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Retinal Arterial Macroaneurysm (RAM)

Retinal arterial macroaneurysms (RAMs) are acquired fusiform or round dilatations of retinal arterioles (Fig. 1). While RAMs are oftentimes asymptomatic, patients with RAMs usually only present to an eye care provider once they have developed a visually significant complication, such as macular exudation or bleeding. These situations can pose diagnostic challenges, as the exam and overall clinical picture can be obscured. Thus, having a working knowledge of RAMs and keeping them in the differential for macular edema and spontaneous hemorrhage can help guide management and counseling of these patients.



Figure 1: Retinal arterial macroaneurysm with surrounding intraretinal and subretinal hemorrhage

While the true prevalence of RAMs is unknown, they are estimated to occur in 1 in 9000 people.¹ RAMs usually occur in the posterior pole along second-order arterioles. Most often they occur along a branch of the superotemporal arcade, although it is possible that this is simply due to the fact that RAMs in this location are more likely to be symptomatic. They are typically located at arteriovenous crossings or arteriolar bifurcations, and can range in size from 100-250 microns in diameter. Macroaneurysms are typically unilateral, although can be bilateral in

10% of patients.² They tend to present in the 6th to 7th decades of life, with women more affected than men.

As might be expected, RAMs are often associated with other systemic vascular issues. History of hypertension is present in 75% of patients, but lipid abnormalities and other cardiovascular diseases are also seen in association.^{3,4} Hypertension and other vascular diseases cause slow damage of retinal arterioles over several years, similar to the arteriosclerotic changes seen elsewhere in the body. Over time, the arteriolar vessel wall becomes thickened, develops focal areas of ischemia, and undergoes further remodeling. Eventually, weak areas in the vessel wall will start to distend, leading to the fusiform or round ectasia that can be visualized on dilated exam.⁵ At this stage, the RAM does not cause any visual symptoms and may be noted incidentally on exam. If a break develops in the wall of the macroaneurysm, however, it runs the risk of leaking (leading to exudation) or rupturing (leading to hemorrhage). This is the stage at which most patients come to the eye care provider's attention.



Figure 2: Retinal arterial macroaneurysm with surrounding subretinal hemorrhage and circinate exudates

Exudation from macroaneurysms develops indolently and may go unnoticed by the patient for months or even years. RAMs with exudation classically have a circinate pattern of lipid exudates surrounding the lesion (Fig. 2). Over time, the edema will accumulate in the macula due to its dependent location. At this point the patient will start to develop a gradual decrease in vision, similar to what would be seen in other causes of macular edema.

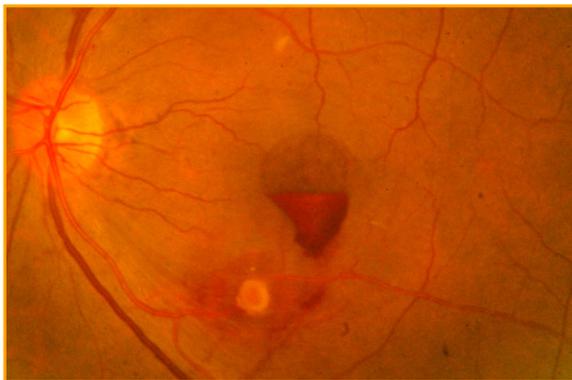


Figure 3: Retinal arterial macroaneurysm with "hourglass" pre-retinal hemorrhage

Hemorrhage secondary to a ruptured RAM usually presents more acutely with a sudden decrease in vision. Hemorrhages from RAMs are unique, as heme can be present in multiple layers at once. This leads to some combination of a subretinal, intraretinal, sub-internal limiting membrane (ILM), sub-hyaloid, and/or vitreous hemorrhage. In these situations the hemorrhage can take on a so-called "hourglass" shape (Fig. 3). Not surprisingly, the multi-layered hemorrhage may obscure the relatively smaller macroaneurysm and complicate the picture.

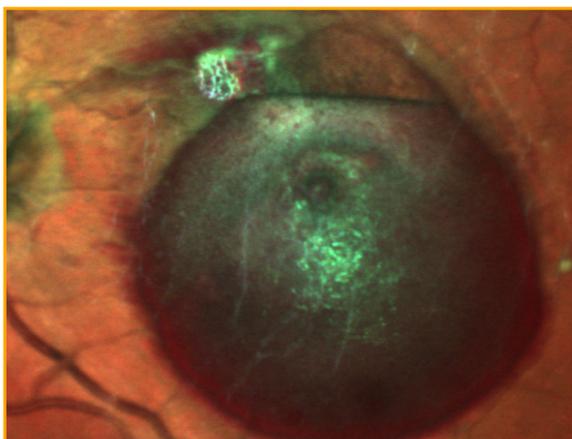


Figure 4a: Ruptured arterial macroaneurysm with large pre-retinal hemorrhage

Fortunately, ancillary tests can be very beneficial in localizing the RAM and sealing the diagnosis.

Optical coherence tomography (OCT) is critical to elucidating the extent of complications from macroaneurysms. The RAM itself appears like a round or oval hyperreflective lesion in the inner retinal layers. If exudation is present, this will be easily visible on OCT and one can determine if the edema involves the fovea, as well as monitor its extent over time or in response to treatment. When hemorrhage is present, OCT is useful for parsing out which layers are affected (Fig 4a-b). Determining if the hemorrhage affects the pre-retinal or subretinal layers can impact treatment and prognostic considerations. This is especially useful when the etiology of the hemorrhage or the presence of the RAM is unknown. Fluorescein angiography (FA) is also a handy tool, which can often highlight RAMs much better than exam or fundus photography. RAMs should fill quickly during the arterial phase, leading to an obvious hyperfluorescent dilatation of the vasculature and providing a contrast to the surrounding hypofluorescent hemorrhage (Fig. 5).



Figure 4b: Corresponding OCT showing sub-ILM hemorrhage (as well as shadowing deeper to the hemorrhage)



Figure 5: Retinal arterial macroaneurysms are hyperfluorescent on fluorescein angiography, which contrasts with the hypofluorescent background of surrounding hemorrhage

It is important to note, though, that the RAM may not be visible if obscured by overlying subhyaloid or sub-ILM hemorrhage, or if there is dense vitreous hemorrhage. In these circumstances, one can consider indocyanine green (ICG) angiography, as ICG has an absorption and emission peak in the near-infrared range and thus allows for deeper penetration through hemorrhage.

Overall, RAMs often have a favorable natural history. Many uncomplicated RAMs will remain dormant and can be observed, as they will usually thrombose and involute over time (Fig. 6). However, the patient must be prompted to undergo systemic evaluation with his or her primary doctor, as RAMs are a sign of underlying vascular disease. A formal blood pressure and cardiovascular evaluation are essential, especially if the patient has no known prior history of these conditions.

Treatment when RAMs become complicated by exudation or hemorrhage can be trickier. RAMs with exudation can be monitored if the exudation is non-central and non-visually significant. Laser photocoagulation directed to the RAM or to the immediate surrounding area has been advocated by some investigators, however this carries the risk of arterial occlusion and loss of distal blood flow, as well as breakthrough hemorrhage and choroidal neovascularization. One must carefully weigh the risks and benefits if choosing this treatment route, and take special consideration if the distal artery supplies the macula. Anti-VEGF injections have more recently been proposed as a treatment for exudative RAMs, although their utility is controversial. One case series of 38 eyes reported that three monthly treatments of bevacizumab was associated with rapid improvement in edema and best corrected visual acuity.⁶ Further investigation of this treatment modality is warranted. When hemorrhage complicates a ruptured RAM, the decision for treatment often depends on the certainty of the diagnosis and the specific features of the hemorrhage, as well as patient-related factors. The hemorrhage should clear over time as the RAM thromboses and involutes, so observation and careful monitoring are often reasonable. If the hemorrhage is non-clearing or the patient is monocular, surgical intervention

with vitrectomy may be indicated. Some investigators have proposed YAG hyaloidotomy for premacular hemorrhage in the subhyaloid space, however this involves risks such as worsening of vitreous hemorrhage, retinal detachment, or iatrogenic macular hole.

Overall, retinal arterial macroaneurysms are not an uncommon entity to present in retinal clinics, however the presentation may be variable. RAM should be on the differential for macular edema and spontaneous vitreous hemorrhage. As mentioned, the prognosis of RAMs is generally favorable as they involute over time, however the outcome will be more variable if the macula is involved, depending on the extent of macular hemorrhage and exudation. Regardless, it is important not to overlook the association with systemic vascular disease, and to ensure that the patient undergoes a formal systemic evaluation with his or her primary doctor.

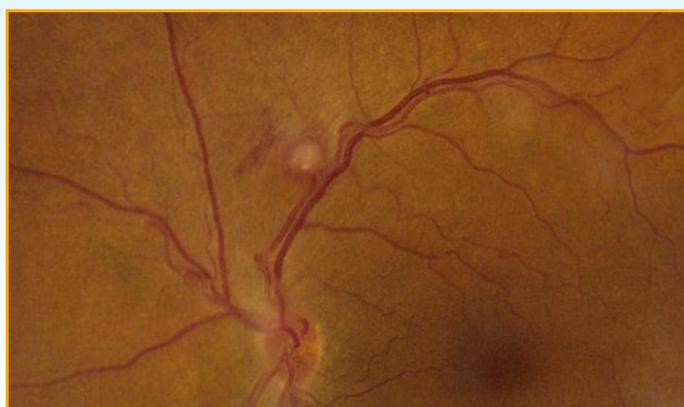


Figure 6: Retinal arterial macroaneurysm that presented with a large vitreous hemorrhage and has now thrombosed and involuted

References:

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