



CHAPTER 6

Retinal Ischemia in Atrial Fibrillation: Do Not Overlook the Carotid Artery

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Retinal ischemia is traditionally associated with internal carotid artery (ICA) stenosis and rarely results from cardiac emboli caused by atrial fibrillation.¹⁻³ In this report, we describe two patients who presented with retinal infarction and new onset atrial fibrillation. Both patients had evidence of an acute, probably cardio-embolic, occlusion of the extracranial carotid artery with secondary artery-to-artery embolism to the ophthalmic artery.

Case 1. A 57-year-old Chinese man experienced sudden loss of vision of his right eye. He had no vascular risk factors except for smoking. His general physical and neurological examination was unremarkable, except for an irregular pulse and complete loss of vision of the right eye with an amaurotic pupil. Ophthalmoscopy showed a white ground-glass appearance of the retina with a cherry red spot at the fovea consistent with central retinal artery occlusion. No retinal emboli were visualized. The electrocardiogram showed atrial fibrillation. Laboratory values including a sedimentation rate were unremarkable. He was started on an intravenous heparin infusion. A transthoracic echocardiogram showed atrial fibrillation, normal left ventricular function, and bi-atrial dilatation. The left atrial appendage was without thrombus, but was poorly visualized. A brain MRI showed no evidence of acute or chronic infarction. Time of flight MR angiography of the carotid arteries demonstrated an occluded right ICA just beyond the bifurcation; distal to the occlusion was a central intraluminal hypointensity suspect for thrombus; the left ICA was normal. A duplex ultrasound showed a very echodense large shadow in the proximal right ICA consistent with fresh thrombus, and highly resistant “to and fro” flow corresponding to a distal occlusion. Transcranial Doppler ultrasound (TCD) monitoring of the right middle cerebral artery (MCA) was positive for the presence of microembolic signals. He was discharged from the hospital on warfarin therapy.

Case 2. A 64 year-old man with a previous myocardial infarction presented with an acute left MCA infarction and new onset atrial fibrillation. He had an expressive aphasia, right-sided weakness, and loss of vision affecting part of the inferior visual field of the left eye. Ophthalmoscopy revealed two acute retinal infarcts in the distribution of the superior temporal arteriole without retinal emboli. TCD examination of the left MCA demonstrated microembolic signals. He was treated with intravenous heparin therapy. A carotid ultrasound and MR angiogram showed near-occlusion of the common carotid artery and total occlusion of the external carotid artery on the left side. Subsequent digital subtraction angiography and a repeat carotid duplex study, 7 and 14 days after presentation, respectively, showed complete recanalization of the left common, external, and ICA with minimal residual stenosis. A transesophageal echocardiogram showed atrial fibrillation without a cardiac thrombus. He was treated with warfarin therapy.

We believe that both patients suffered an acute cardio-embolic occlusion of the carotid artery caused by atrial fibrillation with secondary embolization to the retina from the fresh carotid artery thrombus. The clinical presentation, the diagnosis of new onset atrial fibrillation in the absence of anticoagulation, the presence of microembolic signals in the MCA, the demonstration of fresh thrombus in the ICA in case 1, and the early resolution of carotid thrombus in case 2 strongly suggest this impression. Hemodynamic impairment may have been an additional contributory mechanism. To the best of our knowledge this large thrombus embolization to the ICA followed by microembolization to the ophthalmic artery has not been described before.

Retinal ischemia is uncommon in atrial fibrillation. In the Stroke Prevention in Atrial Fibrillation trials, the ratio of hemispheric versus retinal ischemic events among 2012 aspirin-treated patients was 25:1.¹ In a large hospital-based stroke registry with 2288 patients with cerebral and retinal ischemia, atrial fibrillation was more common in brain events than in retinal events, whereas severe ICA disease was less common.²

These data suggest that there are pathophysiological differences between retinal and brain ischemic syndromes. It has been proposed that embolic particles originating from a stenotic ICA lesion are more prone to be carried to the ophthalmic artery, whereas emboli from the left atrium are more likely to travel to the MCA.² Fibrin-platelet emboli from an ICA lesion are likely to be small and to be displaced by high flow velocities across a stenotic lesion in the periphery of the blood stream allowing entrance in the ophthalmic artery.² In contrast, emboli resulting from atrial fibrillation are large and more likely to remain mid-stream traveling to the cerebral branches of the ICA.² Support for this hypothesis is derived from models showing that particle size influences the position in a flowing liquid and the destination in the distal vasculature.⁴⁻⁶ Furthermore, small particles entering the cerebral circulation are less likely to cause symptoms than the same size particles in the retinal circulation.^{1,2,7}

Thus, our two patients demonstrate that in patients with atrial fibrillation, cardiac embolism with occlusion of the carotid artery and secondary embolization to the ophthalmic artery may be a potential mechanism of retina ischemia. Therefore, imaging of the ICA is indicated in these patients.

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