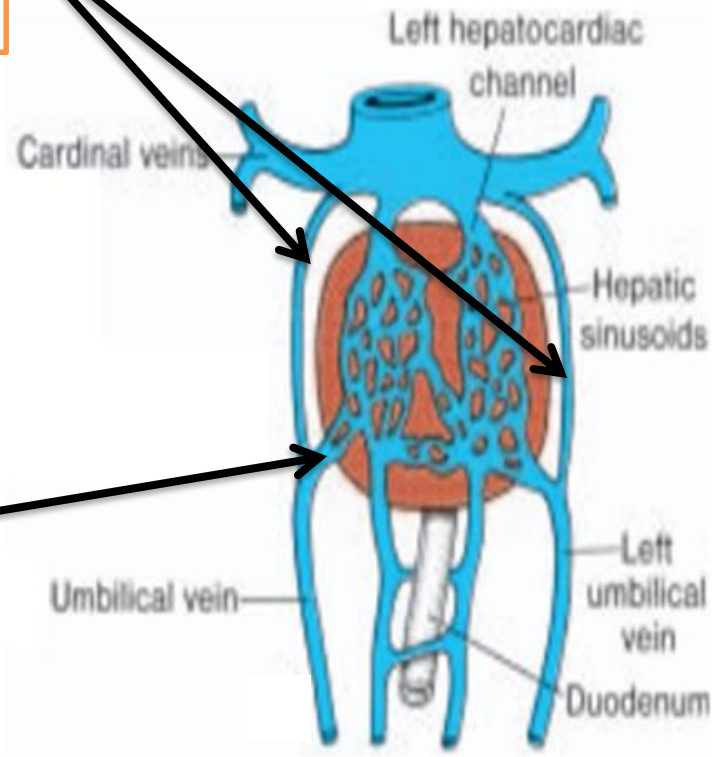
1-Initially the umbilical veins pass on each side of the liver

3-The proximal part of both umbilical veins disappear

No connection between the sinus venosus and the umbilical veins

2-Some connect to the hepatic sinusoids

How they will connect?



A

B

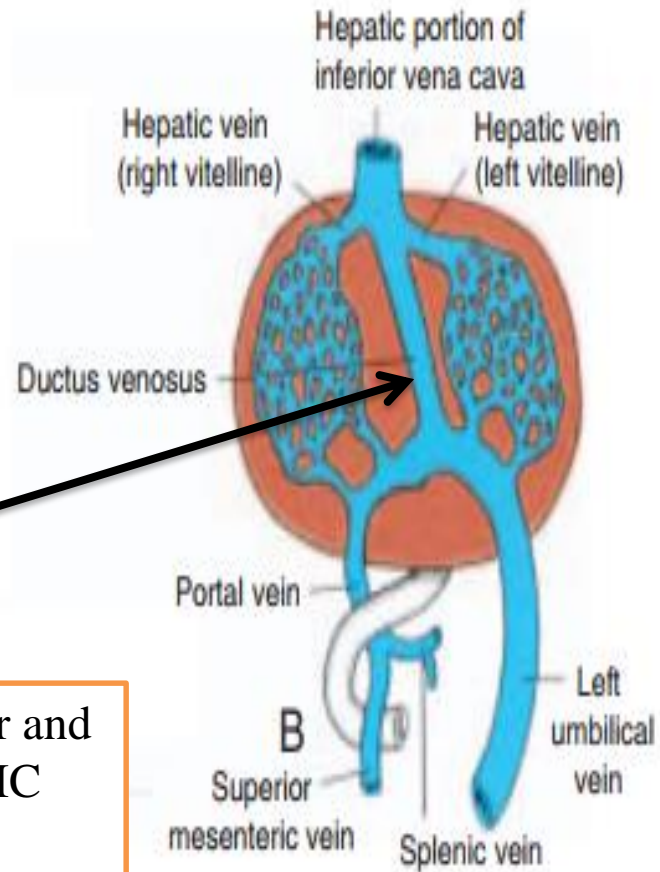
Compare between umbilical veins in A and B

4-The remainder of the right umbilical vein then disappear, so that **the left vein is the only one** to carry blood from the placenta to the liver

5- With the increase of the placental circulation, a direct communication forms between the **left umbilical vein** and the **right hepatocardiac channel** To Form

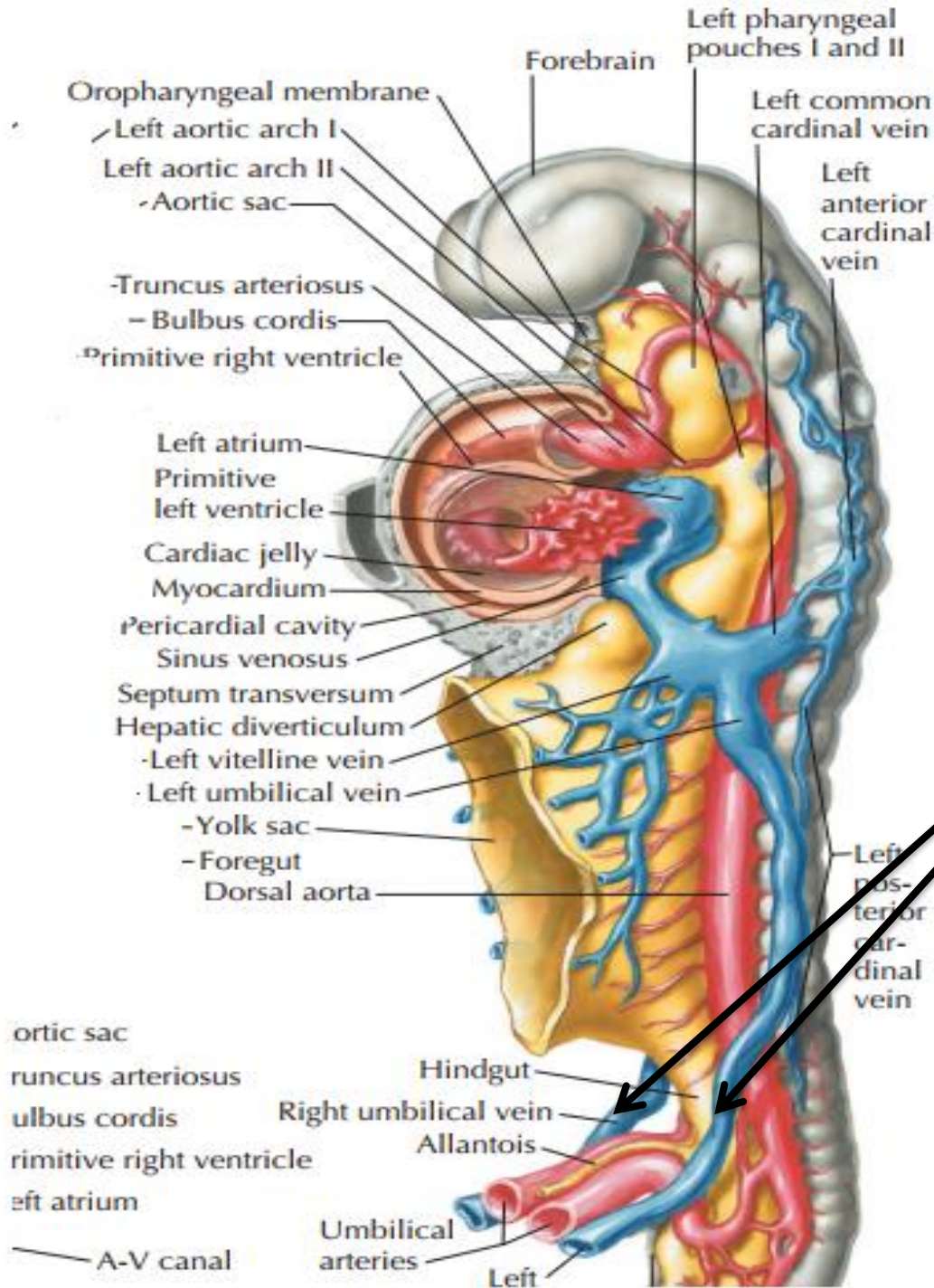
## The ductus venosus

This vessel bypasses the sinusoidal plexus of the liver and directly connects the left umbilical vein to HEPATIC PORTION OF THE INFERIOR VENA CAVA



6- After birth the left umbilical vein and ductus venosus are **obliterated** **left umbilical vein forms..... the ligamentum teres hepatis** **ductus venosus forms.....the ligamentum venosum**





you should have known the answer to the question asked previously



**Why the left sinus horn loses its importance????**

**Umbilical Veins**



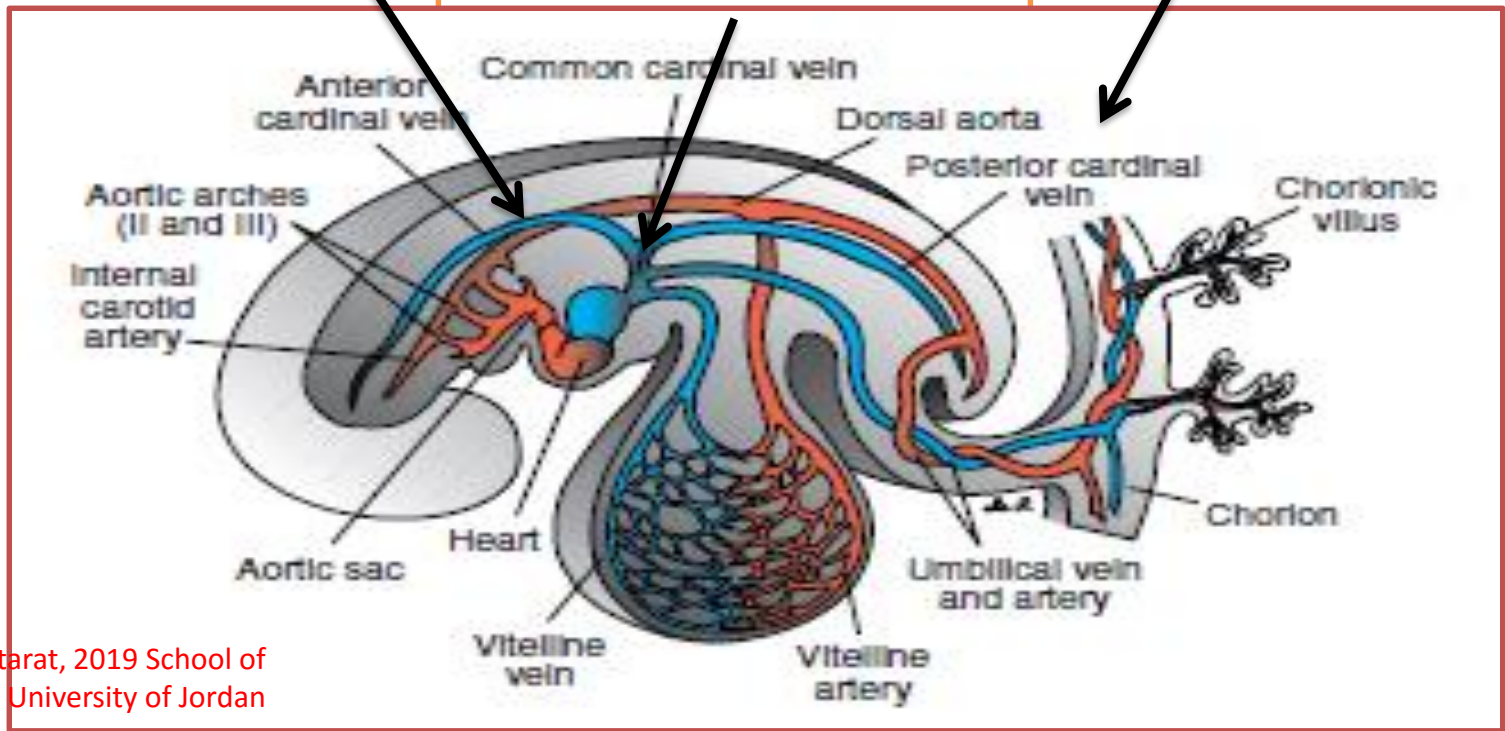
# C- Cardinal Veins

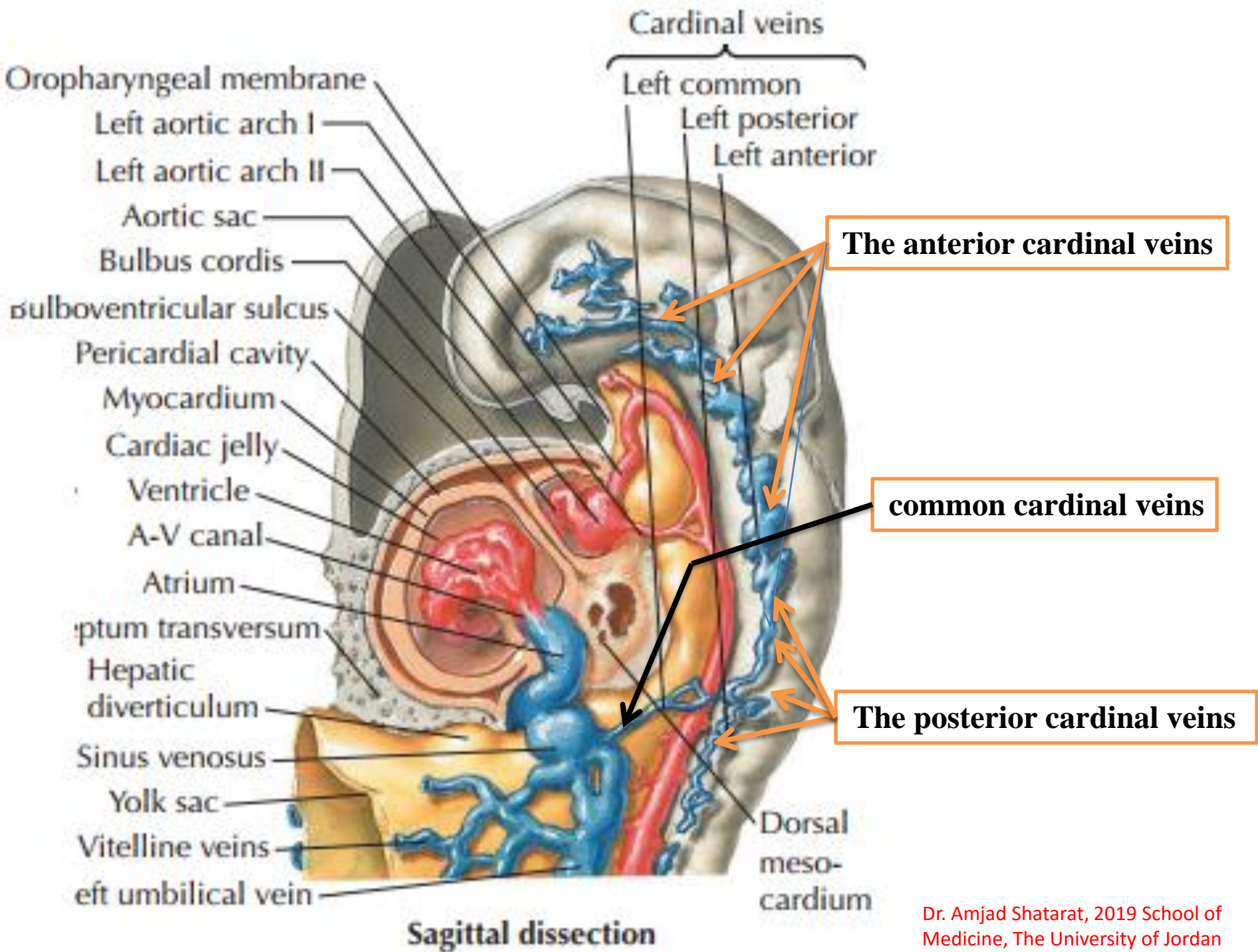
1-This system consists of:

**Right and left anterior cardinal veins**  
which drain the cephalic part of the embryo

**Right and left posterior cardinal veins**  
which drain the rest of the embryo

join before entering the  
sinus horn and form the  
**short  
right and left common  
cardinal veins**





additional veins are formed:

2- During the fourth week, the cardinal veins form a symmetrical system. During the fifth to the seventh week a number of additional veins are formed:

**(a) The subcardinal veins**

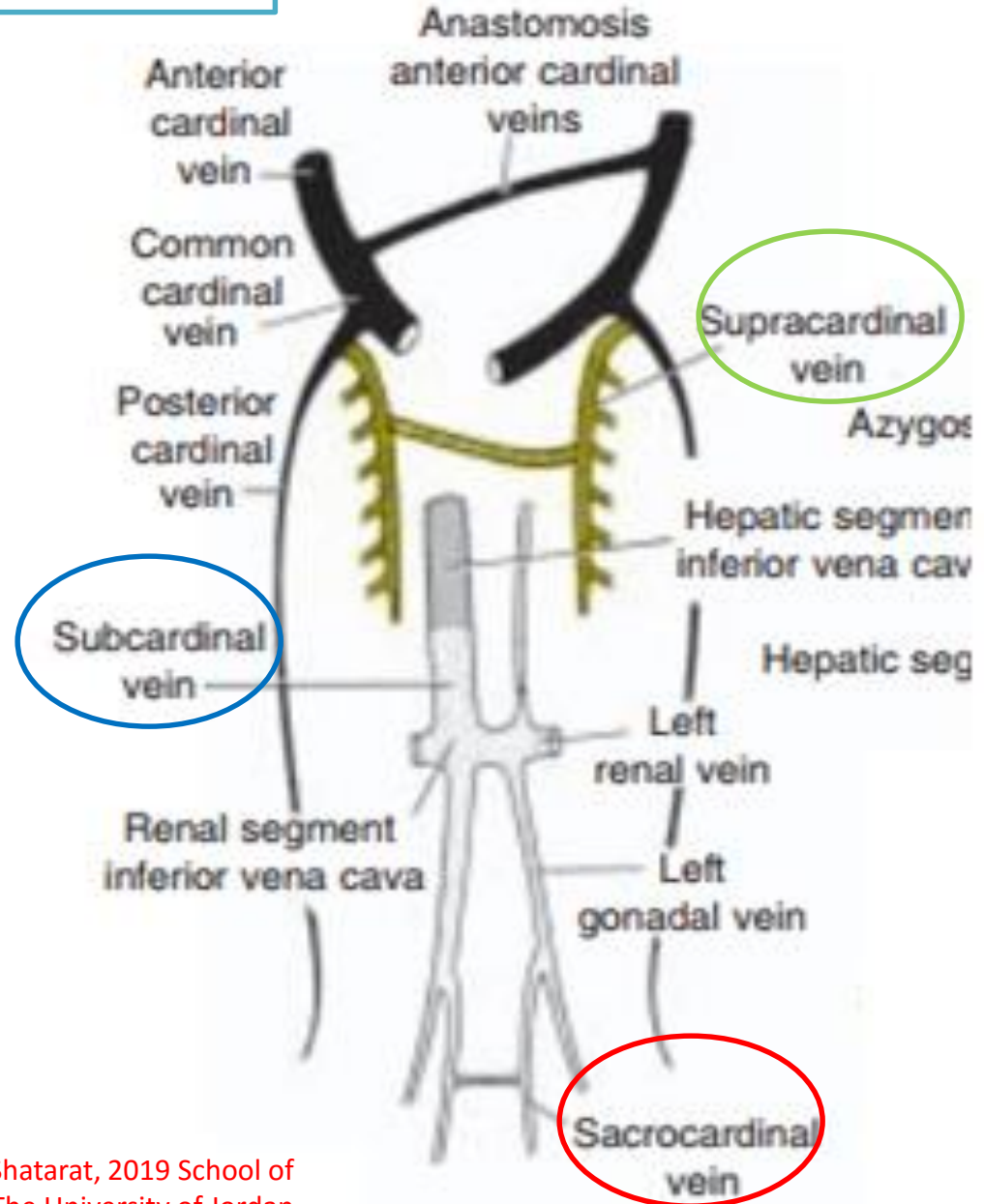
which mainly drain the kidneys

**(b) The sacrocardinal veins**

which drain the lower extremities

**(c) The supracardinal veins**

which drain the body wall by way of the intercostal veins, taking over the functions of the posterior cardinal veins





3-The anastomosis between the anterior cardinal veins develops into

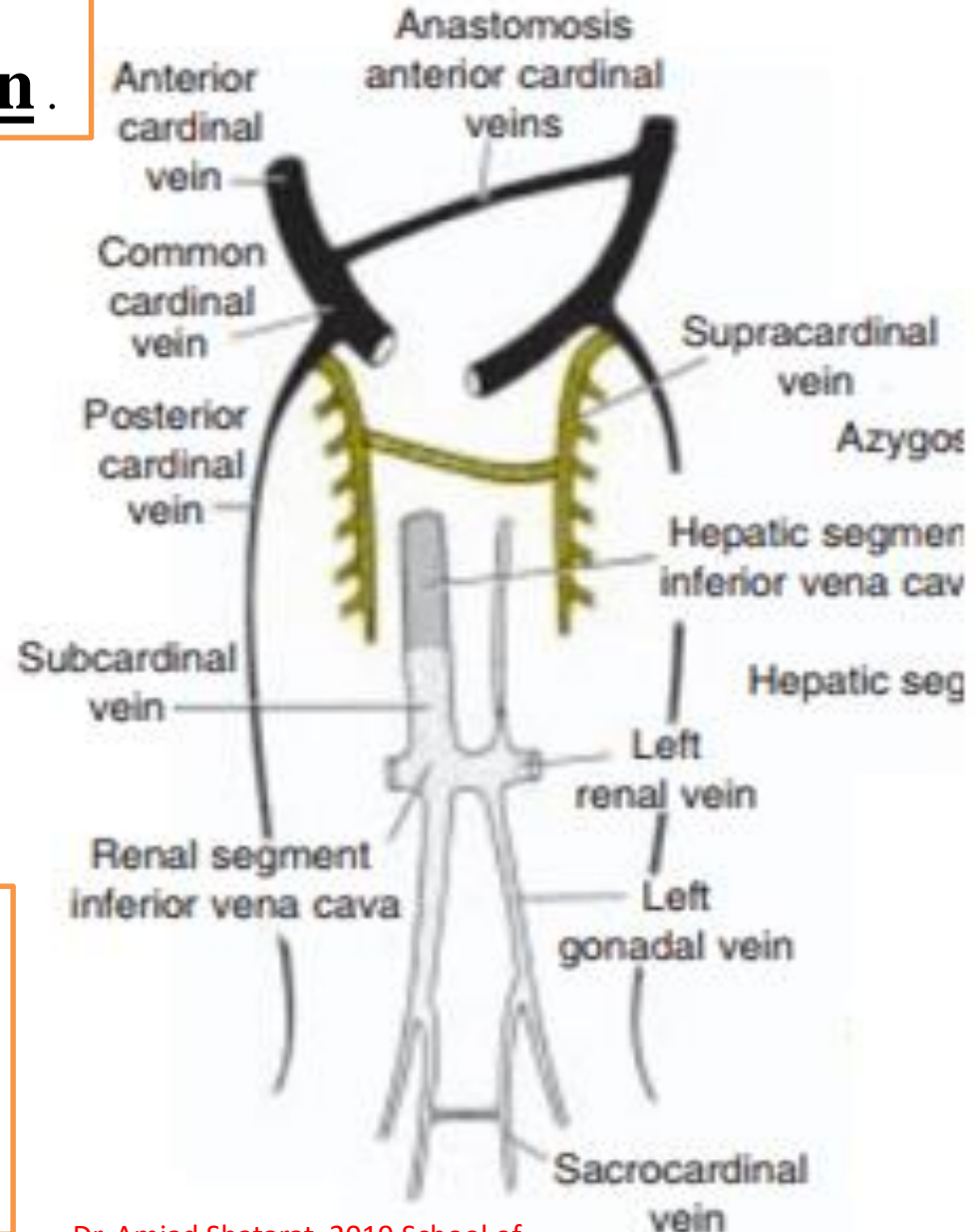
**the left brachiocephalic vein**.



4- Most of the blood from the left side of the head and the left upper extremity is then channeled to the right

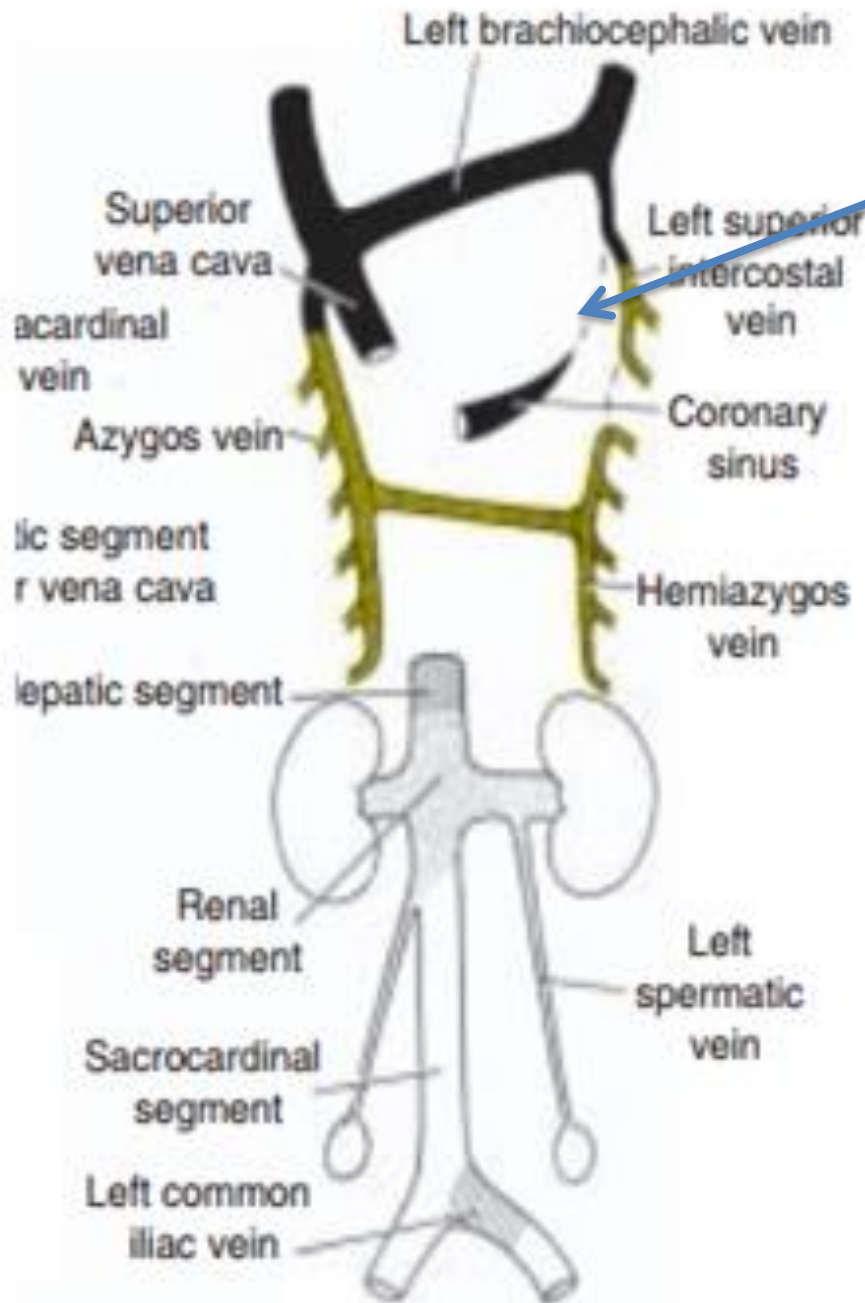
Now, you should have understood

The second left-to-right shunt occurs when the left anterior cardinal vein **becomes connected** To the right anterior cardinal vein by **an oblique anastomosis**



5- **The terminal portion** of the left posterior cardinal vein entering into the left brachiocephalic vein is retained as a small vessel. **the left superior intercostal vein** This vessel receives blood from the second and third intercostal spaces

You should understand, by now, why the left superior intercostal vein Drains into the left brachiocephalic vein

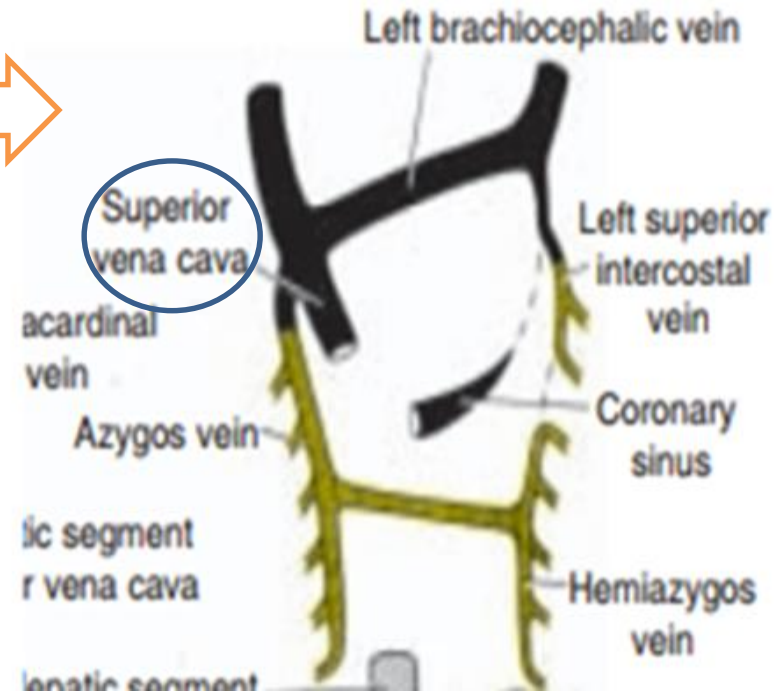
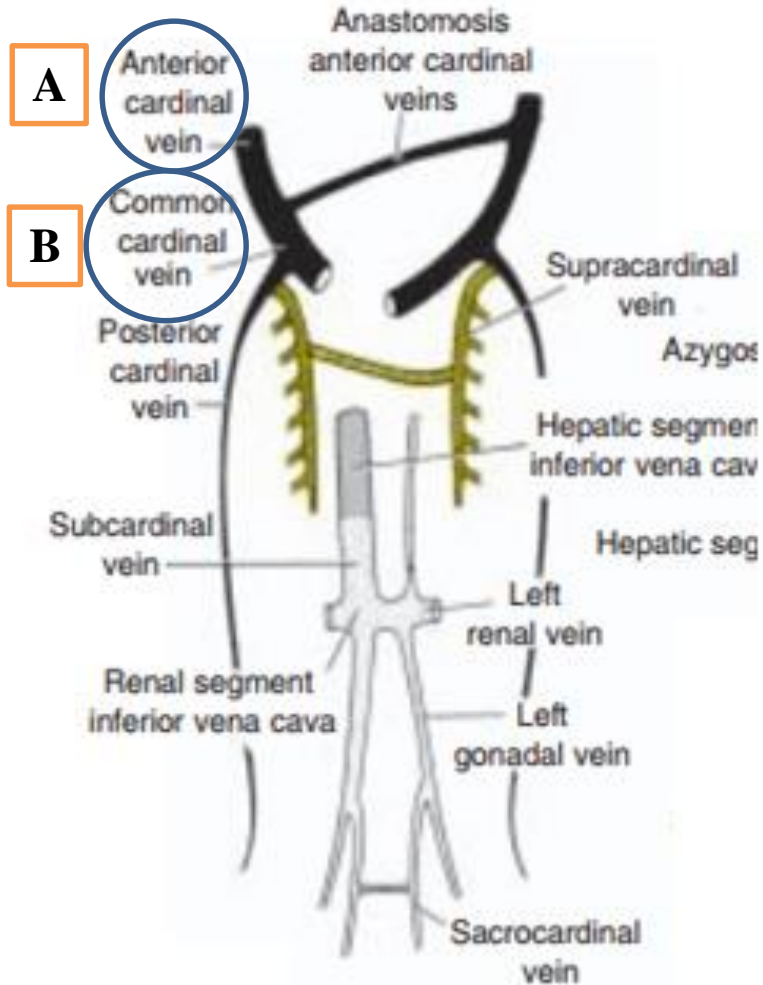


6- The superior vena cava is formed

by

A-The right common cardinal vein

B-The proximal portion of the right anterior cardinal vein



Dr. Amjad Shatarat, 2019 School of Medicine, The University of Jordan



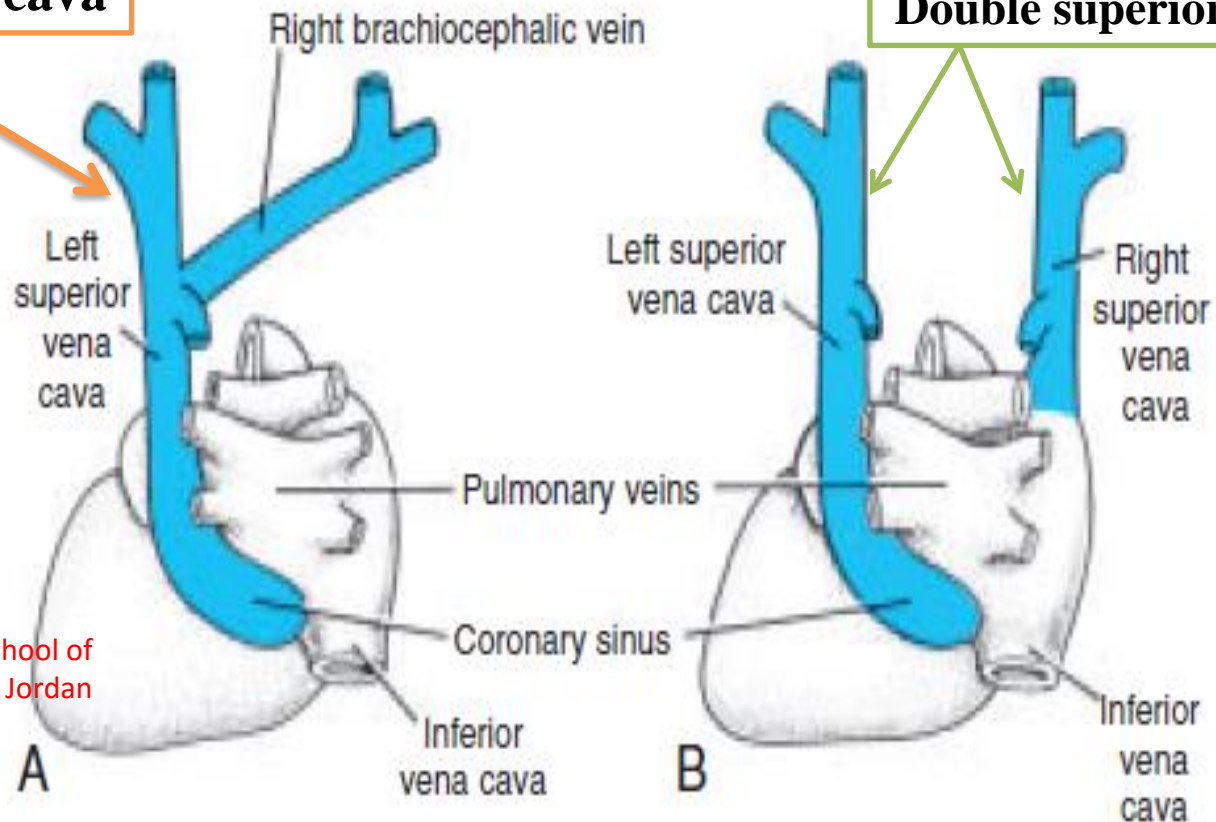
# Clinical correlates

Failure of the right brachiocephalic vein to form

Persistence of the left anterior cardinal vein

**Left superior vena cava**

**Double superior vena cava**



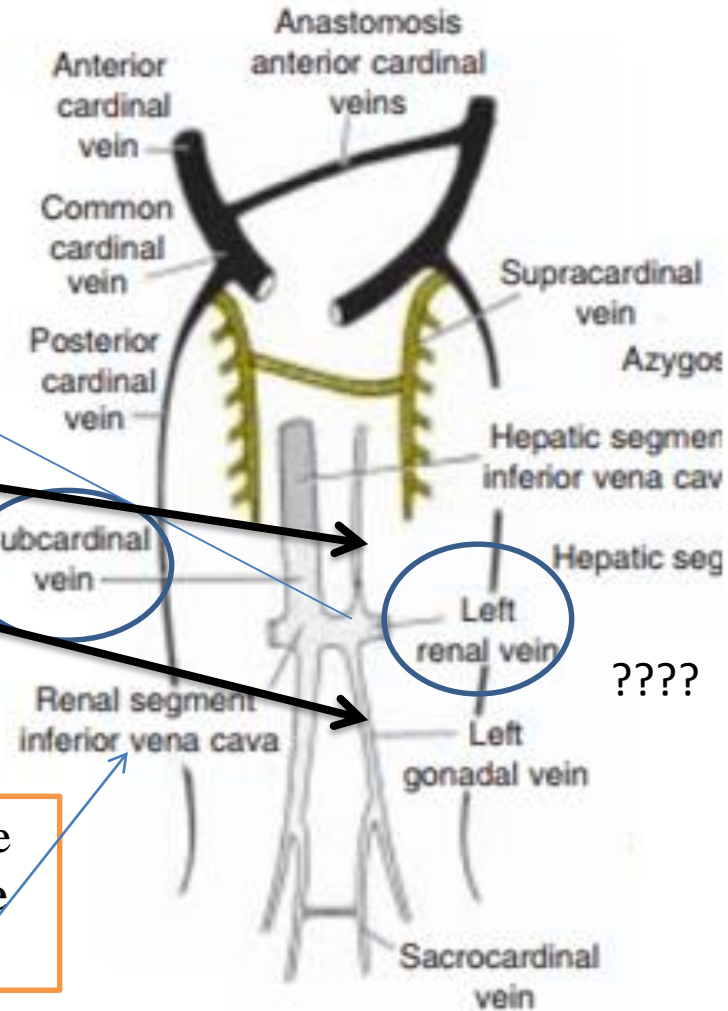
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# Development of the inferior vena cava

7- The anastomosis between the subcardinal veins **forms the left renal vein.**

When this communication has been established, **the left subcardinal vein disappears**, and only its distal portion remains as **the left gonadal vein.**

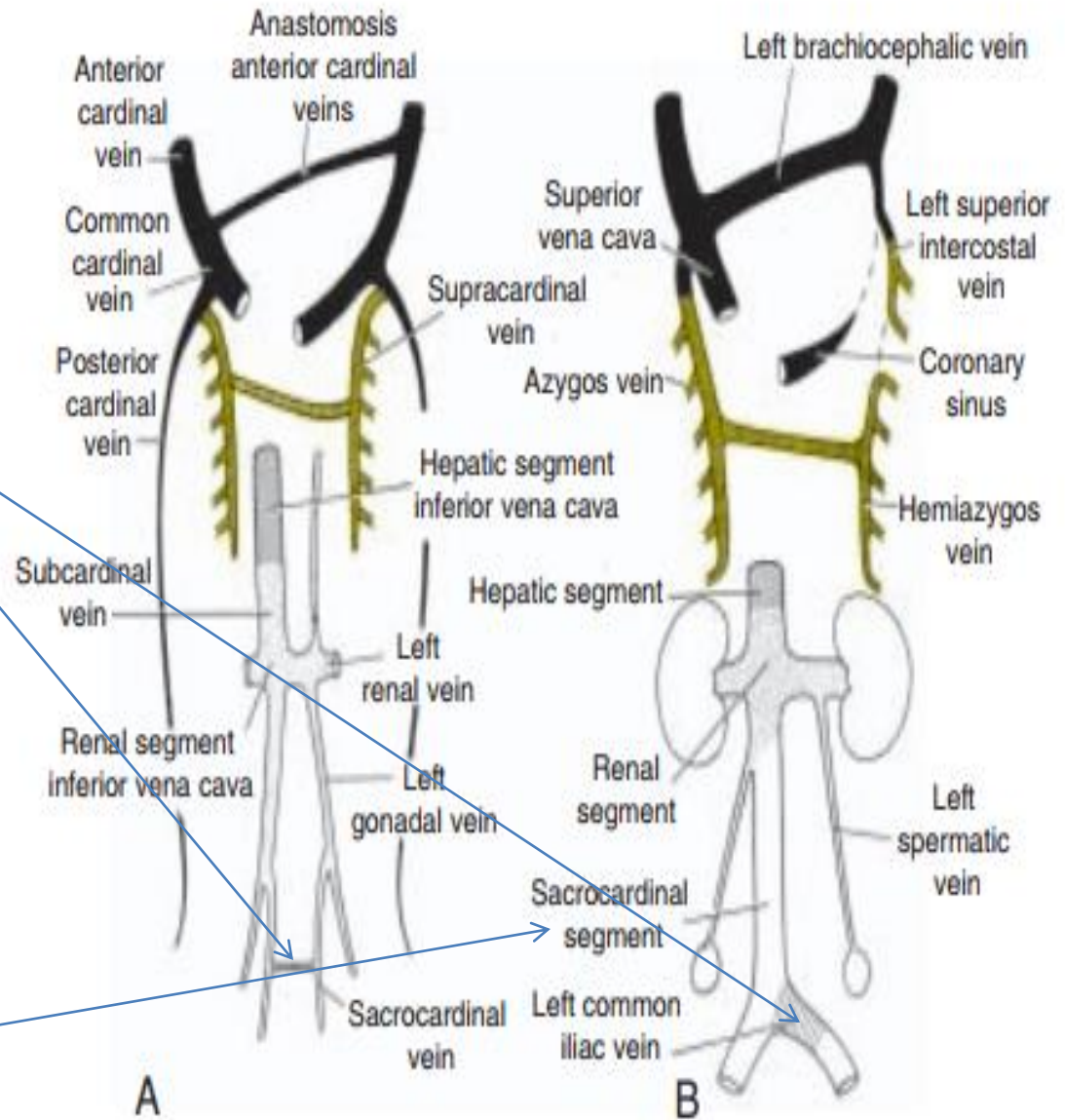
Hence the right subcardinal vein becomes the main drainage channel and develops **into the renal segment of the inferior vena cava**



8- The anastomosis between the sacrocardinal veins forms

## The left common iliac vein

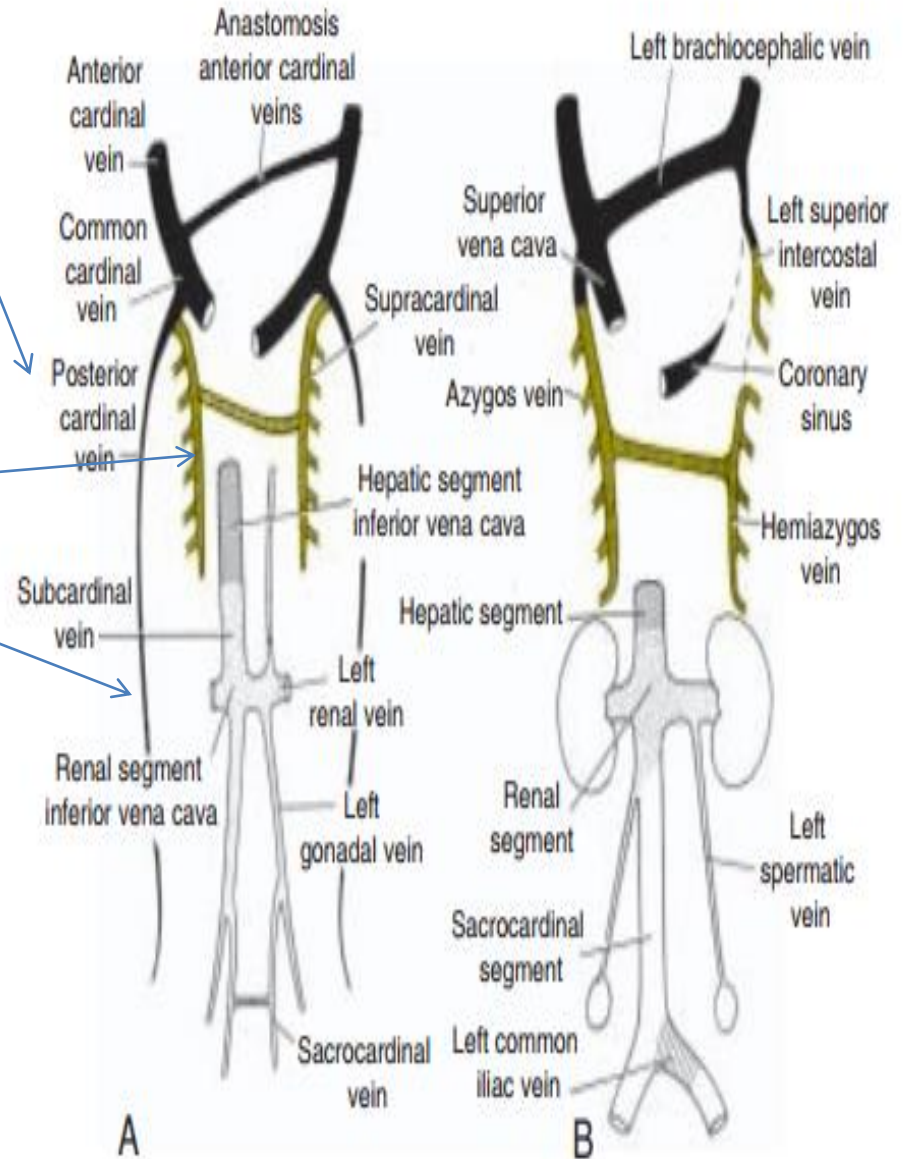
The right sacrocardinal vein becomes **sacrocardinal segment of the inferior vena cava**. When the renal segment of the inferior vena cava connects with the hepatic segment, which is derived from the right vitelline vein, the inferior vena cava, **consisting of hepatic, renal, and sacrocardinal segments, is complete**



**Figure 11.44** Development of the inferior vena cava, azygos vein, and superior vena cava. **A.** Seventh week. The anastomosis lies between the subcardinals, supracardinals, sacrocardinals, and anterior cardinals. **B.** The venous system at birth showing the three components of the inferior vena cava.

9- With obliteration of the major portion of the posterior cardinal veins, **the supracardinal veins assume a greater role in draining the body wall.** The 4th to 11th right intercostal veins empty into **the right supracardinal vein**, which together with a portion of the posterior cardinal vein forms the **azygos vein**

10- On the left, the 4th to 7th intercostal veins enter into the left supracardinal vein, and the left supracardinal vein, then known as the **hemiazygos vein**



**Figure 11.44** Development of the inferior vena cava, azygos vein, and superior vena cava. **A.** Seventh week. The anastomosis lies between the subcardinals, supracardinals, sacrocardinals, and anterior cardinals. **B.** The venous system at birth showing the three components of the inferior vena cava.



# Clinical correlates

**Double inferior vena cava:  
Left sacrocardinal vein remain  
connected to the left subcardinal vein**

**Absence of the inferior cava : The right  
subcardinal vein fails to make the  
connection with the liver**

