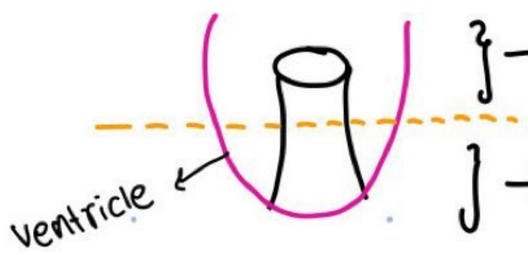
Written by: Maya . alrefai
Corrected by: tasnim ahmed

lecture 3 embryology



} → distal part (truncus arteriosus)

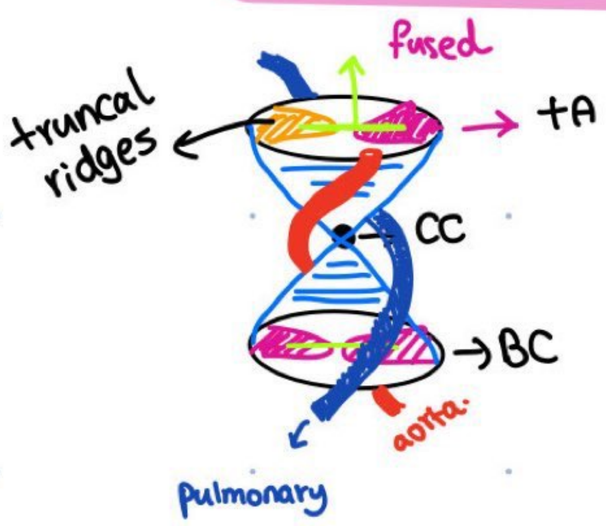
} → proximal part (conus cordis)

* proximal part is absorbed into ventricles forming the outflow tracts of both ventricles

* distal part is divided by spiral aortic-pulmonary septum into ascending aorta & pulmonary trunk.

Formation of the aortic-pulmonary S

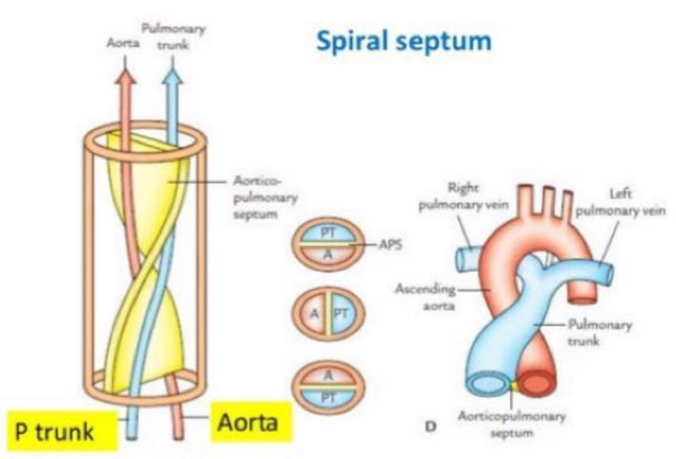
S = septum



① During 5th week, 2 truncal ridges in the truncus arteriosus (right & left) are developed.

② by 8th week the two ridges become fused to Form a spiral aortic pulmonary septum dividing truncus arteriosus into pulmonary trunk & ascending aorta

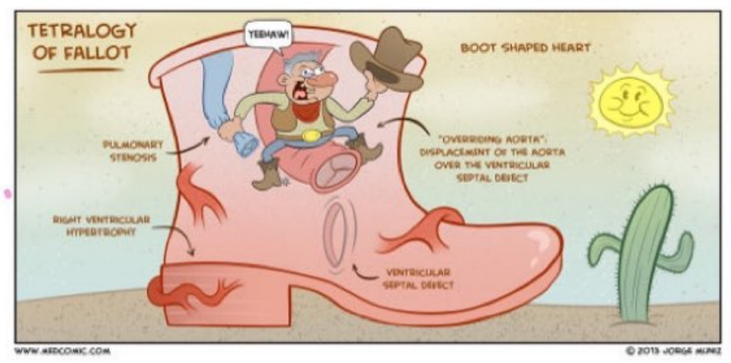
③ at the begining the pulmonary trunk lies anteriorly and then to the left and Finally Posteriorly to aorta



Fallot tetralogy

Drop

- displaced aorta
- Right ventricule Hypertrophy
- Pulmonary Stenosis.
- opening in septum (VSD)

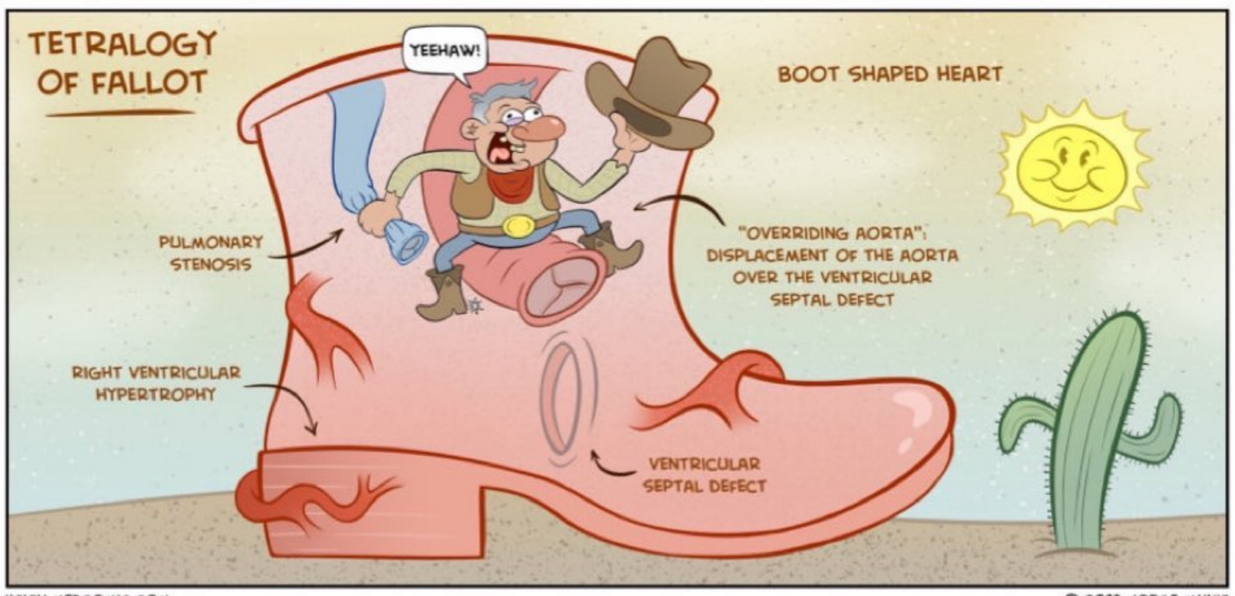


*it's Common Cyanotic Congintal Heart disease

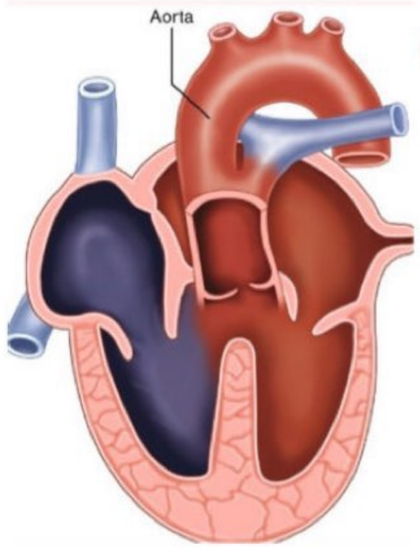
* the aortic pulmonary septum is shifted anteriorly leads to unequal divison of the Conus.

* this is cause Right to left shunt of blood.

X-ray show boot shaped Heart due to Right ventricle Hypertrophy.

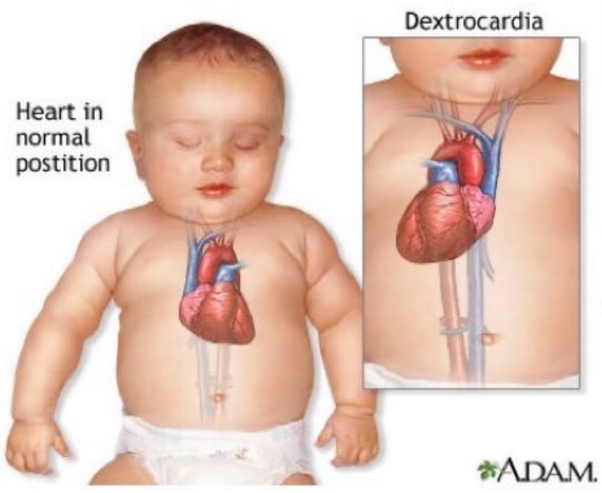


*mouth of aorta recieves blood From both Right & left ventricle.



Persistant truncus arteriosus

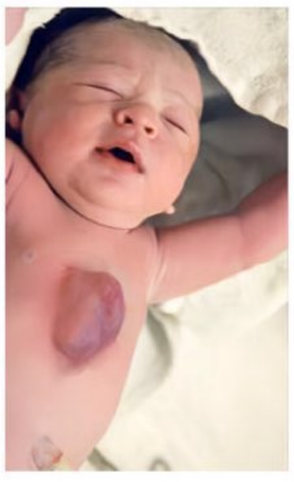
- Failure of Formation of aortic-pulmonary septum
- it's accompained by membranous ventricular septal defect



1- Dextrocardia :

Dextro : meaning in the other side.

- Right sided heart
- due to reverse bending of heart tube (not mentioned by doctor)
- this may occur alone or may be associated with reversal of all abdominal Organs (situs inversus totalis)



Ectopia Cordis

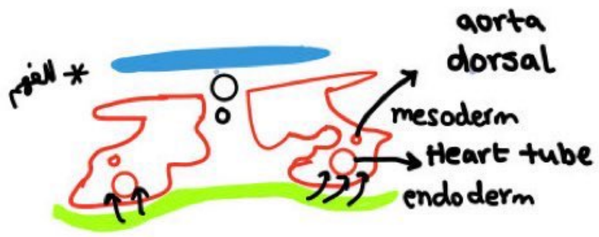
2- Ectopia cordis:

- Ectopia: means not in the right position ← doctor don't mention this
  - Ectopic pregnancy ← مثلاً ما علينا انوا وكملوا
- the heart is exposed to the surface of the thorax through defect in sternum
- it's due to Failure of the embryo to close in the middle line

3- Transposition of the Greater Arteries :

- * the aortic pulmonary septum runs a stright course instead of spiral course.
- * it leads to: ① aorta arising From Right ventricle & pulmonary trunk arising From left ventricle this is cause Right to left shunt of blood (Cynotic)
- * it's usually accompined by other defect as ASD, VSD, PDA which mixing O_2 + non O_2 blood to sustain life.

"Death after birth" "Cynotic"



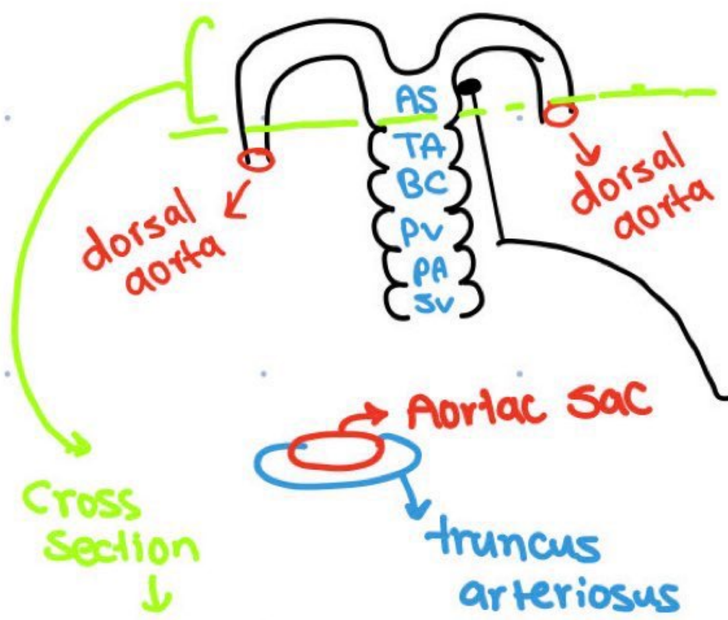
. Development OF Great Arteries

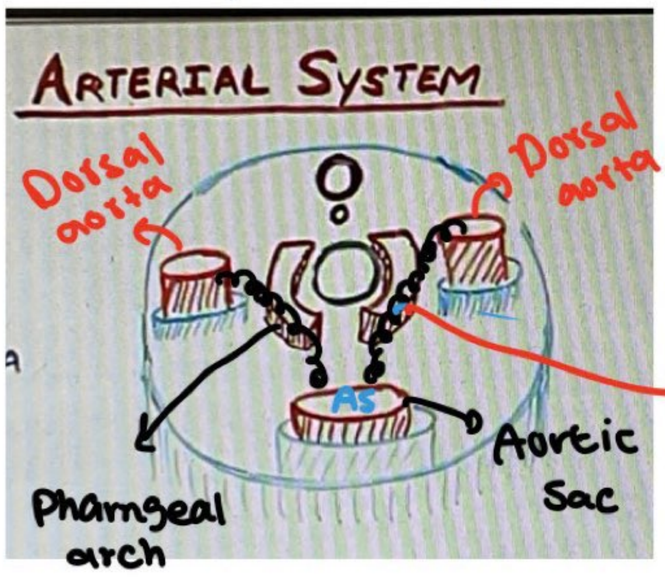
لا أبث فاتعيطش

* endoderm layer released alot oF VEgF (growth Factor) to enhance proliferating oF lateral plate of mesoderm to Form Heart tube and blood vessel.
  ↳ Fused togather Forming Heart

يعني لما كنا بنكون الـ2endocardial tube كنا بنكون (كل الحميان بتصريصوا فركزوا) blood vessel

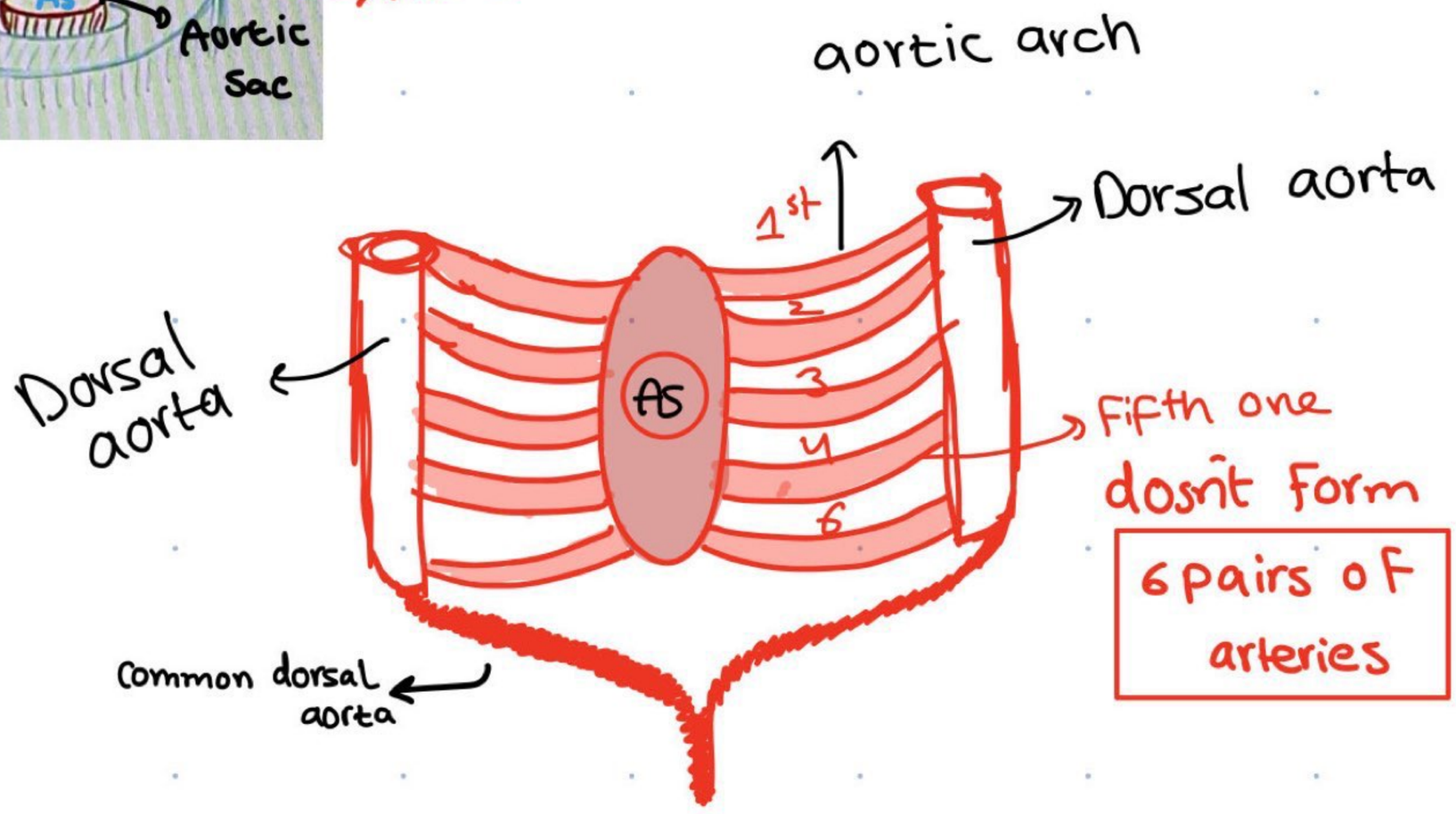
* First intraembryonic arteries are (Right / Left) primitive aorta. which are Continuous with the 2 endocardial tubes.
  - these two primitive aortae (are ventrally to Forgut) So → ventral aortae
  - then these two primitive curve dorsally & continue dorsally to gut (2 dorsal aorta)
  - As 2 endocardial tubes Fuse with each other to Form single endocardial tube, the 2 ventral aorta also Fuse Forming aortic Sac which Continuous Caudally with truncus arteriosus and dorsally with dorsal aorta

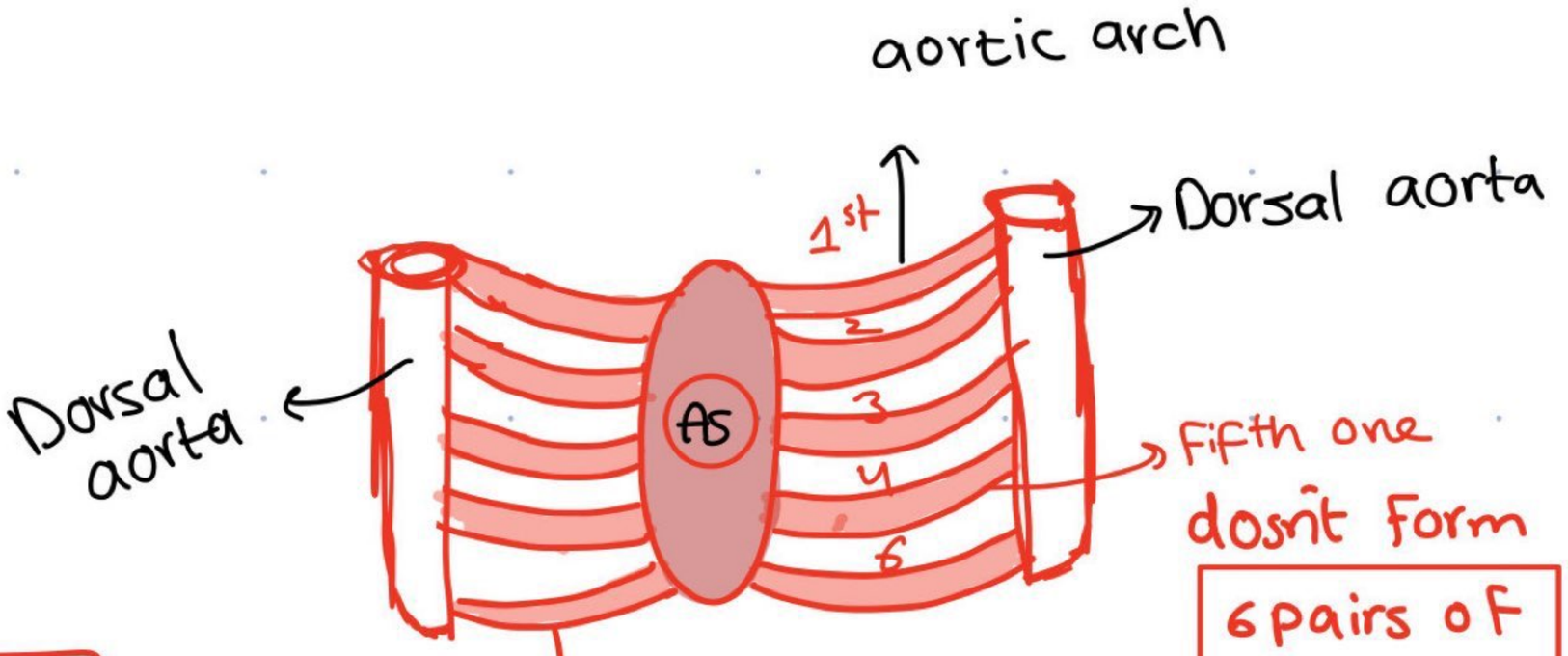




- From aortic Sac it makes blood vessel that moves to mesoderm in pharyngeal arches and makes blood vessel (this Connection is aortic arch)

→ Aortic arch

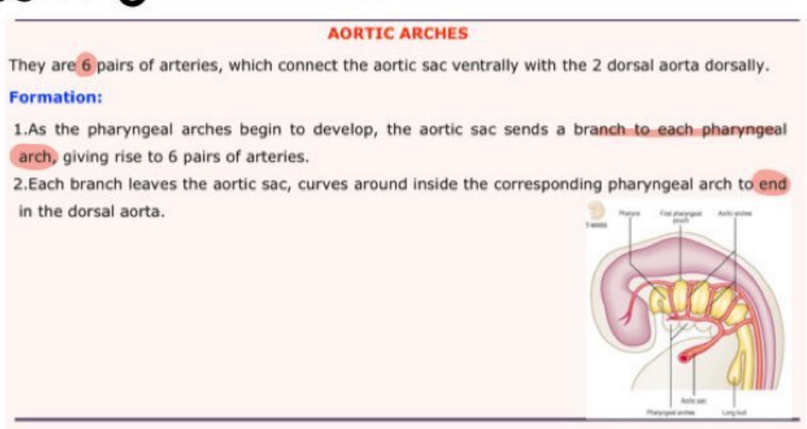




(Slides)

* the vessels of embryo is developed From 3 Sources:

[1] Aortic Sac
[2] Aortic arch
[3] Dorsal & Common aorta



AORTIC ARCHES

They are 6 pairs of arteries, which connect the aortic sac ventrally with the 2 dorsal aorta dorsally.

Formation:

1.As the pharyngeal arches begin to develop, the aortic sac sends a branch to each pharyngeal arch, giving rise to 6 pairs of arteries.

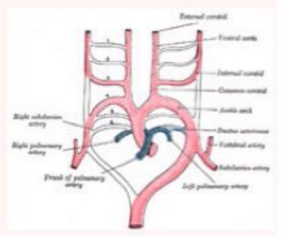
2.Each branch leaves the aortic sac, curves around inside the corresponding pharyngeal arch to end in the dorsal aorta.

- The vessels of the embryo is developed from 3 sources :
  1- **Aortic sac .**
  2- **Aortic arches .**
  3- **Dorsal & common aorta.**

Fate of aortic sac

The aortic sac has two horns (right and left)

- The **right horn** forms the **brachiocephalic artery**.
- The **left horn** form the **proximal part of the arch** of aorta.



aortic arches undergo the Following changes:-

1st arch → First is maximal (it's the max that you can become) so it will become maxillary artery

2nd arch → Form hyoid and stapedial artery (second - Stapedial) (S-S) So 3rd →

3rd arch → C (is the third latter in alphabet) Common Carotid artery + proximal part of Internal Carotid artery

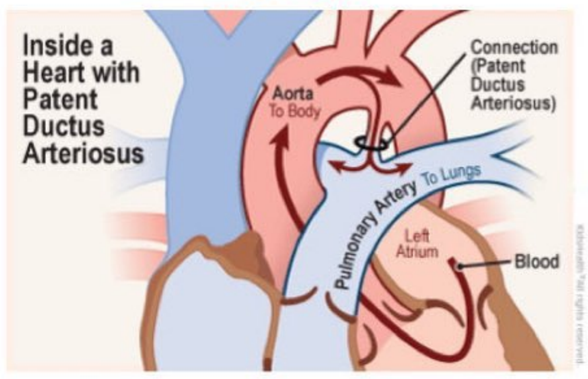
4rd → Right → Proximal Part of Right Subclavian

4rd → left → middle part of the arch of aorta

6th → ventral (Right → Right Pulmonary artery)
(left → left pulmonary artery)

d-d

dorsal (ductus arteriosus) which is forms connection between left pulmonary artery & arch of aorta.



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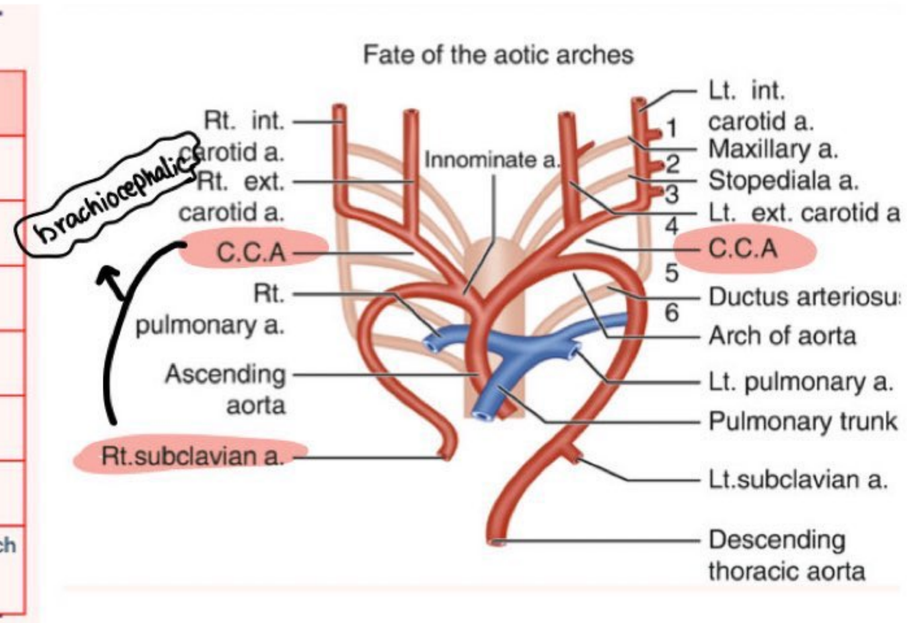
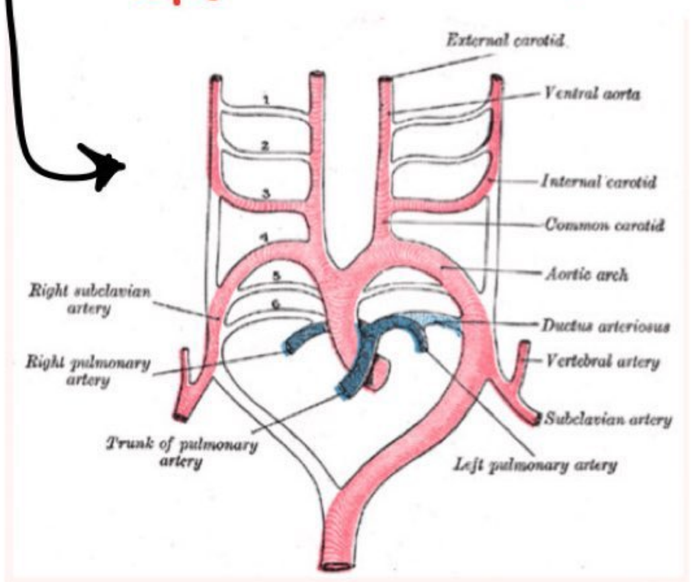
Fate of the aortic arches : The aortic arches undergo the following changes:

Aortic arch	Right	Left
1st	Disappears except for a small part which forms the **Maxillary artery.**	
2nd	Forms the hyoid and **Stapedial artery.**	
3rd	Forms the **Common Carotid** Artery and proximal part of the **Internal Carotid** Artery External carotid is developed from a bud from CCA	
4th	Forms the proximal part of the **right subclavian** artery.	Forms the middle part of the **arch of aorta.**
5th	Disappears completely	
6th Ventral	Forms the right **pulmonary** artery.	Forms the left **pulmonary** artery.
6th Dorsal	Disappears.	Persists forming the **ductus arteriosus** which forms a connection between the left pulmonary artery and arch of aorta.



Fates of aortic sac: it gives two horns → Right, left horn

- Right horn → Brachiocephalic (R-R)
- left horn → proximal part of arch of aorta.

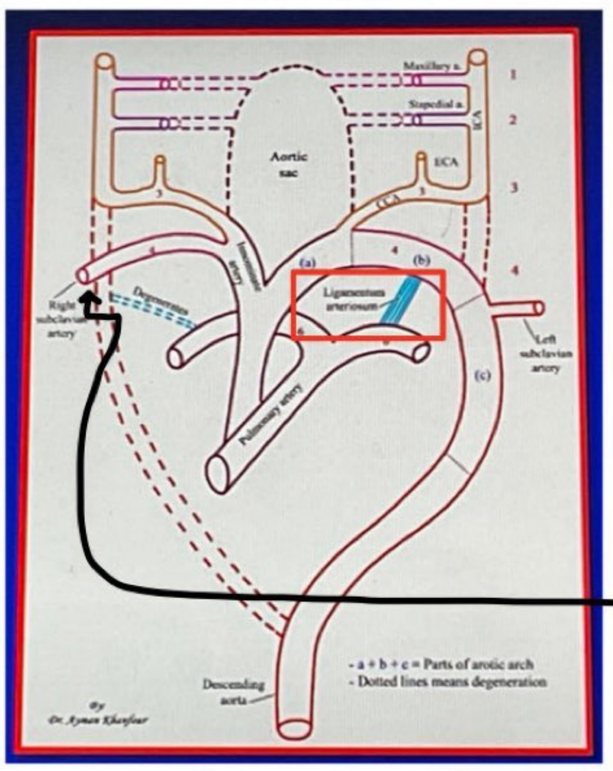


* arch of aorta Formed by
  1. left horn of aortic sac (proximal part)
  2. left 4th arotic arch (middle part)
  3. lower part of left dorsal aorta (distal part)
* on left & Right sides we have Common Carotid but that one in the Right side doesn't Formed by arch it's formed by Brachiocephalic while that one in left side is From 3rd arch.

* left & Right Recurrent laryngeal nerves: → on left side: left reccurent laryngeal nerve hooks around lig.arteriosus (ductus arteriosus)

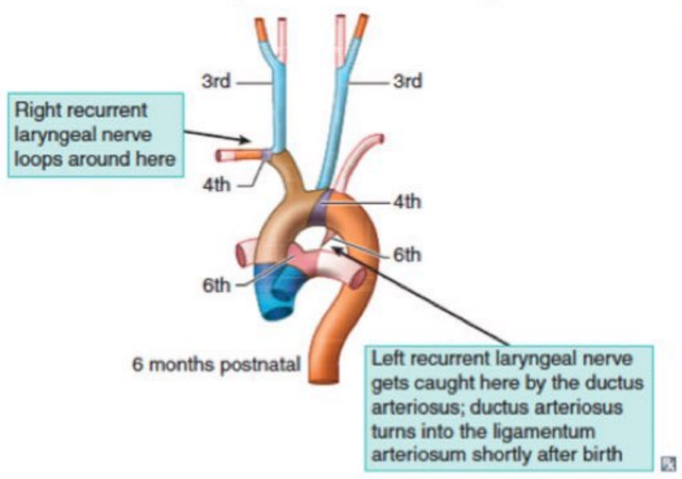
on Right side: the distal segment of the right 6ix arch degenerate

l and the FiFth degenerate so Right reccurent laryngeal nerve hooks around the distal segment oF Right Forth arch (Right Subclavian artery).



اطلعوا على الرسمة

بالأخير الـ left reccurent رح يلف حوالين الـ ligamentum arteriosum بس الفكرة بالـ Right reccurent هو كانه بيمشي فوق الـ 6 بس هدا الـ 5-6 انتفوا فظهار Right بيمشي فوق الـ Subclavian



Development of the arch of aorta

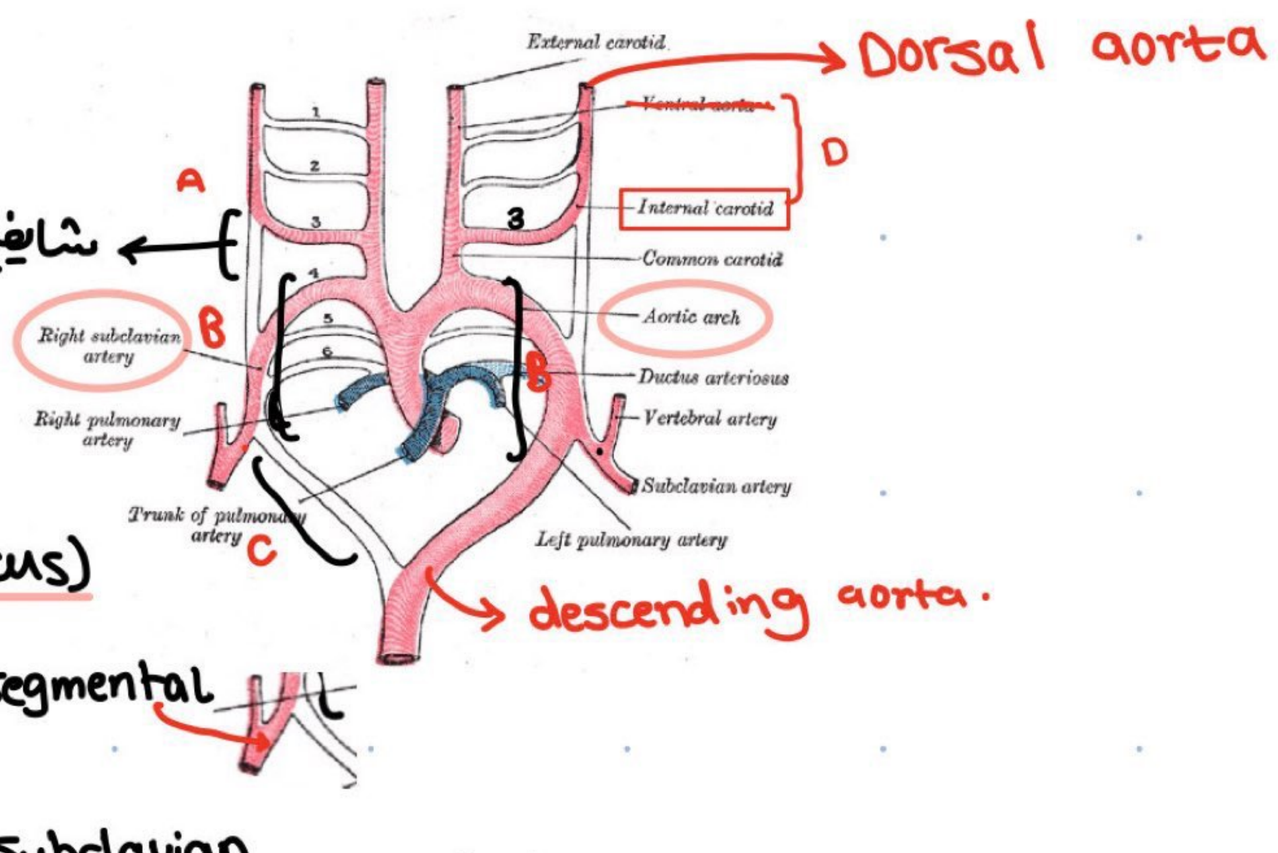
✱ The arch of aorta is developed from:

- **Its proximal part:** arises from the left horn of aortic sac .
- **Its middle part:** arises from the left 4th aortic arch.
- **Its distal part:** arises from the lower part of the left dorsal aorta to the level of 7th inter-segmental artery.

✱ **N.B.: The difference of the course of the right and left recurrent laryngeal nerves:**

- Initially, these nerves, supply the sixth pharyngeal arches. When the heart descends, they hook around the sixth aortic arches and ascend again to the larynx.
- On the right, the dorsal part of the 6th aortic arch and the 5th aortic arch disappear, the recurrent laryngeal nerve hooks around the right subclavian artery which develops from 4th. aortic arch .
- On the left the nerve does not move up, since the dorsal part of the sixth aortic arch persists as the ductus arteriosus, which later forms the ligamentum arteriosus.

اطلعوا على الرسمة



شايفين الياطن ؟

(A)
- Between 3rd & 4th aortic arch → Diappear (it's called ductus caroticus)

(B) - Between 4th & 7th inter segmental artery:
  - ✱. on Right → Right Subclavian
  - ✱. on left → distal part oF Arch oF Aorta

(C) Caudal to 7th inter-segmental artery and Common dorsal aortae:
  - on Right side: disappear
  - on left side: Forms descending aorta. (الفرع) سيتوا الياطن

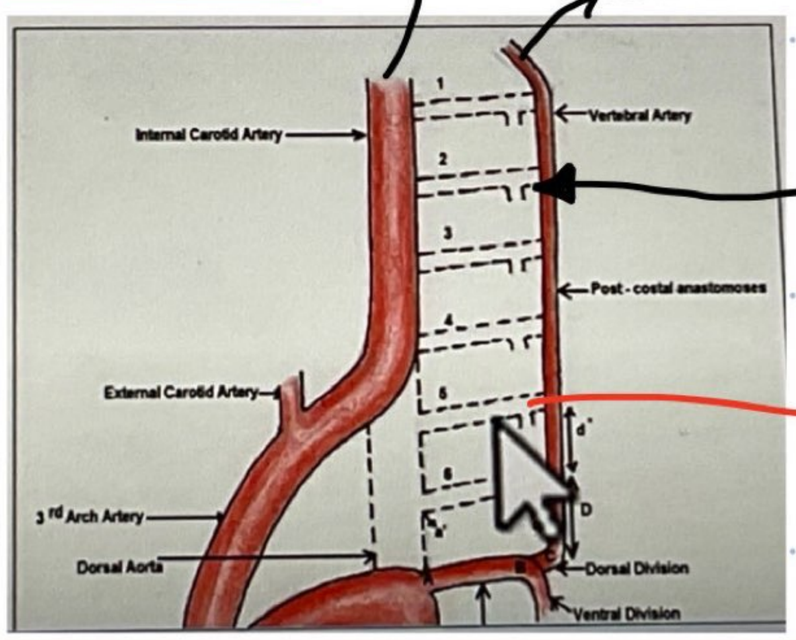
(D) Cranial to the third aortic arch: Distal part oF the Internal Carotid artery

فوقال 3rd بنشوف كلها لرسمة ↩

Branches OF dorsal aorta:

Right dorsal

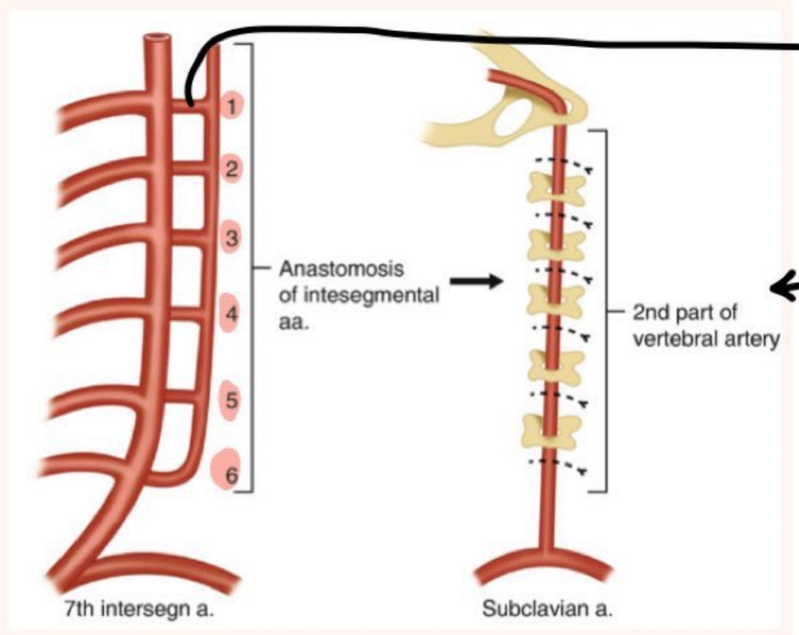
left dosral



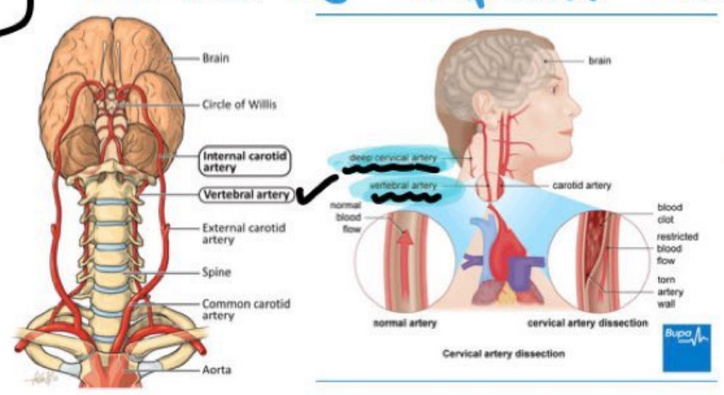
In cervical region:-

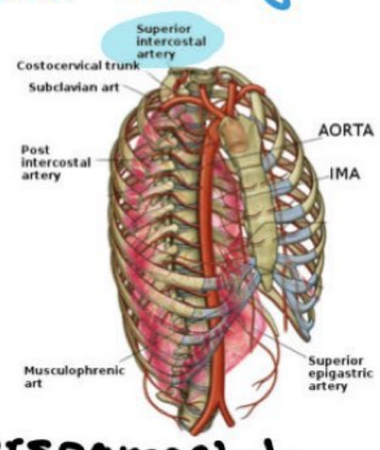
* there are seven cervical intersegmental arteries arising From each of the right & left dorsal aorta.

الـ 6 رح يختفوا ويضل الـ (7) بس



* upper six become connected by vertical anastomoses will give rise to 2nd part OF vertebral artery. and deep cervical arteries as well as superior intercostal artery.





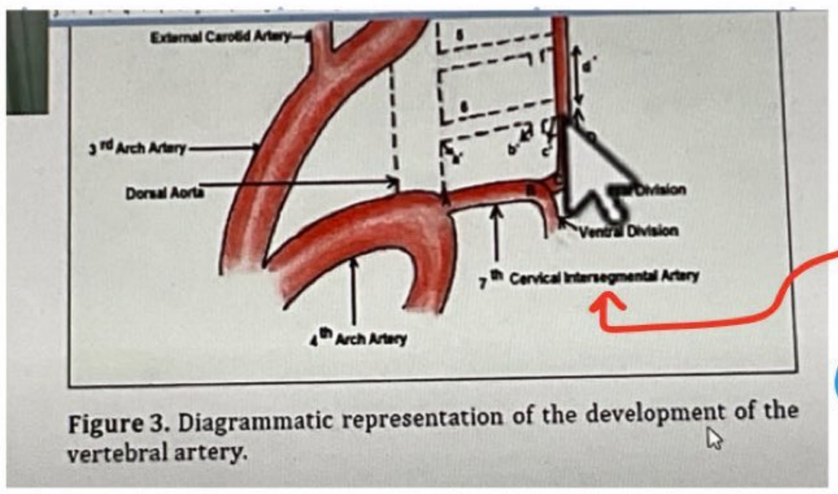


Figure 3. Diagrammatic representation of the development of the vertebral artery.

After anastomosis of upper six intersegmental they disappeared and only the anastomosis stay. but the 7th intersegmental artery. Persist and Form:

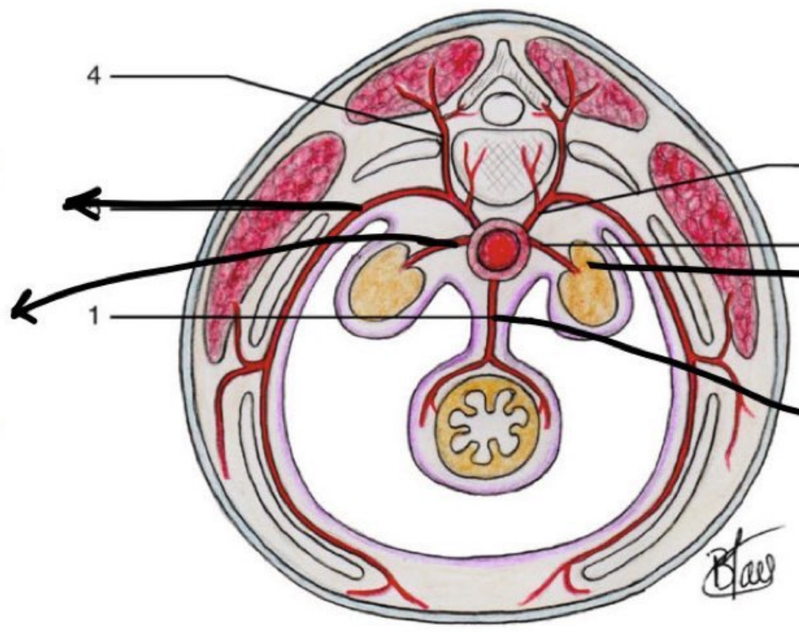
① lower part of the right subclavian artery on the right side

② the whole left subclavian artery on left side.

Branches From Common dorsal aorta:

* 2 dorsal aortae Fused to Form Common dorsal aorta

section From embryo:



Somatic
③ intersegmental arteries.

② lateral splanchnic branches.

Common dorsal aorta gives

① ventral splanchnic branches.

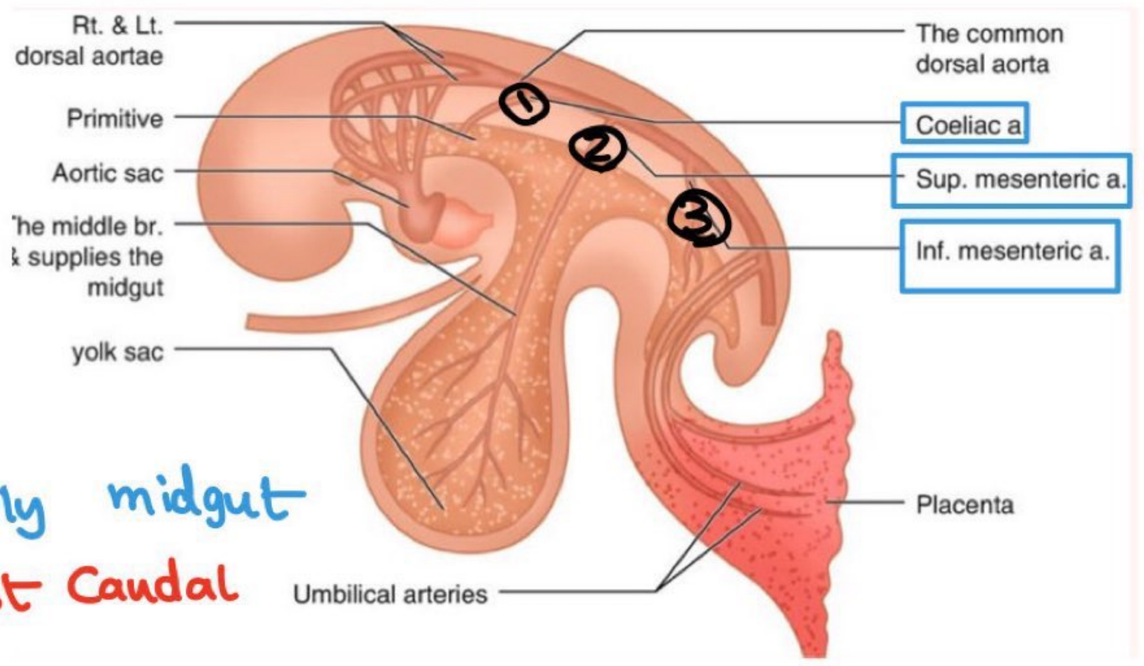
1-Ventral splanchnic_arteries :

*Common dorsal aorta gives 3 ventral splanchnic arteries twards gut:

① Coeliac artery: most cranial and supply Foregut

② Superior mesentric artery: supply midgut

③ Inferior mesentric artery: most Caudal and supply the hindgut.



⇒ remmber splanchnic means visceral.

2- Lateral splanchnic arteries :

① InFerior phrenic arteries.
② middle suprarenal arteries.
③ Renal arteriers.
④ Gonadal arteries.

3- intersegmental arteries (read only but the Fate is required)

Fate of the intersegmental arteries :

In the thorax: persist as 11 posterior intercostals and subcostal arteries.

In the abdomen: persist as 4 lumbar arteries, while the 5th lumbar becomes common iliac artery.

In the sacral region: persist as lateral sacral arteries.

4- Terminal (umbilical) arteries : branches from common dorsal aorta.

→ the two umbilical arteries make anastomosis with 5th lumbar which gives a branch External iliac arter.

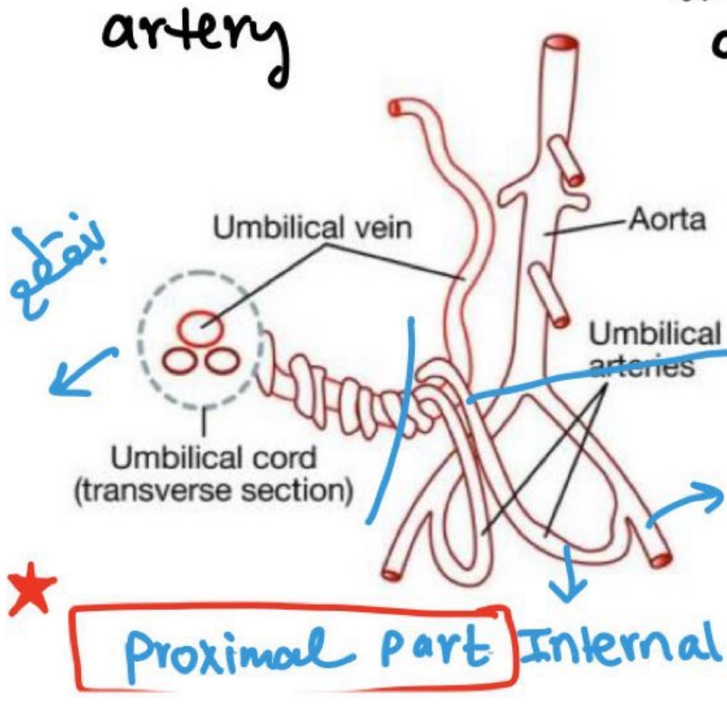
→ proximal part of umbilical artery continues as internal iliac artery

→ after birth, distal part of umbilical artery is obliterated to Form the medial umbilical ligaments. (adult remannant)

① (شوح) umbilical arteries بالأول همة طالعين من الـ Common dorsal aorta بيعملو anastomosis مع الـ 5th lumbar اللي بعطيني الـ Common iliac artery اللي بعطيني الـ External iliac artery

② two umbilical arteries lose their Connection with aorta and stay with common iliac artery and goes to umbilical cord

③ بعدين بنعطع الـ umbilical cord وبنترك الـ Proximal part of umbilical artery اللي بعطي (Internal iliac artery)



بنقطع

distal part obliterated to Form medial umbilical ligaments.

External iliac artery

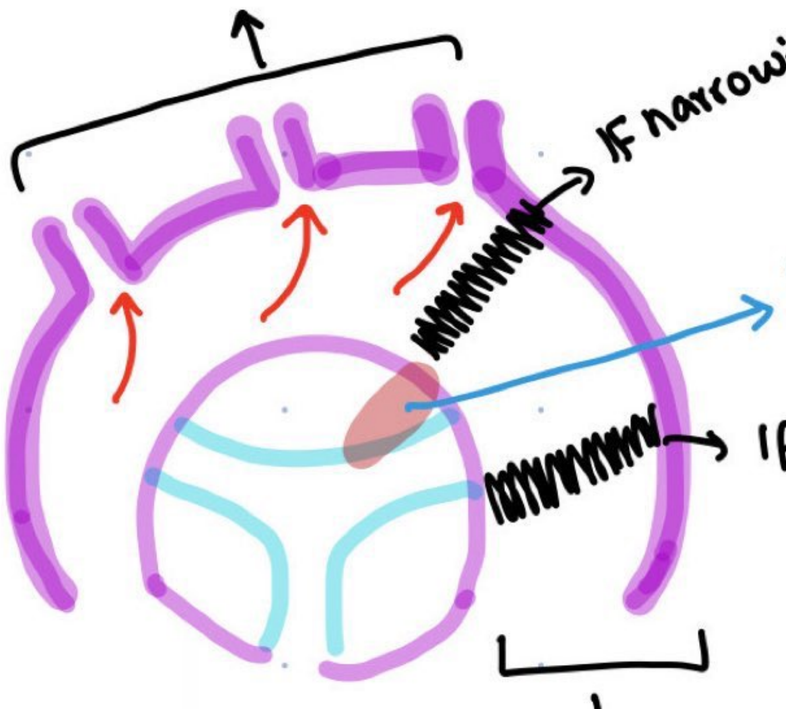
Proximal part Internal iliac artery

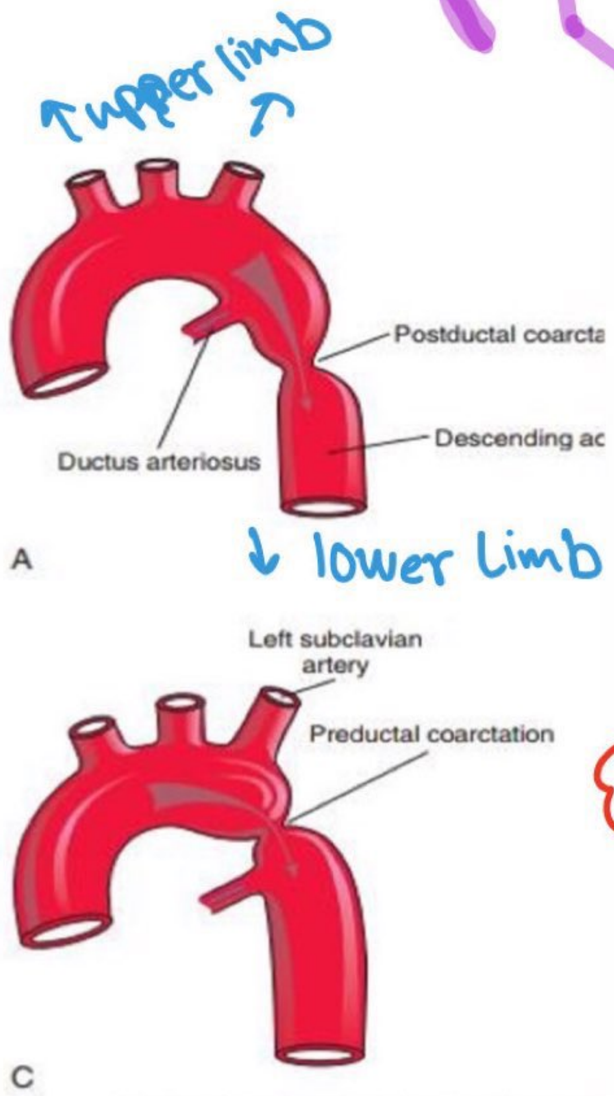
Congenital Anomalies of Arteries

تضيق.

1. Coarctation of the aorta = narrowing of the aorta distal to the origin of left subclavian artery.

* 2 types:
  - Pre-ductal type: narrowing is proximal to the ductus arteriosus.
    - blood goes to upper limb.
  - Post-ductal type: narrowing is distal to the ductus arteriosus.





للتوضيح :-

① لأن صار عندي تضيق بكمية الدم يلي راجعة لـ upper limb كتيرة → Hypertension

② كمية الدم يلي راجعة لـ lower limb قليلة → Hypotention

doctor dont mention this

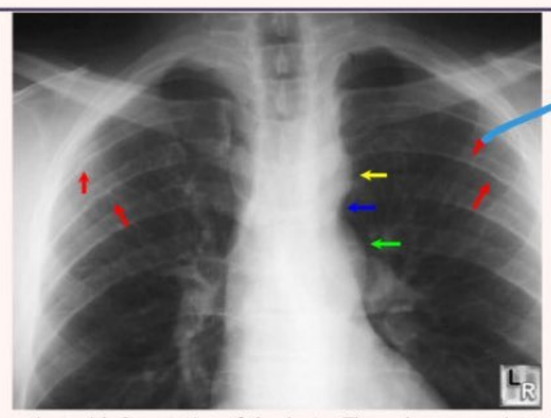
مهم

absent or diminished pulses in the Femoral arteries of both lower limbs is a sign of aortic coarctation.

لأنه كمية الدم يلي راجعة لـ LL قليلة عشان هيك.

الجسم بيبلش يعوض وما بيكتشف

- To compensate for the diminished volume of blood reaching the lower part of the body, a collateral circulation develops, with dilatation of the internal thoracic, subclavian, and posterior intercostal arteries.
- The dilated intercostal arteries erode the lower borders of the ribs, producing characteristic notching, which is seen on radiographic examination



Close up of upper thorax in a patient with Coarctation of the Aorta. The red arrows point to rib notching caused by the dilated intercostal arteries. The yellow arrow points to the aortic knob, the blue arrow to the actual coarctation and the green arrow to the post-stenotic dilation of the descending aorta

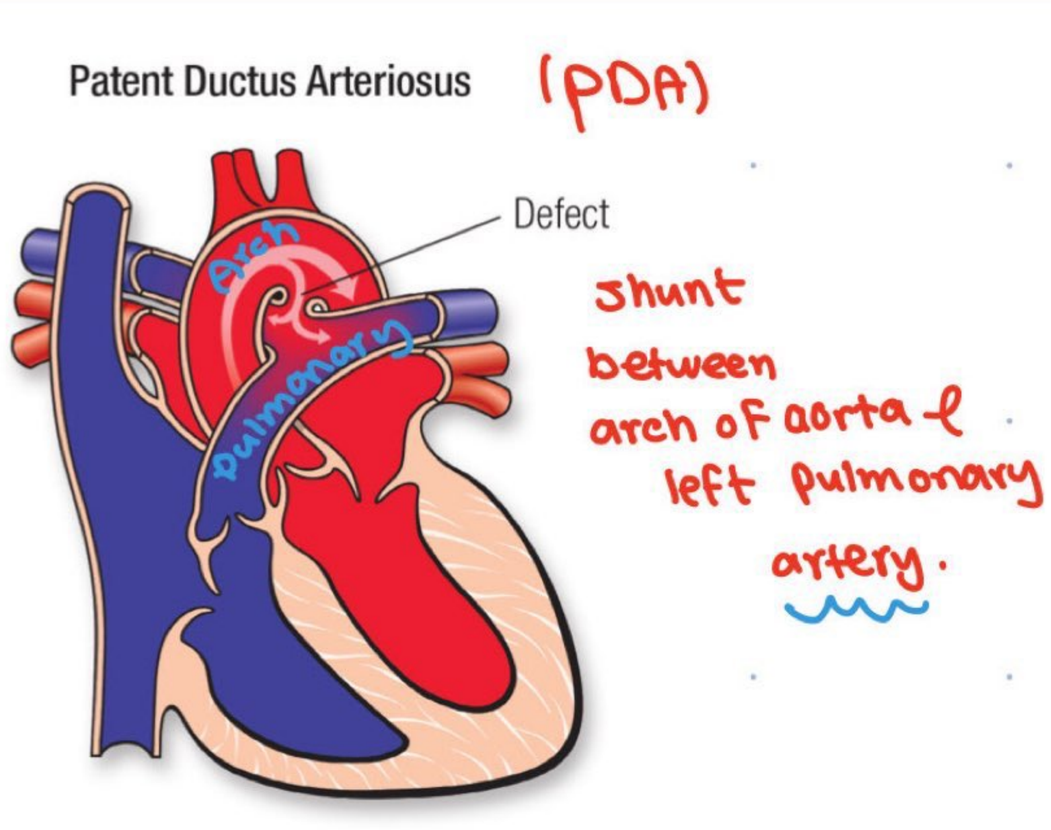
Congenital Anomalies of Arteries

1) Coarctation of the aorta :

- Is narrowing of the aorta distal to the origin of left subclavian artery . There are 2 types:
  1. **Pre-ductal type:** if the narrowing is proximal to the ductus arteriosus.
  2. **Post-ductal type:** if the narrowing is distal to the ductus arteriosus.
- Clinically, absent or diminished pulses in the femoral arteries of both lower limbs is a sign of aortic coarctation
- To compensate for the diminished volume of blood reaching the lower part of the body, a collateral circulation develops, with dilatation of the internal thoracic, subclavian, and posterior intercostal arteries.
- The dilated intercostal arteries erode the lower borders of the ribs, producing characteristic notching, which is seen on radiographic examination

2) Patent ductus arteriosus :

- Normally the ductus arteriosus is closed by contraction of its muscular wall shortly after birth and within 1-3 months fibrosis of the duct is complete.
- Failure of this closure results in shunt between arch of aorta and left pulmonary artery.



الحمد لله