The Case of "Red" Vision Loss

Eleanor Smith,* an 83-year-old woman, presented to our clinic after experiencing sudden-onset, unremitting "dark red–colored" loss of vision that started one week earlier in her left eye. She told us that she had been watching the news when she noticed that the screen looked too dark. At first, she thought something was wrong with her "old TV," but then she noticed a persistent reddish tinge when looking at the screen. She reported no ocular pain, diplopia, headache, photopsias, metamorphopsia, floaters, or visible redness.

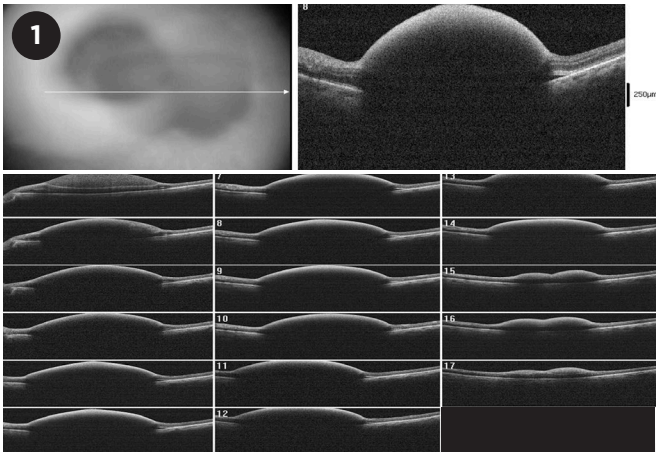
History

Ms. Smith had no significant ocular or family history, and she did not consume alcohol or use tobacco products. Her relevant medical history included hypertension, hyperlipidemia, atrial fibrillation, and a remote history of a transient ischemic attack. She was taking atenolol and had recently stopped clopidogrel one week before presentation. She took no other systemic medications.

Examination

On examination, Ms. Smith's VA was 20/20 in the right eye and counting fingers at a distance of 5 feet in the left eye. Slit-lamp examination showed posterior chamber IOLs and intact, clear lens capsules in both eyes; there were no other notable findings.

Upon direct funduscopic examination of the right eye, the vitreous was clear, and the optic nerve head cup-disc ratio was 0.2. The macula and vessels were unremarkable. In contrast, examination of the left eye revealed a large subretinal hemorrhage directly off the superotemporal arcade with an associated macular aneurysm. This aneurysm was one-half disc diameter in size and located superotemporal to the optic nerve. We also observed a large preretinal hemorrhage over the macula.



OCT. *Retinal convexity indicated a subretinal hemorrhage.*

Differential Diagnosis

Due to the retinal vasculopathy demonstrated in this eye, our differential included a number of possible conditions, including retinal artery macroaneurysm (RAM), traumatic multilayer hemorrhage, branch retinal vein occlusion, capillary hemangioma, cavernous hemangioma, arteriovenous malformations, diabetic retinopathy, diabetic macular edema, exudative age-related macular degeneration, and retinal telangiectasias. In addition, some disease processes such as Coats disease and von Hippel–Lindau disease can present in a similar manner. As the patient was not diabetic and had no history of macular degeneration, some of these diagnoses were unlikely.

Due to the presence of a visible aneurysm as well as pre- and subretinal hemorrhage, our leading candidate was RAM. We felt it was essential to further investigate the underlying cause with OCT imaging and angiography.

Making the Diagnosis

We used high-resolution OCT and fundus fluorescein angiography (FFA) to visualize and confirm our suspected diagnosis of RAM. Our ancillary testing confirmed a preretinal and a subretinal hemorrhage in the superotemporal quadrant of the left eye, with a preretinal hemorrhage over the macula. Based on these clinical and imaging findings, our diagnosis was RAM due to dilation of a major retinal arteriole (Figs. 1,2).

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Discussion

Disease. Retinal artery macroaneurysms are focal dilations of the retinal artery within the first three orders of vascular bifurcation.

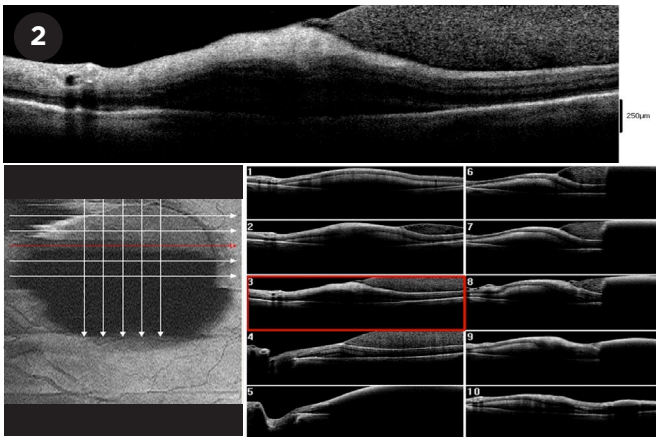
Macroaneurysms range in size from 100 to 250 µm in diameter, which differentiates them from microaneurysms (<100 µm).[1] Larger macroaneurysms can also expand further, traversing the entire thickness of the retina.

The most common location is in the superotemporal retina.

Broad categories of RAMs include hemorrhagic versus exudative and saccular (blowout) versus fusiform (cuffed).[1] Saccular RAMs are thin, localized outpouchings of the arterial wall that are more prone to bleeding than are fusiform RAMs. In contrast, fusiform RAMs are more resistant to rupture but are more liable to leak plasma derivatives.[2] In either type of RAM, perianeurysmal exudates are not likely to affect vision if they do not extend to the macula.[2]

RAMs can be either congenital or acquired. They are associated with numerous conditions, including the following: von Hippel–Lindau syndrome, Coats disease, Eales disease, Leber miliary aneurysms, systemic hypertension, arteriosclerosis, diabetic retinopathy, retinal vein occlusion, retinal arteritis, cytomegalovirus retinitis, radiation retinopathy, sickle cell retinopathy, hyperviscosity syndromes, Takayasu arteritis, and aortic arch syndromes.[3]

Clinical findings. RAMs are most commonly discovered incidentally or during routine funduscopic examinations in asymptomatic patients.[2] However, certain variations of disease can result in specific symptoms. Patients may present with vision loss if macular edema and hemorrhage are present. Embolic or thrombotic occlusions of end arterioles can be seen as white infarcts, whereas hemorrhages in any retinal layer may be seen as red infarcts.[1] If a vitreous hemorrhage is present, a patient may report floaters.[1] In addition, patients with vitreous hemorrhage may report "reddish-tinged vision" or red floaters. Patients may also complain of metamorphopsia and decreased VA if the macroaneurysm extends to the macula.[2]



FURTHER IMAGING. *We also noted subretinal fluid/hemorrhage. In the fundus image (bottom left), one can appreciate the bubble-like appearance of the large retinal aneurysm.*

Funduscopic examination can reveal blood at multiple layers (preretinal, intraretinal, subretinal, sub–internal limiting membrane spaces, and vitreous) or hourglass hemorrhages, representing simultaneous preretinal and subretinal hemorrhages.

Other possible findings include yellow or white hard lipid exudates in a circinate pattern surrounding the aneurysm, pulsations of the aneurysm (10%), and artery occlusions downstream.[4] In addition, capillary telangiectasias and remodeling, with or without retinal edema, may be evident within the macula.[1]

Imaging. A dilated fundus examination alone may be enough to visualize an outpouching of a retinal arterial wall. However, imaging modalities such as OCT and FFA are often used to confirm the diagnosis when hemorrhage or lipid obscure a macroaneurysm. OCT imaging in such cases may demonstrate an oval or circular lesion within the intraretinal layers. The inner lumen of the lesion may appear dark, with the wall appearing hyper-reflective. OCT imaging may also be used to follow the macroaneurysm's size posttreatment, as it will be smaller.[3,4]

FFA is, perhaps, the most helpful imaging tool to diagnose macroaneurysms because immediate filling of a saccular dilation in the arteriolar wall is pathognomonic of a RAM. Late fluorescein leakage from the area of dilation or from surrounding capillaries throughout the study also supports the diagnosis.[2] If a retinal hemorrhage is present, an area of blocked fluorescence around the aneurysm may be observed.[2] The involved arteriole may also be narrowed or irregularly shaped.[2]

Pathophysiology. Two main hypotheses support the current understanding of the pathophysiology of RAMs. The first hypothesis focuses on how arteriosclerosis promotes vessel wall fibrosis, decreased elasticity, and an elevation in luminal pressure that finally causes aneurysmal dilation.[2] The second hypothesis is that emboli or intra-arterial thromboses mechanically damage the endothelium and adventitia of the vessel wall, thus predisposing the vessel to aneurysm formation.[5-8] Regardless of the etiology, systemic hypertension, if present, further promotes decreased autoregulation and hyaline degeneration within the vasculature.[8]

Pathology. An overall thickening of the arterial wall occurs secondary to hypertrophy of the muscularis layer.[6] Other classic features of RAMs include widening of the periarterial capillary-free zone, capillary dilation, nonperfusion, and intra-arterial collaterals.[5] Histopathology further reveals linear breaks in the arterial walls surrounded by a laminated layer of fibrin-platelet clots. Lipid-laden macrophages, hemosiderin, and fibroglial reactions may also be seen.[5]

Epidemiology. RAMs present most often after the sixth decade of life and have a female preponderance.[6] The aneurysm is usually singular and unilateral, although 10% of cases are bilateral, and 20% present with multiple aneurysms along the same or multiple vessels.[2,6] Systemic hypertension has the strongest association with RAM. Other

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relevant risk factors include hyperlipidemia and systemic vasculitides, including polyarteritis nodosa, sarcoidosis, rheumatoid arthritis, diabetes mellitus, and Raynaud disease.

Treatment. Currently, there are no consensus guidelines for the treatment of RAMs. However, a thorough workup for hypertension and systemic vascular disease is warranted, given the high degree of association. If a patient with RAM has a positive history of hypertension, diabetes, and/or other vasculopathy, tight control of blood pressure, blood sugar levels, and cholesterol is absolutely warranted as these are modifiable risk factors.

Laser photocoagulation may be employed if worsening macular edema threatens central visual function.[2] Indications for laser therapy include loss of vision from chronic macular exudates or edema and recurrent or high risk for bleeding.[5] This therapy should be applied with caution, as direct photocoagulation may cause branch retinal artery occlusions.[5]

Surgical removal of a macroaneurysm has been attempted in the past but is not the treatment of choice. Pars plana vitrectomy for vitreous hemorrhage and, in some cases, subretinal hemorrhage may be used as surgical intervention for RAM. Use of Nd:YAG laser to perform a posterior hyaloidotomy has been reported to speed the clearing of the vitreous in cases with a premacular hemorrhage.[6]

Submacular hemorrhages can be treated by means of pneumatic displacement, with or without tissue plasminogen activator.[2]

Results from recent studies have shown a benefit to using anti-VEGF agents in patients with RAM-associated macular edema.[8,9] A case series by Pichi and colleagues showed a decrease in macular edema and hard exudates in all 38 eyes evaluated in the study.[9]

Prognosis. Fortunately, most RAMs resolve spontaneously and can be managed with observation. Most patients have preservation or return of vision unless they have extensive subfoveal hemorrhage or chronic macular edema.[6] Ultimately, the site and severity of hemorrhage and edema determine visual outcomes.[6] Spontaneous closure often accompanies macroaneurysm-related hemorrhage. However, bleeding very rarely occurs more than once.[5] Resolution of retinal hemorrhage and visual recovery takes eight to 10 weeks on average without intervention.[2]

Our Patient

In our case, Ms. Smith was treated with an intravitreal injection of bevacizumab, which resulted in a gradual clearance of the preretinal hemorrhage. Over several weeks, the macroaneurysm also resolved, and her vision improved to 20/100.

* Patient's name is fictitious.

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