



A Rare Asymmetrical Enlargement of the Anterior Jugular Vein Involving COVID-19

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- Received Date: 11 Jan 2025
- Accepted Date: 22 Jan 2025
- Publication Date: 02 Feb 2025

Keywords

Anterior Jugular Vein, COVID-19, Thromboembolism

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Abstract

The anterior jugular vein (AJV) is a superficial and symmetrical structure in the neck. Anatomical variations can occur and are usually notable due to their clinical significance particularly in the context of systemic conditions such as COVID-19. A case of a 82-year-old female cadaver who exhibited a rare asymmetrical enlargement of the left AJV was presented. The patient's cause of death was attributed to COVID-19 complications and acute respiratory distress. While the left AJV was significantly larger than the right, there was no corresponding enlargement of the internal and/or external jugular veins. Although venous thromboembolisms are commonly documented in COVID-19 cases, they usually present in deep veins, highlighting the unusual nature of this presentation. The findings from this case highlight the need to further investigate and understand COVID-19 related vascular anomalies, which could provide insight to underlying systemic or vascular diseases.

Introduction

The superficial venous drainage system in the head and neck refers to the venous structures that drain the subcutaneous tissue and is made up of the anterior jugular vein (AJV) and the external jugular vein (EJV) [1]. The AJV generally originates near the suprahyoid, descending along the middle of the anterior part of the neck [2]. Once the AJV reaches towards the sternocleidomastoid muscle, it will pierce through a layer of cervical fascia where it finally drains into another major vein like the subclavian vein or the EJV [2]. However, the vein the AJV drains into has a number of variations. One variation includes one AJV draining into the EJV while the other into the subclavian vein. Another includes one AJV draining into the EJV and the other into the transverse cervical vein [1]. Aside from the variation in the drainage of the AJV, the communication of both AJV forms the jugular venous arch and these vessels are encountered during certain procedures like rhytidectomy, central venous catheterization, percutaneous tracheostomy, and transoral thyroidectomy [2].

The coronavirus disease (COVID-19) caused a viral pneumonia outbreak that began in Wuhan, China in 2019 [3]. Clinical manifestations ranged from asymptomatic carriers to common symptoms of fever, cough, and fatigue to severe respiratory

distress and multiple organ dysfunction that ultimately led to death [3,4]. Although initially thought to be a respiratory illness, a major sequelae of the disease was prothrombotic arterial and venous thrombosis [3]. Different studies found variable incidence for venous thromboembolism most ranging in the mid 20% while the incidence of arterial thrombosis seems to be much more minor [3].

Case Report

On February 20, 2024, a cadaveric dissection was performed by first year medical students at the California Northstate University College of Medicine, wherein a unilateral enlarged AJV and common carotid artery were found. The cadaver was for an 82-year-old female donated from the University of California, San Francisco for the purpose of research and education. The cause of death was attributed to COVID complications and acute respiratory distress in April of 2023.

Upon initial dissection it was observed that the left AJV was noticeably enlarged (Figure 1). The left AJV was found to be 2.5 times wider than the right one (7.94 mm vs. 3.18 mm wide respectively).

Upon closer inspection, the left common carotid artery (CCA) was similarly enlarged (Figure 2). The Left CCA was found to be 2 times wider than the right CCA (12.70 mm vs. 6.35 mm wide respectively).

Citation: Nguyen J, Bharadwaj K, Aboukhalil D, et al. A Rare Asymmetrical Enlargement of the Anterior Jugular Vein Involving COVID-19. Case Rep Rev. 2025;5(2):04.

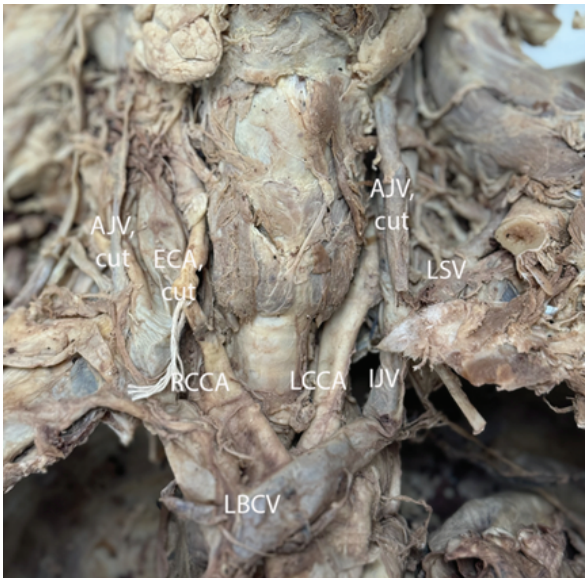


Figure 1. Anterior angle of the neck showing the left anterior jugular vein enlargement. AJV = anterior jugular vein, LSV = left subclavian vein, LCCA = left common carotid artery, IJV = internal jugular vein, LBCV = left brachiocephalic vein, ECA = external carotid artery, RCCA = right common carotid artery.



Figure 2. Anterior angle of the neck showing the left common carotid artery enlargement. AJV = anterior jugular vein, LSV = left subclavian vein, LCCA = left common carotid artery, IJV = internal jugular vein, LBCV = left brachiocephalic vein, ECA = external carotid artery, RCCA = right common carotid artery.

Discussion

The enlargement of the AJV remains a rare occurrence that is not commonly documented in literature [5]. Possible causes of pathological enlargement of the AJV could be seen in cases of aneurysm, hemangioma, phlebectasia, or Lemierre syndrome. Aneurysm of the AJV is thought to be caused by a congenital abnormality of abnormal elastic and muscular fibers, leading to development of an aneurysm [6]. However, this rarely affects solely the AJV [7]. To our knowledge, hemangioma development from the wall of the AJV was also reported twice in literature [8]. Notably, the distension due to hemangioma can be confused with phlebectasia, a dilation of a vein that slowly grows in size, which usually involves the right side and presents earlier in childhood [9].

One case detailed Lemierre’s Syndrome of EJV precipitated by a COVID-19 infection [10]. Lemierre syndrome usually precedes an oropharyngeal infection caused by the anaerobic bacteria *Fusobacterium necrophorum*, which can spread hematologically to a vein leading to a thrombus formation and can cause venous enlargement [11]. In this case, SARS-CoV-2 infection provoked septic thrombophlebitis by increasing the risk of a venous thrombosis and secondary infection. It was hypothesized that SARS-CoV-2 infection targets the ACE-2 receptor leading to endothelial cell damage and a prothrombotic state, which could offer a possible underlying pathophysiology for why Lemierre’s Syndrome developed [12]. Although Lemierre’ Syndrome typically affects IJV, there has also been a case where the thrombus was found in the AJV [13]. Notably, there have been cases where the clinical course of Lemierre’s syndrome was complicated by Acute Respiratory Distress Syndrome [14]. Given that our patient’s cause of death was attributed to COVID-19 complications and acute respiratory distress, the enlargement of her left AJV could be a result of a COVID-19 induced hypercoagulable state that precipitated Lemierre’s Syndrome. However, without evidence of septic emboli in the patient’s clinical history, Lemierre syndrome

causing our patient’s venous enlargement is unlikely.

A few instances of this anatomical anomaly can be found such as in Young et al. finding a similarly enlarged AJV during a routine anatomy laboratory dissection [15]. However, the cause of this anomaly is not fully understood. A thromboembolism was suggested as a possible cause of the venous enlargement, but was unlikely due to a lack of accompanying enlargement of EJV [15]. A study of 30 cadavers found that there were no discernable patterns of anatomical variations that were influenced by comorbidities, making an acquired pathological process causing the enlargement unlikely [16]. One case report did show an enlarged AJV, but it was due to an abnormal connection between the left AJV and right AJV forming a Common AJV, rather than just a sole enlarged left AJV [17]. These cases point to our case might be due to a congenital anomaly or variant anatomy rather than a pathological process due to COVID-19.

Conclusion

Symmetry has always been explicitly important when considering paired anatomical structures, especially structures with cardiovascular involvement. Diseases such as atherosclerosis often progress into other vascular morbidities such as ischemic heart disease and peripheral artery disease around the world [18]. When assessing an individual’s cardiovascular risk, symmetry has been fundamentally important to evaluating the integrity of vasculature [19]. With improvements in technology and computation along with imaging, machine learning based models have found ways to incorporate their techniques with carotid and coronary artery scans to better evaluate and improve outcomes for patients [20]. In cases of asymmetry, such as the AJV enlargement observed in this report, recognizing these variations can be clinically significant. It may offer early indications of underlying vascular or systemic diseases, such as hypercoagulability seen in COVID-19, that could otherwise go unnoticed.

Clinicians encountering similar cases of AJV asymmetry, particularly in patients with a history of COVID-19, should maintain a high level of suspicion for underlying vascular pathologies. Assessments, such as detailed imaging studies such as Doppler ultrasound or CT angiography, should help evaluate the extent and causes of vein enlargement. COVID-19's ability to induce hypercoagulable states should alert clinicians of the importance of screening for thromboembolic events, even if asymptomatic. Early recognition of such anomalies can warrant further investigation with associated systemic conditions. Documenting presentations such as this one can contribute to our understanding of vascular complications in the post-COVID-19 era.

Compliance With Ethical Standards

Conflict of Interest: none

Contributions: all authors have an equal contribution to finalize this work

Acknowledgment

The authors wish to thank individuals who donate their bodies and tissues for the advancement of education and research.

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