

## Case Report

### Cryptogenic, Embolic Stroke—Looking Backstage

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## Abstract

Stroke is a common and devastating event and the majority of cases are caused by thromboembolism from the left atrium, left ventricle or left sided valves. This case report describes a case of embolic stroke with the origin of the thrombus from the left inferior pulmonary vein. The importance of this case is twofold. Firstly, it is the fourth case report of pulmonary venous thrombosis, a very rare condition, due to COVID-19 infection and secondly, it focuses attention on the fact that the left atrium is not the most proximal address of arterial thromboembolism—the pulmonary veins are. Thus, it is proposed that a thorough assessment of the pulmonary veins should be done in all cases of arterial thromboembolism.

**Key Words:** Stroke; Embolic; COVID 19; Pulmonary veins; Thrombosis

## Introduction

Stroke is the second most common cause of death in the world today, but the leading cause of disability.<sup>1</sup> The accurate identification of the mechanism of stroke is crucial in order to guide the clinician to the correct therapy and thus reduce recurrence and further disability or death. Current evidence indicates that the majority of ischemic strokes are embolic in nature.<sup>2</sup> The term “embolic” was coined by Virchow in 1854 when he described a patient with stroke due to cardiac emboli.<sup>2</sup> Such emboli can be thrombotic or nonthrombotic in nature.<sup>2</sup> Nonthrombotic, atherogenic emboli may be atherosclerotic in origin from the aortic arch or any part of the extra- or intracranial arteries.<sup>2</sup> Nonthrombotic, non atherogenic emboli may be septic valvular vegetations, calcified valvular fragments, tumor, fat, air or amniotic fluid.<sup>2</sup>

Thrombotic emboli may originate from the left ventricle (dysfunction with reduced or preserved ejection fraction, regional wall motion abnormalities, non-compaction, diverticula or aneurysm), the left atrium, the left atrial appendage, atrial septal aneurysm, valvular pathology or due to arrhythmia.<sup>2</sup> Dissected cervical or carotid arteries and numerous causes of vasculitis are less common causes of thrombotic cerebral emboli.<sup>2</sup> Various causes of paradoxical embolism, such as atrial and/or ventricular septal defects and pulmonary arteriovenous fistulae have also been described.<sup>1,2</sup>

The clinical features of embolic stroke include a sudden onset to maximal deficit (<5 minutes) and a rapid regression of symptoms, known as the “spectacular shrinking deficit syndrome”.<sup>1</sup> Other common secondary symptoms of cardioembolism is Wernicke or global aphasia, visual field abnormalities and neglect.<sup>1</sup> Embolism can also affect the posterior circulation resulting in Wallenberg’s syndrome, cerebellar infarcts, multilevel infarcts, top of the basilar syndrome or posterior cerebral artery infarcts.<sup>1</sup> Distal migration of the embolus with recanalization of the initially occluded vessel is the most probable reason for dramatic improvement of an initially severe neurological deficit which is so characteristic of cardioembolism.<sup>1</sup>

The dramatic advancement in the science of cardiac imaging during the past two decades has led to the detection of previously unrecognised causes of cardioembolism and thus fewer cases of idiopathic cardioembolism are diagnosed.<sup>3,4</sup>

The following case report will be adding another cause of cardioembolism to the current pool of knowledge on cardioembolism.

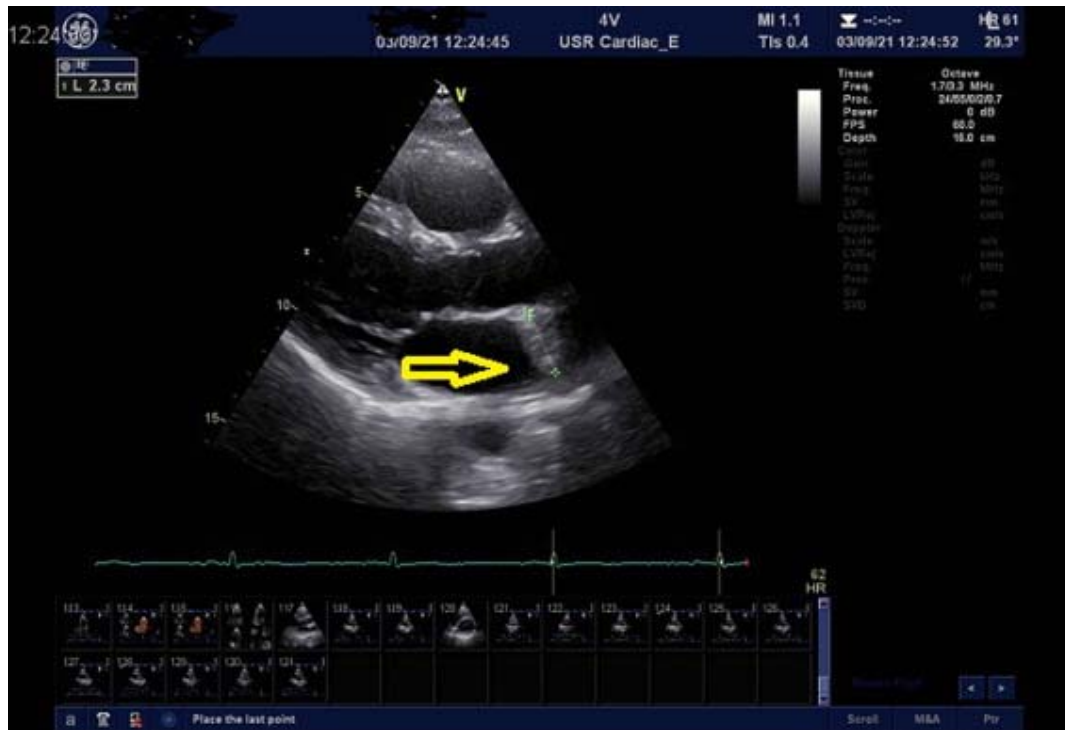
### **Case presentation**

A 35-year old woman presented with a sudden onset of right hemiplegia with aphasia.

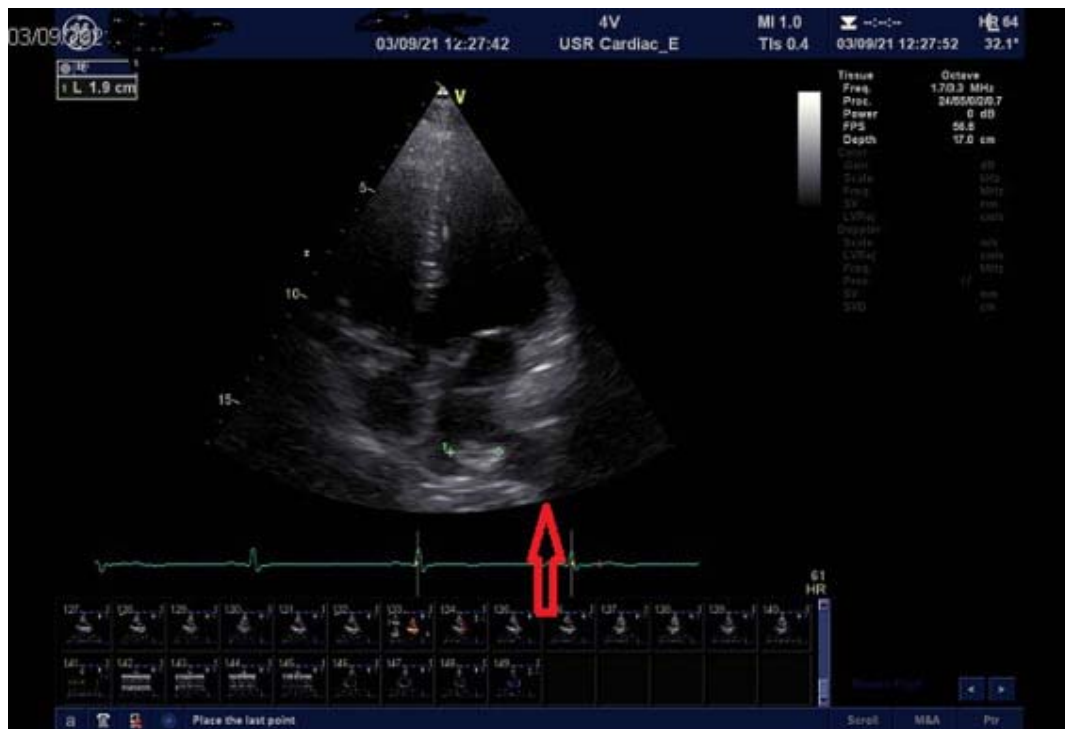
She was seen and admitted to a rural facility with limited resources. However, urgent cerebral angiography via computed tomography excluded intracerebral aneurysm and intracranial bleeding. During the course of the next 24 hours all neurological deficits resolved and the patient was transported to our unit. She was an otherwise healthy young woman with two normal pregnancies delivered via elective caesarean section with no other surgical procedures or any medical diagnoses and no chronic medication use. Her two children were nine and 12 years of age. She was a non smoker with no use ever of any illicit drugs.

However, 3 weeks before presentation the patient was diagnosed with COVID-19 infection, confirmed with real time RT-PCR from a nasal swab. Her symptoms were limited to a dry cough and fever. No hypoxemia occurred and she apparently recovered uneventfully, until the sudden hemiplegia. She did not receive any COVID-19 vaccinations.

At presentation at our unit she had complete recovery of the hemiplegia and normal speech with a normal clinical neurological examination. Blood pressure was 120/70 mmHg with a normal electrocardiogram. Echocardiography revealed a structurally normal heart with a normal left ventricle, normal interventricular and interatrial septae. Structurally the left atrium appeared normal with normal transverse and lateral dimensions with a normal left atrial appendage. However, a peculiar echodense shadow was observed at the posterior aspect of the left atrium on the parasternal long-axis view (Figure 1). The apical four chamber view clearly demonstrated a thrombus migrating from the left inferior pulmonary vein into the posterior aspect of the left atrium (Figure 2).



**Figure 1.** Echodense shadow at the posterior aspect of the left atrium on the parasternal long-axis view (arrow).



**Figure 2.** Thrombus migrating from the left inferior pulmonary vein into the posterior aspect of the left atrium on apical four-chamber view (arrow).

No evidence of any myocardial injury was present with undetectable levels of cardiac troponin T and normal global longitudinal strain (GLS) and normal tissue velocity imaging (TVI) of both the septum and lateral wall of the left ventricle.

A comprehensive biochemical screen revealed no abnormalities and in addition antiphospholipid antibody syndrome, anti-thrombin III deficiency and protein C and S deficiency was excluded. Both factor V Leiden R506Q mutation and Factor II G20210A mutations were absent. Furthermore, stool occult blood, chest radiography, mammography and abdominal and thyroid ultrasound excluded occult malignancy. The full blood count and iron studies were both normal with a normal blood platelet level. Screening for deep venous thrombosis (DVT) of the iliac, femoral and popliteal veins were negative. D-dimer levels were not measured during the initial admission.

In conclusion, a young and otherwise fit and healthy young woman presented with an embolic stroke due to a thrombus migrating from the left inferior pulmonary vein into the left atrium with resultant cerebral embolism. The only significant finding was recent COVID-19 infection. She was given rivaroxaban at a dose of 20 mg daily and 14 days later no residual thrombus was present.

## **Discussion**

Pulmonary vein thrombosis is a rare, but serious condition.<sup>5,6,7</sup> Until recently it was seen after lung transplantation or lobectomy for malignancy or after pulmonary vein isolation in the treatment for atrial fibrillation.<sup>5,6,7</sup> It is known that COVID-19 is primarily a pulmonary disease, but numerous extrapulmonary complications has been noted and published.<sup>6</sup>

The importance of pulmonary vein thrombosis is that the pulmonary veins are the most proximal source of arterial thromboembolism.<sup>8</sup> However, this rare and serious condition is underdiagnosed.<sup>8,9</sup> Furthermore, the rare occurrence is due to the rich network of collateral vessels that drain the lung.<sup>8</sup>

Recently, due to the COVID-19 pandemic a new cause of pulmonary venous thrombosis has been described with 3 rare cases reports of pulmonary venous thrombosis due to COVID-19 infection.<sup>5,6,7</sup>

This case clearly describes another such event with the importance that this may lead to embolic stroke.

It is concluded that the left atrium is not the most proximal cause of thromboembolism—we need to look behind the left atrium at the pulmonary veins, which are the most proximal source of thromboembolism. Therefore, it is proposed that a thorough assessment of the pulmonary veins should be part of the examination in all cases of arterial thromboembolism.

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