Application of Transpupillary Thermotherapy in a Patient With Asteroid Hyalosis and Premacular Hemorrhage

Jack Yu-Shih Lin, MD
Shun-Ling Lin, MD
Shih-Yu Tseng, MD
Hsin-Jul Lee, MD
Ying-Shan Chen, MD

Abstract. A 70-year-old woman with long-term poor vision was found to have unilateral massive premacular hemorrhage and asteroid hyalosis. Transpupillary thermotherapy (TTT) was applied sequentially to the vitreous in four separate spots, covering the area of the asteroid hyalosis and hemorrhage. Outcome measures included visual acuity, biomicroscopic appearance, ultrasonography, and fluorescein angiography. Significant resolution of the hemorrhage was observed 3 months after TTT, with visual acuity improvement from counting fingers at 25 cm to 20/60. There were no complications noted during the procedure or during follow-up. The long-term safety measures and visual prognosis following TTT for resolution of the vitreous impurities remain to be evaluated, but the procedure may be effective for treating premacular hemorrhage and asteroid hyalosis. [Ophthalmic Surg Lasers Imaging 2006;37:140-143.]

INTRODUCTION

Premacular hemorrhage may occur in retinal vessel rupture with physical exertion, in association with vascular disorders such as proliferative diabetic retinopathy and retinal artery macroaneurysm. This leads to significant loss of central vision. We describe a case of premacular hemorrhage with dense asteroid hyalosis and long-term visual loss, in which fundus details on ophthalmoscopy were obscured by the asteroid bodies. As an alternative to pars plana vitrectomy, transpupillary thermotherapy (TTT) infrared radiation was applied to the area of hemorrhage and asteroid bodies in an effort to derive diagnostic and therapeutic benefit.

TTT is a procedure in which heat is delivered slowly to the target tissue through a dilated pupil using an 810-nm diode laser modified for large spot size and long exposure time needed to produce a localized hyperthermia. After the thermotherapy, both visual acuity and fundus picture improved. Ultrasonography also revealed clearance of the asteroid hyalosis. The results from this case report provide insight into the effect of infrared irradiation on the vitreous and the possibility of infrared laser application in clearance of vitreous impurities.

CASE REPORT

A 70-year-old woman with no significant medical history presented to the eye clinic complaining of diminished vision in the right eye for the past 6 months. The best-corrected visual acuity of the right eye was counting fingers at 25 cm. A detailed view of the fundus of the right eye was not achieved due to the dense asteroid hyalosis, but dense epiretinal hemorrhage over the macula was noticed vaguely (Fig. 1A). Fluorescein angiography revealed blocked fluorescence over the macula in the right eye in all phases (Fig. 1B), consistent with premacular hemorrhage. B-scan ultrasound also showed dense asteroid bodies and hemorrhage over the macula (Fig. 2A).

The patient was observed for the next 2 months; however, spontaneous resolution of hemorrhage and clearance of the asteroid hyalosis did not occur. Because of her long-term poor vision, failure of spontaneous clearing of the hemorrhage, and a compromised fundus view due to the asteroid hyalosis, we performed...
TTT in an attempt to help the absorption of the hemorrhage and the asteroid bodies.

TTT at a wavelength of 810 nm, with a spot size of 2.0 mm, a power of 400 mW, and a duration of 60 seconds per spot, was performed in a grid pattern with a total of 4 spots to cover the area of the posterior pole where dense asteroid hyalosis and hemorrhage were noticed. During the laser application, the focus of the beam was kept on the asteroid bodies and the anterior part of the premacular hemorrhage. Gradual clearance of the hemorrhage and the asteroid bodies from the vitreous was revealed on follow-up funduscopy (Fig. 1C) and B-scan ultrasound (Fig. 2B). Angiography (Fig. 1D) performed 3 months later showed significant resolution of the premacular hemorrhage. The best-corrected visual acuity of the right eye improved to 20/60 at 3 months following the treatment.

DISCUSSION

Premacular hemorrhage resulting from proliferative diabetic retinopathy, a ruptured macroaneurysm, Valsalva retinopathy, or other vascular disorders usually causes a profound loss of vision. The conventional management is awaiting spontaneous resolution or vitrectomy.² In our case, premacular hemorrhage was noted on fluorescein angiography but the detailed
fundus view was significantly confounded by the dense asteroid hyalosis, which is generally a unilateral condition characterized by white, refractile particles (termed asteroid bodies) surrounded by a tightly adhering network of vitreous fibrils. The significant visual impairment experienced by this patient was primarily due to the premacular hemorrhage, but, to some extent, may also have been caused by the dense asteroid hyalosis.³

A treatment dilemma was presented by this particular case. Early vitrectomy may be beneficial in clearing the asteroid bodies and the premacular hemorrhage; however, complications associated with this intraocular procedure, including active bleeding and retinal breaks, are well known. Awaiting spontaneous clearing of the hemorrhage usually takes several months and may lead to epiretinal membrane formation overlying the macula, causing permanent macular damage. A newer method, Nd:YAG laser membranotomy, has been used to effect intravitreal drainage and subsequent clearance of the premacular hemorrhage.⁴ However, in our patient, a proper site of choice for Nd:YAG laser membranotomy could not be properly localized due to a compromised fundus view caused by the large amount of reflected light scattered back to the examiner by the asteroid bodies.⁵

A study by Mainster concluded that from a thermodynamic viewpoint, a CO₂ laser probe emitting wavelength in the infrared region could be used to vaporize regions of vitreous without traction.⁶ The study also indicated that irradiation on vitreous should not cause damage to the retina if the focus of the laser beam is more than 2 mm away from the retina. Because of the patient’s long duration of hemorrhage and a compromised fundus view, we elected to employ TTT, which uses infrared laser at a wavelength of 810 nm as a way to enhance the resolution of the asteroid bodies and hemorrhage through a localized hyperthermia.

After the thermotherapy, both the asteroid bodies and premacular hemorrhage seemed to resolve. We propose that during the laser irradiation, the temperature increase around the impact point causes ultrastructural and compositional changes in the surrounding tissues leading to hemoglobin denaturation and the melting of the asteroid bodies.⁷ The voids observed in the post-treatment B-scan may have been caused by the melting of the asteroid bodies, which in the process transformed into a more soluble form. The disintegrated asteroid bodies and the denatured hemoglobin became more soluble after the therapy and therefore were cleared from the vitreous more easily.

In this case report, we demonstrated the application of infrared irradiation to the vitreous as a way to enhance the clearance of the premacular hemorrhage and the asteroid bodies. The effect of clearing by TTT may not be as immediate as that by vitrectomy. It is also possible that the premacular hemorrhage may spontaneously clear if given enough time. Nevertheless, in our case, there is no doubt that compared to observation alone, which was greater than 8 months, TTT clearly accelerated the absorption of the vitreous impurities in 3 months.

The visual improvement experienced by this patient was primarily due to the clearing of the premacular-
lar hemorrhage and, to a certain extent, the reduced asteroid hyalosis. The clearance of the asteroid bodies also allowed a more lucid fundus view for posterior pole examination. Although no complications were noted on follow-up in our case, the possibility of thermodynamically induced posterior segment anomalies must be considered. Further studies to evaluate TTT as a treatment modality to remove vitreous opacities, particularly with its long-term safety measures and visual prognosis, are warranted.

REFERENCES