



Bilateral Cryptogenic Stroke Related to an Aortic Arch Thrombus

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Abstract

Around 30-40% of acute ischemic strokes are cryptogenic, with potential causes including atrial fibrillation, paradoxical embolism through a Patent Foramen ovale (PFO), or sub-stenotic atherosclerosis. Aortic atherosclerosis, while rare, is a significant cause of systemic embolization. Despite its rarity, aortic atherosclerosis is common, with varying characteristics. Complex aortic atherosclerotic thrombi, though infrequent, pose an increased risk for embolic stroke and recurrence. Typically located in the descending aorta, complex distal atherogenic aortic arch thrombi are uncommon sources of systemic embolism. Here, we present a case highlighting the significance of complex aortic arch atherogenic thrombi as independent risk factors for cryptogenic stroke.

A 53-year-old female with a complex medical history presented with generalized weakness. Imaging revealed multifocal acute ischemia, predominantly in the right parietal lobe. Further investigation, including Transesophageal Echocardiogram (TEE), identified a large, mobile thrombus in the distal aortic arch near the subclavian artery, alongside a small patent foramen ovale. Surgical intervention via transverse aortic arch thrombectomy was performed successfully, and the patient was transitioned to anticoagulant therapy postoperatively.

Ischemic strokes, categorized by the TOAST classification, often have cryptogenic origins, necessitating thorough investigation. Aortic arch atherosclerotic lesions, though rare, can lead to arterial embolism, emphasizing the need for targeted diagnostic measures such as TEE. Management strategies include medical therapy with anticoagulants or surgical intervention, tailored to individual patient risk factors and thrombus characteristics. This case underscores the importance of considering aortic arch thrombosis as a potential etiology of cryptogenic stroke, particularly in patients with relevant risk factors.

Received: April 29, 2024

Accepted: May 17, 2024

Published Online: May 24, 2024

Journal: Journal of Clinical Images

Publisher: MedDocs Publishers LLC

Online edition: <http://meddocsonline.org/>

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Keywords: Ischemic stroke; Cardio-embolic stroke; Aortic thrombus; Cryptogenic stroke.



Introduction

About 30-40% of acute ischemic strokes are cryptogenic, or unexplained [1]. Some of the potential mechanisms underlying cryptogenic stroke include: Atrial Fibrillation (AF), paradoxical embolism through a patent foramen ovale (PFO), or substenotic atherosclerosis [2]. Among atherosclerotic causes, aortic atherosclerosis is a rare cause of systemic embolization [3].

While aortic atherosclerosis as a cause of embolization is rare, it itself is common with varying locations and characteristics [4]. In the Stroke Prevention: Assessment of Risk in a Community (SPARC) study, aortic atherosclerotic plaques were found in 43.7% of 588 randomly sampled subjects. However, complex plaques (defined as large (>4 mm) and/or ulcerated, or mobile) were present in only 7.6% of that same population [5]. Complex aortic atherosclerotic thrombi carry an increased risk for embolic stroke and recurrence [6-8]. Additionally, atherosclerotic aortic thrombi are generally located in the descending aorta and less frequently, in the aortic arch [9]. A complex distal atherogenic aortic arch thrombus is an uncommon source of systemic embolism.

Here, we present a patient with a cryptogenic stroke found to have a complex distal atherogenic aortic arch thrombus extending just past the subclavian artery on Transesophageal Echocardiography (TEE). The patient was treated with a transverse aortic arch thrombectomy. The aim of this report is to increase identification of a complex aortic arch atherogenic thrombus as an independent risk factor for cryptogenic stroke.

Case Report

Our patient is a 53-year-old female with a past medical history significant for Crohn's Disease status post multiple bowel resections, cerebrovascular accident, Bell's Palsy, essential hypertension, asthma, and tobacco use who presented initially to an outside facility with progressively worsening generalized weakness for several weeks. CT brain done showed heterogeneous parenchymal hypo-attenuation in the superior right parietal lobe concerning for an acute versus subacute stroke; as well as heterogeneous parenchymal hypo-attenuation and encephalomalacia throughout the left cerebellar hemisphere and right basal ganglia which appeared more chronic in nature. She was transferred to our facility for escalation of care. Initial workup suggested that this is not an acute stroke, and follow up imaging and echocardiogram was recommended by the stroke team to identify potential etiologies for the stroke. MRI showed multifocal acute ischemia, notably large in the right parietal lobe and a small area involving the left cerebellar hemisphere; as well as petechial hemorrhage within the right parietal infarct, presumed to be cardioembolic in etiology (Figure 1). MRA of the head showed no gross major branch occlusion, but did show asymmetric moderate narrowing at the proximal M2 segment of the right MCA; and the MRA of the neck showed an apparent filling defect in the distal aortic arch possibly a thrombus. Transthoracic Echocardiogram with bubble study was negative for any pathology. Transesophageal Echocardiogram (TEE) was performed due to high suspicion for cardiac source of stroke. The TEE showed a large and mobile 4cm thrombus in the distal aortic arch near takeoff just past the subclavian, as well as a small thrombus and, a very small tunnel Patent Foramen Ovale (PFO) with right to left shunting (Figure 2). Cardiology recommended a CTA of the chest that showed a large thrombus identified in the aortic arch with a component extending into the proximal left subclavian artery.

Our patient was started on a heparin infusion and cardiothoracic surgery was consulted for further evaluation. The patient underwent a surgical transverse aortic arch exploration and thrombectomy with left atrial appendage ligation using a 35mm atircure clip. Intraoperatively, the orifices of the common trunk of the innominate and left carotid artery were widely patent without presence of disease. The left subclavian orifice was widely patent. There was a relatively large calcific plaque with a small artery of penetration present just distal to the subclavian artery. Approximately a 4 x 1.5 cm thrombus was hanging, at that point, from the intima. This was removed under direct vision (Figure 3). A small residual stump about 3-4 mm was also cleaned off the plaque.

The surgery was successful, and the patient was able to be bridged to coumadin along with aspirin and high-intensity statin. Autoimmune and antiphospholipid syndrome workup was negative. Overall, the thrombus was thought to be atherosclerotic in origin.

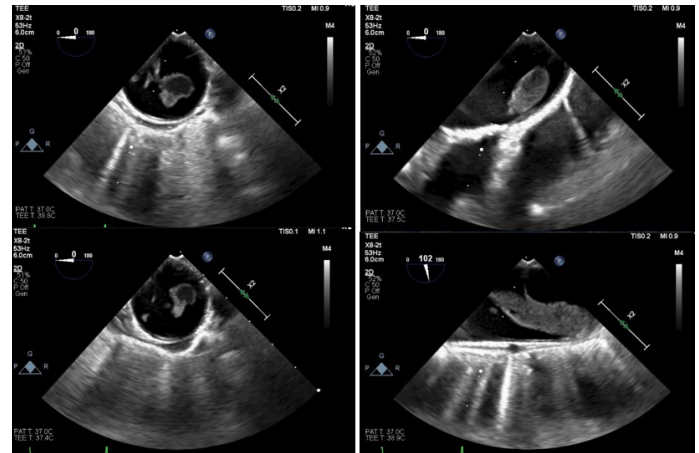


Figure 1: Intra-operative Transesophageal Echocardiogram showing thrombus.

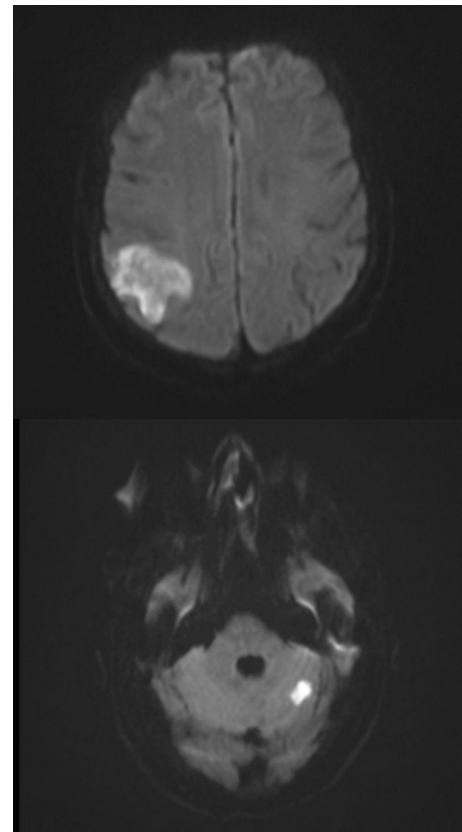


Figure 2: Diffusion MRI brain showing multifocal acute ischemia.



Figure 3: Distal aortic arch mobile thrombus that was extracted surgically.

Discussion

Ischemic strokes are responsible for 87% of all strokes in the United States alone. The pathophysiology of ischemic strokes can be explained by various mechanisms. Ischemic strokes are categorized into five types by the TOAST (Trial of Org 10172 in Acute Stroke Treatment) classification system [10]. The classification was based on clinical characteristics and findings from diagnostic studies. It includes the following sub-groups of ischemic strokes: 1) large-artery atherosclerosis, 2) cardioembolic, 3) small-vessel occlusion, 4) stroke of other determined etiology, and 5) stroke of undetermined etiology/cryptogenic stroke. About 30-40% of ischemic strokes are attributable to a cryptogenic etiology [1]. Due to the high risk of recurrence associated with cryptogenic strokes [11-13], it is important to identify its origins by targeted investigations.

Aortic arch atherosclerotic lesions are a potential source of arterial embolism. Transesophageal Echocardiogram (TEE) generally allows for accurate delineation of aortic arch anatomy and potential lesions [3]. A thrombus in the aorta can be managed by medical or surgical interventions. Medical management involves anticoagulation with heparin, especially when perceived risk of thromboembolism is low [14]. Surgical intervention, involving aortotomy with endarterectomy, thrombectomy or balloon embolectomy, along with thrombolysis, are suggested therapeutic approaches [11]. Continued long-term anticoagulation is necessary unless the underlying causative process resolves [12]. Therefore, it is crucial to consider atherosclerosis of the aortic arch leading to systemic embolism as part of the differential diagnosis when assessing the cause of cryptogenic stroke.

The patient described in the case study had multiple risk factors for atherosclerosis including history of significant tobacco use and essential hypertension. The thrombus observed in aortic arch on TEE was likely atherogenic in origin. The patient had a past medical history significant for Crohn's disease, which is an independent risk factor for atherosclerosis as well as venous thrombosis¹⁵. Long-term use of steroids has been previously reported to increase the risk of blood clotting [11]. Consider-

ing the patient's history of asthma/COPD and Crohn's disease, it is reasonable to concur that the use of steroids for management of these chronic conditions may have contributed to the pathogenesis of thrombus formation. The presence of aortic arch thromboses seems to represent a distinct manifestation of atherosclerotic disease in the aorta, linked to arterial embolism, especially in younger patients [3].

In conclusion, our case underscores the importance of considering thrombosis of the aortic arch as a potential cause of systemic embolism, especially in cases where a definite source is not identified.

Declaration of Generative AI and AI-assisted technologies in the writing process

Statement: During the preparation of this work the author(s) used ChatGPT in order to improve the grammar and language. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Conflict of interest: The authors declared no conflict of interest.

Funding: None.

Author contributions: All authors drafted the manuscript, critically revised the manuscript and reviewed the literature. All authors read and approved the final manuscript.

All authors have participated in the work and have reviewed and agree with the content of the article.

None of the article contents are under consideration for publication in any other journal or have been published in any journal.

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Data availability statement: The authors declare that all the data supporting the findings of this study are available within the manuscript.

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