



SURGICAL EMBOLECTOMY FOR FOVEA-THREATENING ACUTE RETINAL ARTERY OCCLUSION

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Purpose: To describe a technique of surgical intraocular embolectomy in patients with acute fovea-threatening branch retinal artery occlusion.

Methods: Pars plana vitrectomy with embolectomy involving embolus isolation, dissection, and removal in patients with an acute fovea-threatening arterial occlusion without a patent cilioretinal artery.

Results: The surgical technique involves a core vitrectomy. The blocked artery is incised using a microvitreal blade, and microsurgical forceps are used to retrieve the embolus. No significant complications were noted. The study technique offers an excellent safety profile and minimizes the risk of vitreous hemorrhage by carefully dissecting the vascular adventitial sheath and isolating the embolus.

Conclusion: Surgical embolectomy is a viable technique for patients with acute fovea-threatening arterial occlusions without patent cilioretinal artery. Careful dissection and retrieval of the embolus minimizes the risk of vitreous hemorrhage, which is an important improvement in previous techniques for management of acute retinal arterial occlusions.

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Branch retinal arterial occlusion (BRAO) is a common clinical entity and has been reported to account for approximately 40% of all arterial occlusions.^{1,2} Displaced embolus is the most common etiology.³ Surgical embolectomy is a controversial therapy for arterial occlusions; however, in some cases where the fovea is threatened and no patent cilioretinal artery exists, embolectomy maybe the only realistically efficacious management available. Although visual acuity may remain intact in most patients, a subset of patients will have progressive and permanent visual decline and field deficits²; these patients are most likely to be ones without cilioretinal arteries and BRAO that are close to the fovea. Given the lack of efficacy of noninvasive treatment

options for arterial occlusions,⁴ surgical embolectomy is proposed as an alternative invasive option for fovea-threatening acute arterial occlusions.

We describe a surgical technique for the isolation and retrieval of an embolus in acute cases of fovea-threatening symptomatic BRAO. Our technique uses a pars plana vitrectomy approach to retrieve the arterial embolus under direct visualization. By carefully dissecting the overlying vitreous, retina, and vascular sheath, one is able to minimize the risk of vitreous hemorrhage, which has commonly plagued previous examples of retinal embolectomy.

Surgical Technique

A standard three-port pars plana vitrectomy is performed. A press-on macular lens is used for high-magnification and enhanced stereopsis. Dilute 50% intravitreal triamcinolone acetonide is injected into the vitreous cavity to induce a complete posterior vitreous detachment and aid in visualization and removal of any unopacified vitreous overlying the embolectomy site. Meticulous mechanical dissection of any remnant

vitreous strands overlying the occlusion site is necessary for subsequent successful dissection of the vascular adventitial sheath. Once all vitreous is removed from the embolus site, a 25-gauge microvitrectomy blade is used to carefully dissect the vascular sheath with longitudinal incisions along the plane of blood vessel flow. This dissection is performed until the wall of the arteriole is carefully and completely (i.e., full thickness) incised; during this part of the procedure, the infusion pressure should be temporarily elevated to approximately 50 mmHg to 60 mmHg to minimize risk of hemorrhage. Intraocular end-gripping forceps are then used to grasp the exposed embolus, through the arteriole lumen, and remove the embolus from the eye.

It should be noted that, if significant traction is encountered when trying to remove the embolus with forceps, a small retinal hemorrhage may be encountered, which indicates that the adventitial sheath has not been fully dissected and the arteriolar lumen not yet incised. To overcome this, reintroduce the microvitrectomy blade and further dissect and expose the embolus. With better exposure and minimal traction, the embolus can then be retrieved using microsurgical forceps. Careful dissection of overlying vitreous, and the vascular sheath, is key to exposing the embolus without the occurrence of vitreous hemorrhage, which severely limits ability to visualize the subsequent embolus removal. The technique, in its entirety, is provided in video format (see Video, Supplemental Digital Content 1, <http://links.lww.com/ICB/A16>).

Discussion

In this report, we describe a surgical embolectomy technique for cases of acute fovea-threatening branch

arterial occlusions. Surgical embolectomy is a controversial technique that maybe of limited benefit in cases of stationary peripheral BRAO. However, when a branch arterial occlusion threatens the fovea, and there is no patent cilioretinal artery to offer collateral blood flow to the fovea, then surgical embolectomy provides a viable intervention to help prevent possible compromise of the central macula.

Given the acute ischemic insult of arterial occlusions, prompt reperfusion is paramount to maximize visual benefit.³ Although largely safe, noninvasive treatment options—such as lowering the intraocular pressure or hyperbaric oxygen—have been found to lack efficacy.⁴ More invasive options, including intraarterial tissue plasminogen activator, similarly offered no treatment benefit with significant adverse events.⁵ Transluminal Nd:YAG laser has been used to photodisrupt obstructive arterial emboli with promising visual outcomes; yet, significant vitreous hemorrhage, collateral tissue damage, and the potential for emboli fragmentation remain.^{6–8}

Surgical embolectomy was successfully attempted by Peyman and Gremillion in 1990.⁹ At the time of writing this report, a total of 12 cases have undergone surgical embolectomy in the literature^{9–13}; however, because of the common complication of vitreous hemorrhage present in all previously published cases, no clear surgical technique appears in the literature. We believe our technique is succinct in its ability to prevent intraoperative vitreous hemorrhage by means of careful vitreous removal and vascular sheath dissection along the plane of blood vessel flow; we have performed this technique three times without any incidence of vitreous hemorrhage.

A number of points should be considered with regards to our surgical embolectomy technique; first and foremost, case selection is critical, and only patients with fovea-threatening BRAO without a patent cilioretinal artery should be considered. Second, the natural history and prognosis of branch and central retinal artery occlusions should be discussed preoperatively during the consent process, and only after a thorough discussion about the risks and benefits of the surgery, should appropriate consent be obtained and surgical embolectomy planned. Third, mechanical vitreous displacement facilitates precise vessel incision and minimizes traction, which prevents vessel rupture and vitreous hemorrhage during embolus retrieval that was present in all previously reported cases. Fourth, the initial vessel wall incision may need to be extended in almost all cases. A larger incision improves exposure and decreases the grasping force required to retrieve the embolus. Finally, intraocular pressure variations could cause either retrograde or antero-

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D. R. P. Almeida and V. B. Mahajan had full access to all the data in the study and take full responsibility for the integrity of the data and the accuracy of the data analysis. All authors contributed to the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, and approval of the manuscript; and the decision to submit the manuscript for publication.

Full adherence to the Declaration of Helsinki and all Federal and State laws was observed.

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embolus movement, an aspect that complicated the retrieval of the embolus in one report.¹² We recommend using valved cannulas and maintaining a steady but elevated intraocular pressure during the vessel incision and embolus removal for optimal results.

This report describes the successful technique of embolus retrieval in acute cases of fovea-threatening BRAO with no occurrence of intraoperative vitreous hemorrhage. Careful preoperative clinical considerations such as patient consent and selection of only fovea-threatening cases without a patent cilioretinal artery are paramount to success. We provide a surgical video and a number of pearls to help vitreoretinal surgeons perform this procedure.

Key words: vitrectomy, retinal artery occlusion, embolectomy.

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