

# A Retroesophageal Right Subclavian Artery as the Last Branch of the Aortic Arch- In Vivo Case Report

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## ABSTRACT

Three major arteries normally originate from the aortic arch. Variations of the aortic arch branches are observed in some cases. Rare variation of the aortic arch branches is originated from the retroesophageal right subclavian (RRS) artery as the last branch of the aortic arch. Variation of artery is possibly associated with the variation of the recurrent laryngeal nerve. This research provides an in vivo report of retroesophageal right subclavian artery during examination of the cervical vessels using magnetic resonance angiography (MRA). It is very important to consider the variation of the right subclavian artery during head and neck surgery. Non-invasive techniques such as MRA of cervical arteries can be used in order to examine them.

## 1. Introduction

The aortic arch normally branches into three important arteries: brachiocephalic artery, the left common carotid, and the left subclavian artery [1]. This is the arrangement of aortic arch branches in 80% of cases [2]. In 11% of the cases, the aortic arch branches into two arteries. The first branch includes a common trunk of the left common carotid and brachiocephalic arteries and the second one includes the left subclavian artery. In 8% of cases, the vertebral artery is branched from beside the left subclavian artery as the fourth branch of the aortic arch. Rare variations of the aortic arch branches are observed in the other 1% [3]. One of these cases which is being reported, is the separation of

the retroesophageal right subclavian artery as the last branch of the aortic arch.

The right subclavian artery is normally formed in embryonic life from the fourth aortic arch, dorsal aorta, and the seventh inter-segmental artery. In embryology, this aortic arch disorder occurs when the artery is formed from the distal portion of the right dorsal aorta and the seventh inter-segmental artery. In this case, the proximal portion of the right dorsal aorta and the right fourth aortic arch are removed [4].

Considering the direction of the recurrent laryngeal nerve and its relationship with the embryonic fourth aortic arch, the association between variation of this nerve and variation of the right subclavian artery is not improbable.

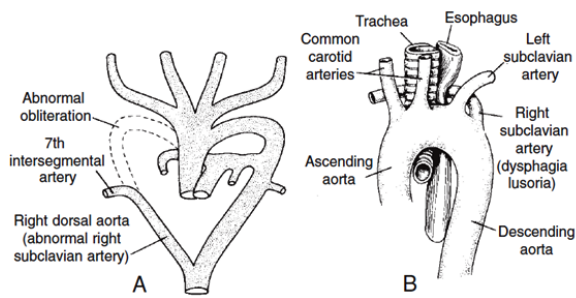
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**Figure 1.** The embryonic formation of the variation of the right subclavian artery (A). Schematic image of variation of the right subclavian artery with retropharyngeal direction (B).

In a report of variation of retropharyngeal right subclavian artery by Marios Loukas et al. (2004), variation of the right subclavian artery was associated with the variation of the right recurrent laryngeal nerve [5].

**2. Case Report**

A 75-year-old man referred to the doctor with the symptoms of vertigo. After the clinical examinations, he was introduced for MR angiography. During in vivo examination of the cervical vessels using the MRA technique, the variation of aortic arch branches was confirmed. During the 3D evaluation of reconstructed images, it was indicated that the aortic arch is located above the heart and has a normal shape. It was unusual that four arteries had branched out; from right to left: the right common carotid artery, the left common carotid artery, the left subclavian artery, and the right subclavian artery.

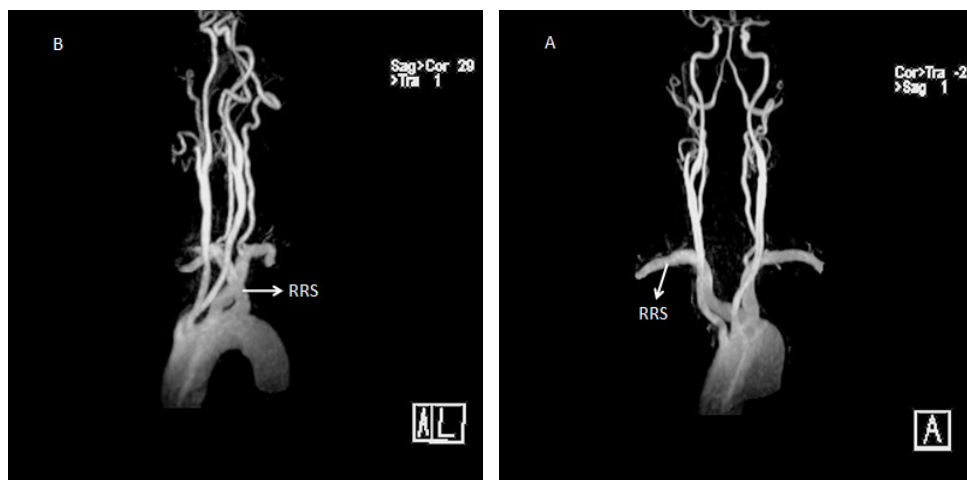
The first branch is the right common carotid artery which is unusually branched out directly from the aortic arch and runs its common upward direction. The second branch of the arch is the left common carotid artery with a normal direction. The left subclavian artery is branched out directly from the arch and runs its direction. The largest aortic arch is the right subclavian artery which is branched out the distal portion of the posterior wall of the aortic arch and passes posterior to the esophagus and anterior to the thoracic spine, and runs its direction towards the right upper extremity.

**3. Discussion**

The first report of variation of the right subclavian artery was presented by Hunald in 1735 [6]. In addition, Kumiama et al. (1995) reported variation of the right subclavian artery [7]. Afterwards, during several studies aimed at determining the separation pattern of aortic arch branches, different variations were reported. In a research conducted on 230 cases, only one case of variation of the right subclavian artery was observed. In another research conducted by Nelson and Spark on 193 cases, variation of the right subclavian artery was not observed but there were 9 cases of variation of the left vertebral artery [8, 9].

Investigation of these cases as well as other studies show that this type of variation is not very frequent in the branches of the aortic arch and its prevalence is 0.4-2% [10, 11].

In this type of variation which is due to the passage of the artery posterior to esophagus, the esophagus and



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**Figure 2.** Cervical vessels MR angiography: showing variation of the retroesophageal right subclavian (RRS) artery in both anterior (A) and lateral (B) views.

trachea are located in a vascular arch between the right subclavian artery and the aortic arch. This does not cause specific symptoms in most cases, but esophageal dysphagia has been occasionally reported.

Brown et al. (1993) reported a variation of retroesophageal subclavian artery causing esophageal dysphagia. Another case of dysphagia due to the variation of the right subclavian artery with the retroesophageal direction was reported in 2002 [12,13].

The main difference between previous researches and the present one is that all of them were conducted on human corpses and variation was reported after fixation and dissection. This research provides an in vivo report in which the anatomical and physiological conditions of the artery were maintained. The observation and report of the variation was non-invasive and did not have any complications for the patient. Along with the examination of the anatomical condition of the arteries, the rate of blood flow was examined. In this patient, variation of the artery did not cause esophageal dysphagia, and also blood flow was normal.

#### 4. Conclusion

It is very important to consider the variation of the right subclavian artery during clinical experiments and head and neck surgery. For example, the variation of the artery causes problems in angiography, during which the catheter is directed through the subclavian artery towards the ascending aorta. If variation of artery is associated with the variation of the recurrent laryngeal nerve, neck surgeries can become very problematic.

Therefore, it is of great importance to consider these variations during neck surgeries, and non-invasive techniques such as MRA of cervical arteries can be used in order to examine them.

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