Supplementary File 1.

QUERIES ABOUT AORTIC ARCH

VARIANT

1. The brachiocephalic artery shares a common trunk with the left common carotid artery, resulting in only two great vessels originating from the aortic arch.
2. The left common carotid artery arises directly and distally from the brachiocephalic artery.
3. The right subclavian artery originates as the last main branch of the aortic arch, most frequently coursing posterior to the esophagus.
4. A common trunk gives rise to the right subclavian, right common carotid, and left common carotid arteries, with the left subclavian artery being the second branch.
5. The left vertebral artery arises directly from the arch, which consequently presents four branches.
6. The arch yields three branches: the right subclavian artery, a common trunk for the right and left common carotid arteries, and the left subclavian artery.
7. A bicarotid trunk, the left subclavian artery, and the right subclavian artery (as the last arch branch) constitute the three vessels originating from the arcus aorta.
8. The arch features two main stems: one common stem for the right and left common carotid arteries and a second common stem for the right and left subclavian arteries.
9. The brachiocephalic trunk is absent, resulting in four separate branches arising from the arch.
10. An additional branch, the thyroidea ima artery, originates from the arcus aorta, creating a four-branch configuration.
11. The aortic arch gives rise to doubled brachiocephalic arteries.
12. The brachiocephalic artery arises from the descending aorta.

PATHOLOGIC

13. Persistence of both fourth aortic arches results in a vascular ring that encircles and compresses the trachea and esophagus, often with the right limb being dominant.
14. There is a complete loss of vascular continuity between the subclavian artery and the aortic arch, with the isolated vessel being filled by collateral flow, often from the ductus arteriosus or vertebral artery.
15. The aortic arch crosses over the right main bronchus due to the regression of the left dorsal aorta, leading to the descending aorta opacity along the right paraspinal space.
16. The aortic arch crosses the midline posterior to the esophagus before descending, resulting in the ascending and descending aorta lying on opposite sides of the spine.
17. A branching pattern where the left brachiocephalic artery is the first branch, followed by the right common carotid and the subclavian arteries.
18. Interruption of the left arch between the left common carotid and left subclavian artery causes the left subclavian artery to arise as the last branch, often from a Kommerell diverticulum, and usually follows a retroesophageal course.
19. This presentation features a branching order of right carotid, right subclavian, and finally a retroesophageal brachiocephalic artery.
20. This condition involves an interruption of the aortic arch at two levels (proximal and distal to the left subclavian artery)
21. A congenital constriction of the aortic lumen, typically occurring at the junction between the aortic arch and the descending aorta. A focal constriction is often accompanied by hypoplasia (underdevelopment) of a long segment of the aortic arch proximal to a patent ductus arteriosus.
22. A congenital constriction of the aortic lumen, typically occurring at the junction between the aortic arch and the descending aorta. Obstruction distal to the ductus arteriosus is caused by a shelf-like indentation in the posterolateral aortic wall and is frequently associated with a bicuspid aortic valve.
23. An uncommon, congenital formation characterized by a kinking of a tortuous aortic arch at the level of the ligamentum arteriosum, which lacks the significant pressure gradient seen in aortic coarctation.
24. A congenital heart condition characterized by a complete gap in the aortic lumen between the ascending and descending aorta, classified into three types based on the location of the separation.
25. The aortic arch is elongated, running upward, typically on the right side, above the sternum
26. A prominent, fusiform enlargement of the aorta beyond the attachment point of the ductus arteriosus, following the naturally narrowed aortic isthmus, a formation that can persist into adulthood.
27. A focal enlargement with smooth margins located along the anteroinferior surface of the isthmic region of the aortic arch, often considered a vestige of the closed ductus arteriosus.
28. A structural condition resulting from the ductus arteriosus (derived from the left sixth aortic arch) remaining open after birth, causing a portion of oxygenated blood to flow from the aorta to the pulmonary circulation.
29. A condition where the descending aorta is either split into two separate vessels or divided into a single vessel by an internal septum.

Normal

30. The aortic arch with three major vessels is the section of the aorta that bridges the ascending aorta and the descending aorta.
31. The aortic arch courses superiorly, posteriorly, and to the left, reaching its summit near the T4 vertebra.
32. The aortic arch terminates level with the sternal end of the left second costal cartilage and so lies wholly within the superior mediastinum.
33. The aortic arch gives rise to three major vessels from its superior convexity.
34. The first branch off the arch is the brachiocephalic trunk.
35. The brachiocephalic trunk ascends and travels superiorly to the right, where it typically divides into the right common carotid artery and the right subclavian artery.
36. The left common carotid artery is the second branch of the arcus aortae.
37. The final branch originating directly from the aortic arch is the left subclavian artery.
38. After the left subclavian artery origin, the aortic arch continues inferiorly as the descending thoracic aorta.
39. The shadow of the arch is easily identified in frontal chest radiographs; its left profile is sometimes called the aortic 'knuckle' or 'knob'.

Supplementary File 2.

You are a **twenty-year-experienced anatomist**. Your task is to classify the following anatomical description of a vascular configuration.

Please analyze the configuration described below and, based purely on established human vascular anatomy, select the single most appropriate classification from the three options: 'normal,' 'variant,' or 'pathological (anomalous)'.

Your entire response **must be a single, structured JavaScript Object Notation (JSON) object** with the following keys:

description: A copy of the anatomical description provided in the question.

classification: Your chosen category ('normal', 'variant', or 'pathological (anomalous)').

reasoning: A concise, professional justification for your classification, referencing the typical embryological development or standard adult anatomy.

Examples for Reference:

Example 1: NORMAL Configuration Input Description: The internal carotid artery originates as the superior terminal branch of the common carotid artery at the level of the C4 vertebra.

Expected JSON Output:

JSON

{

"description": "The internal carotid artery originates as the superior terminal branch of the common carotid artery at the level of the C4 vertebra.",

"classification": "normal",

"reasoning": "The bifurcation of the common carotid artery into the internal and external carotid arteries at the level of the C4 vertebra is the standard anatomical arrangement in adult human anatomy."

}

Example 2: VARIANT Configuration Input Description There is a persistent left superior vena cava draining into the coronary sinus.

Expected JSON Output:

JSON

{

"description": "There is a persistent left superior vena cava draining into the coronary sinus.",

"classification": "variant",

"reasoning": "Persistence of the left anterior cardinal vein leads to a left-sided superior vena cava, which is a well-documented congenital venous variant without pathological significance in most individuals."

}

Example 3: PATHOLOGICAL Configuration Input Description: A single arterial trunk arises due to failure of truncoconal septation.

Expected JSON Output:

JSON

{

"description": "A single arterial trunk arises due to failure of truncoconal septation.",

"classification": "pathological (anomalous)",

"reasoning": "Persistent truncus arteriosus is a congenital defect in which the truncus arteriosus fails to divide into the aorta and pulmonary trunk, causing a single outflow tract and mixed oxygenated blood, representing a severe embryological malformation."

}

Anatomical Description to Classify (Your Test Question):

[HERE IS THE SENTENCE]