

# Isolated retroaortic left innominate vein in an adult without cardiac or aortic anomalies

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## Abstract

Retroaortic innominate vein is an uncommon variant reported in patients with congenital heart disease. However, isolated retroaortic innominate vein without associated cardiac or arch anomalies is extremely rare. We present a case of a 68-year-old man who was found to have this anomalous variant incidentally on computed tomography (CT) of the thorax. We also briefly discuss its associations, embryology, and clinical significance.

**Key words:** Anomalous left innominate vein; embryology; imaging

## Introduction

The left innominate vein usually courses anterior or anterosuperior to the aortic arch to join the right innominate vein, forming the superior vena cava (SVC). However, retroaortic course is reported in around 0.2-1% of patients with congenital cardiac anomalies such as Tetralogy of Fallot and right ventricular outflow obstruction.<sup>[1,2]</sup>

Also, 80% of cases with this anomaly have cardiac anomalies. Isolated retroaortic innominate vein in situs solitus without cardiac or aortic anomalies is extremely rare with very few reports in literature.

## Case Report

A 68-year-old man was recovering from bacterial pneumonia involving both lungs. Patient had loss of weight and appetite. He did not have any heart disease. His clinical examination

was unremarkable. No significant cardiac abnormality was noted on auscultation and in electrocardiography. However, his blood levels showed persistently high eosinophil count. Chest radiograph was unremarkable except for resolving pneumonia. Contrast-enhanced computed tomography (CT) scan of thorax, abdomen, and pelvis was done in dual-energy CT scanner (SOMATOM Definition Flash, Siemens Healthcare, Erlangen, Germany) to rule out any underlying neoplasm. No definite mass was noted in the CT. Incidentally, the left innominate vein had an abnormal course [Figure 1] behind the ascending aorta before joining the right innominate vein to form the SVC which was normal in position (on the right side). The volume-rendered three-dimensional images obtained by dual-energy based bone removal clearly showed the relationship with the aortic arch [Figure 2]. The arch of aorta was left-sided. Heart was normal in CT scan. The anomalous course of the retroaortic innominate vein was highlighted in the report because of its clinical implications.

## Discussion

Retroaortic innominate or brachiocephalic vein is an uncommon variant, first described 125 years ago by Kershner.<sup>[3]</sup> It is usually reported in patients with congenital

heart diseases,<sup>[2,4]</sup> with a reported incidence of 0.2-1%.<sup>[1,4,5]</sup> Common association is Tetralogy of Fallot with right aortic

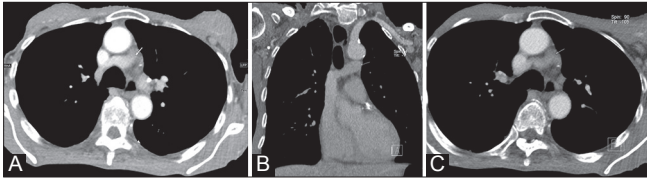
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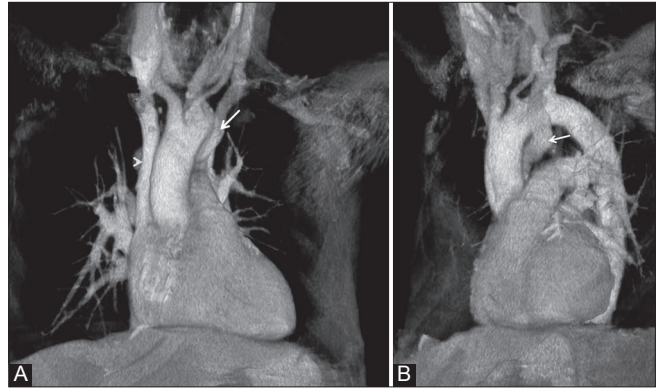


**Figure 1 (A-C):** Anomalous retroaortic left innominate vein. (A, B) Axial and (C) Coronal post-contrast computed tomography (CT) section showing the retroaortic course of left innominate vein (arrow)

arch, with or without pulmonary atresia. Less common associations include right atrial isomerism and septal defects.<sup>[5]</sup> Chen *et al.*<sup>[5]</sup> reported 27 cases of anomalous retroaortic vein on routine scanning of patients with congenital heart disease during a period of 8 years. Even after increasing use of cross-sectional imaging, incidental detection of this anomaly is extremely rare. Only few reports of isolated anomalous innominate vein without cardiac anomalies and with normal left aortic arch exist in literature.<sup>[6-8]</sup> Nagashima *et al.*<sup>[7]</sup> reported only one patient with anomalous vein out of 4805 patients (without congenital heart disease) who underwent cardiac surgeries.

It is important to understand the embryology of development of the innominate vein. Primitive venous system consists of paired precardinal and postcardinal veins which join to form the common cardinal vein.<sup>[4,5]</sup> Right common cardinal vein develops into the SVC in later life (the left common cardinal vein and most of left anterior cardinal vein usually disappear). If left common cardinal is patent, it develops into left-sided SVC. The venous channels of the left side of head and neck are directed toward the right precardinal vein through superior and inferior transverse anastomotic channels. Normally, the inferior transverse anastomosis which lies beneath the fourth aortic arch regresses and the superior anastomotic channels form the left brachiocephalic vein.<sup>[5,9]</sup> Presence of high aortic arch and lack of shortening of the aortic arch may exert compression over the superior transverse anastomotic plexus. In such situations, the subaortic space may be widened which facilitates persistence of inferior transverse anastomotic channels that develop into the anomalous innominate or brachiocephalic vein. Similarly, pulmonary atresia, hypoplasia, or stenosis also facilitates development of anomalous left brachiocephalic vein.

The anomalous retroaortic innominate vein has certain clinical implications,<sup>[4,5]</sup> and hence, needs to be highlighted if incidentally detected. On non-contrast axial CT sections, this variant may mimic an enlarged lymph node, although it is easy to appreciate in multiplanar projections. Difficulty may be encountered during insertion of central venous catheter through left jugular or subclavian approach. This variant may also cause difficulties during cardiopulmonary bypass, this can be mistaken for absent left brachiocephalic vein after sternotomy. During cardiopulmonary bypass, the cannulation of SVC has to be done more caudally as the



**Figure 2 (A, B):** (A and B) Volume-rendered three-dimensional reconstruction showing the retroaortic course of the left innominate vein (arrow). Superior vena cava is normal (arrowhead) and the aortic arch is left sided

anomalous vein enters the vena cava more inferior than usual. During surgeries for congenital abnormalities, anomalous innominate vein may obscure the surgical field, causing difficulties in visualization of pulmonary arteries.

In conclusion, although extremely rare in isolation, recognition of anomalous left brachiocephalic vein is important for the treating physician before planning any intervention or surgery.

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