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# Variants of The Aortic Arch

[1]Dr. Anadhi Joshi, JR-3, Department of Radiodiagnosis, MGM Medical College and Hospital, Kamothe, Navi Mumbai, Maharashtra

[2]Dr. Abhay Gursale, Professor, Department of Radiodiagnosis, MGM Medical College and Hospital, Kamothe, Navi Mumbai, Maharashtra

[3]Dr. Namrata Jamale, JR-3, Department of Radiodiagnosis, MGM Medical College and Hospital, Kamothe, Navi Mumbai, Maharashtra

[4]Dr. Balaji S., JR-3, Department of Radiodiagnosis, MGM Medical College and Hospital, Kamothe, Navi Mumbai, Maharashtra

[5]Dr. Sneha, JR-3, Department of Radiodiagnosis, MGM Medical College and Hospital, Kamothe, Navi Mumbai, Maharashtra

**Corresponding Author:** Dr. Anadhi Joshi, JR-3, Department of Radiodiagnosis, MGM Medical College and Hospital, Kamothe, Navi Mumbai, Maharashtra

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**Abstract**

The aortic arch is a crucial structure in the cardiovascular system, giving rise to several major arteries that supply blood to the head, neck, and upper limbs. Variations in the branching pattern of the aortic arch are relatively common and arise due to the abnormal development of the embryonic aortic arches. This study aims to identify and characterize the different branch variants of the aortic arch using contrast-enhanced computed tomography (CT) scans.

Conducted as a retrospective study at MGM Hospital Navi Mumbai over a period of four months, the research involved a thorough review of CT scans performed on patients for various clinical indications. This research underscores the importance of imaging modalities, particularly contrast-enhanced CT scans, in the evaluation of aortic arch anatomy. The findings contribute to the existing body of knowledge on vascular anatomy and emphasize the need for careful pre-procedural planning to account for anatomical variations.

**Keywords:** aortic arch, cross sectional studies, interventional procedures, variant branch

## Introduction

There are multiple branch variants of the aortic arch, which are formed due to the abnormal formation of the 1st, 2nd and 3rd arch vessels. These variants are usually seen as incidental findings in scans done for other complaints. These variations can have significant clinical implications, particularly in the context of diagnostic imaging, surgical planning, and interventional procedures. Cross sectional studies are one of the few modalities which are relatively more accessible and can

be used for evaluation of these branch variants, for example – contrast enhanced CT or MRI scans.

Understanding the prevalence and types of aortic arch variants is essential for radiologists, surgeons, and interventionalists. Knowledge of these variations aids in accurate diagnosis, helps avoid potential complications during surgical or interventional procedures, and can be critical in the assessment of related conditions, such as dysphagia lusoria caused by an aberrant right subclavian artery.

**Aim**

To see and identify the different branch variants of the aortic arch.

**Materials and Method**

This was a retrospective study done in MGM Hospital, Navi Mumbai over a period of two months from 20th January to 30th May, 2024.A total of 50 cases were included in the study. All Contrast enhanced CT studies were performed either on 128 slice Fujifilm CT Machine or 16 slice Toshiba CT machine.

All patients who had undergone contrast enhanced CT studies with visualization of the aortic arch, showing a variant branch arising from the aortic arch were included.

**Result**

| Aortic arch variant branch | No. of cases |
|---|---|
| Aortic origin of the Left Vertebral Artery | 28 |
| Bovine arch (Common origin of Brachiocephalic Trunk and Left Common Carotid Artery) | 19 |
| Aberrant Right Subclavian Artery | 4 |
| Common origin of Bilateral Common Carotid Arteries | 1 |
| Total | 52 |

Figure 1:

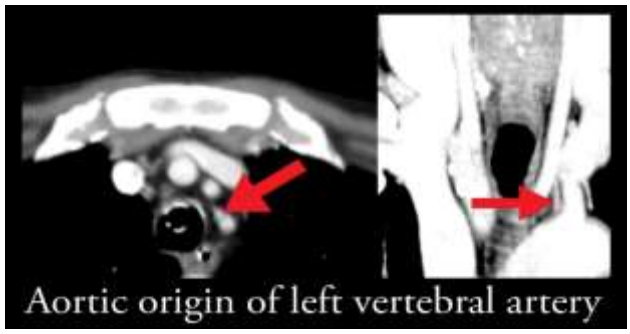



Figure 2:

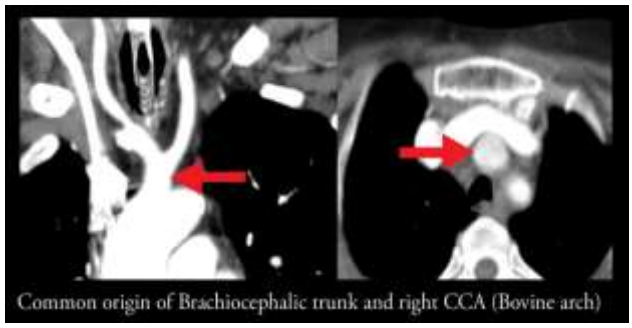



Figure 3:

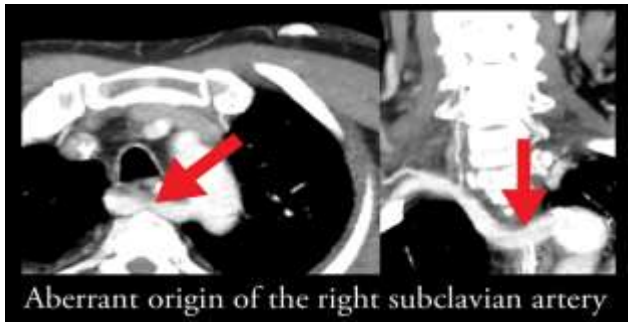
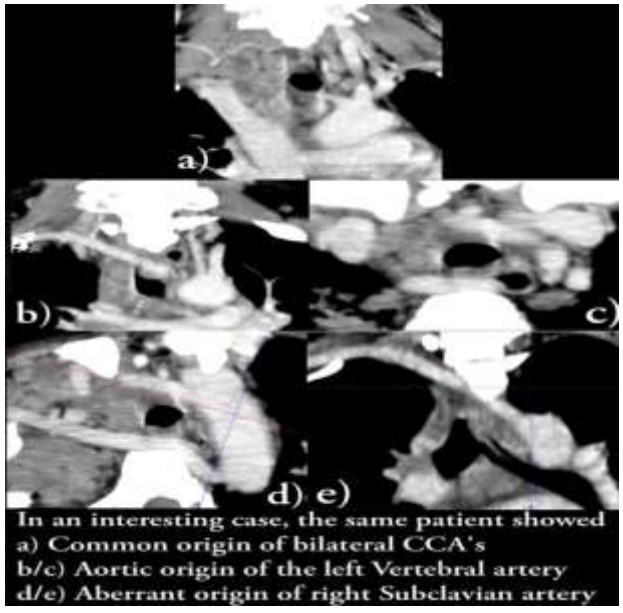



Figure 4:



**Discussion**

52 aortic branch variants were detected in 50 patients, out of a total of 463 patients who had undergone contrast enhanced CT studies with visualization of the aortic arch. Knowledge of these variants is essential for preoperative planning, especially in surgeries involving the head, neck, and thoracic regions.

The most common variant observed was the aortic origin of the left vertebral artery, present in approximately 54% of the cases. The second most common variant, the bovine arch (common origin of the brachiocephalic trunk and the left common carotid artery), was observed in around 36% of cases. The presence of these variants can influence the choice of catheters, the approach to vascular access, and the overall strategy for the intervention.

These aortic branch variants can complicate surgical and catheter-based interventions in the neck and thorax. Surgeons and interventionalists must be aware of the presence of anatomical variants to avoid inadvertent injury and ensure proper vascular access. Contrast-enhanced CT scans remain the most accessible and reliable modality for analyzing the aortic arch and its branch variants.

The aberrant right subclavian artery, present in 8% of cases, can lead to dysphagia lusoria, a condition caused by esophageal compression. The rarest variant found in the study was common origin of bilateral common carotid arteries, seen in 2% of the cases. Rest of the aortic arch variants are rarely symptomatic.

The thyroidea ima artery, although not directly related to the primary findings of this study, is another significant variant that should be reported in cases of head and neck surgeries, particularly thyroidectomy. Its presence can alter surgical plans and help prevent excessive bleeding or inadvertent damage to the artery. Its presence can alter surgical plans and help prevent excessive bleeding or inadvertent damage to the artery.

**Conclusion**

The study reinforces the importance of screening for aortic arch variants using contrast-enhanced CT, which provides comprehensive visualization and aids in accurate diagnosis and effective management.

The most common variant observed was the aortic origin of the left vertebral artery, present in approximately 54% of cases. This was followed by the bovine arch, with a common origin of the brachiocephalic trunk and the left common carotid artery, observed in around 37% of cases. The aberrant origin of the right subclavian artery was found in 8% of cases, while the common origin of bilateral common carotid arteries was the rarest, noted in 1% of cases.

Variant branches of the aortic arch should be preferably identified prior to interventional procedures, like Cerebral DSA, as they can guide the neurointerventionalist towards an easier access to the vessels. Patients with an Aberrant right Subclavian artery may present with dysphagia lusoria, due to its esophageal compression The Thyroidea Ima artery is another branch variant that can arise from the aortic arch, supplying both the trachea and thyroid gland. This vessel needs to be reported in cases of head and neck surgeries, especially thyroidectomy.

Future research should aim to explore the clinical implications of these variants further and develop standardized protocols for their assessment and reporting.

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