Biopsy of a Choroidal Melanoma Using Transvitreal Pars Plana Vitrectomy

by Peter H. Tang, MD, PhD; Ryan A. Shields, MD; and Prithvi Mruthyunjaya, MD, MHS

Within the last decade, multiple prospective data sets have validated the use of the gene expression profile test in predicting metastatic risk in patients with uveal melanoma (UM). Recently, fine-needle aspiration biopsies were added to the recommended work-up of patients with UM by the National Comprehensive Cancer Network for the purpose of prognostication, metastatic surveillance, and enrollment of patients into clinical trials. As such, it is imperative that ocular oncologists be able to perform transvitreal biopsies of UM tumors of all sizes safely.

Amy C. Schefler, MD, FACS

In this case, Tang et al. present a video of a tumor biopsy using the 27-gauge cutter as the primary instrument. As the authors note, use of the cutter rather than a needle offers advantages such as providing less damage to normal tissues than a needle, and enabling more tumor yield via increased aspiration during tumor cell withdrawal than could be obtained with a needle. An additional advantage of using the operating microscope rather than traditional upside-down viewing with an indirect ophthalmoscope is that visualization improves significantly for the surgeon. The view also benefits trainees for teaching purposes. Finally, the use of trocars is thought to be protective against iatrogenic tumor seeding at the pars plana by facilitating safe, direct removal of any residual cells left in the trocar barrel.

It is worth noting that this technique requires several careful steps not detailed in the excellent accompanying video. First, a skilled assistant is critical. Vigorous tugging on the cutter can result in inadvertent enlargement of the retinotomy site, with a rapid increase in subretinal fluid volume and the risk of a long-term rhegmatogenous detachment. Notably, in uncomplicated biopsies performed by skilled ocular oncologists, rhegmatogenous retinal detachments are rare after biopsies. Second, in some cases in which the cutter is used, a needle is required to initiate the retinotomy as the cutter tip is not sharp enough to break through the retina with a "pushing" technique as demonstrated in the video. Finally, a mild-to-moderate amount of vitreous or subretinal hemorrhage as observed in the video is not a cause for alarm and nearly always resolves within several months.

It is quite possible that in the future, a new instrument will be developed that will facilitate the safe delivery of tumor cells while enabling the creation of an even smaller retinotomy site than is currently possible with the 27-gauge cutter. Until then, this excellent video demonstrates the safest, most advanced currently available approach.

Amy C. Schefler, MD, FACS
Retina Consultants of Houston
Blanton Eye Institute, Houston Methodist Hospital
University of Texas Health Science Center

Peter H. Tang

Ryan A. Shields

Prithvi Mruthyunjaya

ABSTRACT: Determining when a previously benign choroidal nevi becomes malignant can be challenging, as traditional biopsy methods are often invasive and can lead to secondary complications such as endophthalmitis and vitreous hemorrhage. Using a transvitreal approach with the 27-gauge vitrectomy system provides several advantages, including direct visualization, theoretically lower risk of inadvertent seeding, and collection of a larg-

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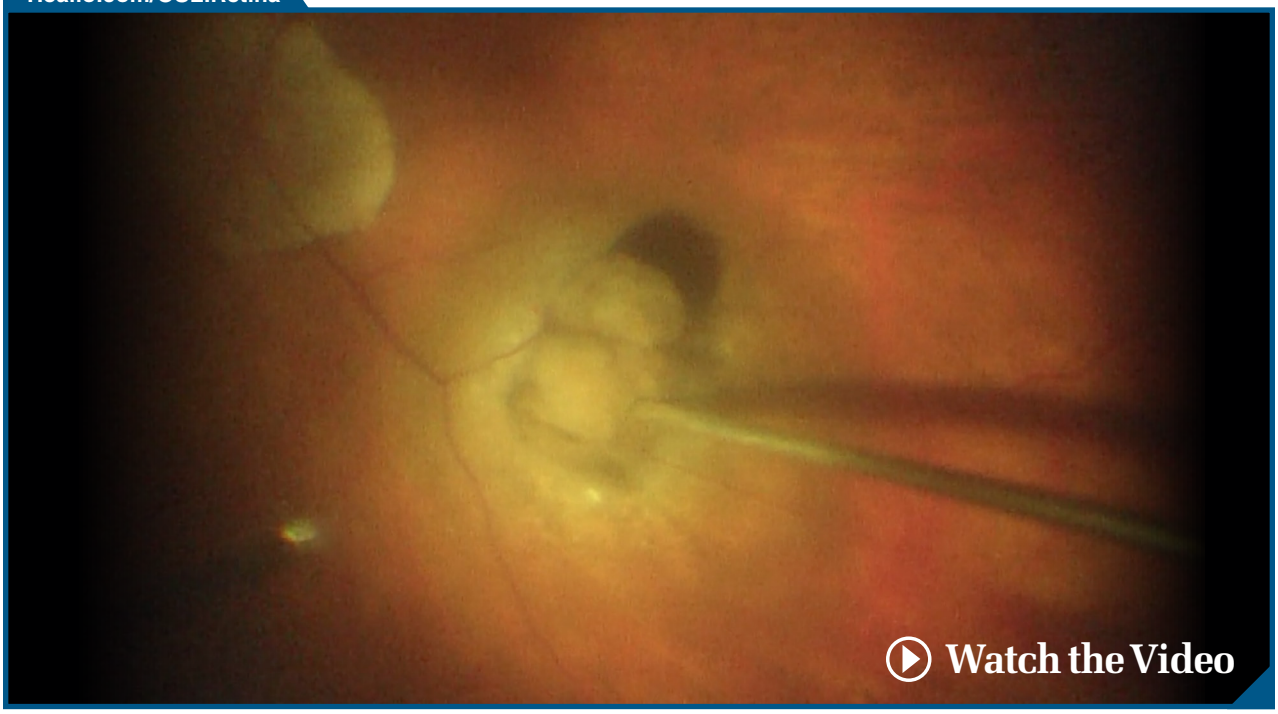

Figure. Image of choroidal lesion biopsy using a transvitreal approach with a 27-gauge pars plana vitrectomy system. Under direct visualization, an unprimed vitreous cutter is inserted into the lesion and set to low cut rate (300 cpm) and high aspiration (600 mm Hg) to obtain samples for further analysis.

er sample size. In this video, the authors present their technique for transvitreal biopsy of choroidal lesions using the 27-gauge vitreous cutter.

Biopsy of choroidal lesions using a transvitreal 27-gauge pars plana vitrectomy (PPV) approach offers potential advantages over fine-needle aspiration, including theoretically lower risk for iatrogenic retinal tears as well as obtaining a larger biopsy sample for analysis.[1] Furthermore, the 27-gauge PPV is preferred over other larger gauges since it produces a smaller retinotomy and can be used to biopsy thinner lesions. In this video article, we describe our experience using this technique to biopsy a choroidal lesion.

A woman in her seventies was referred for evaluation of a choroidal nevus in her right eye (OD) that was previously monitored for more than 20 years with overlying drusen and no change in size. She was asymptomatic upon presentation, and her best-corrected visual acuity was 20/20 in both eyes (OU). Her past ocular history was notable only for uncomplicated cataract surgery OU, whereas her past medical history was noncontributory. The anterior segment exam was unremarkable, and her dilated fundus exam was notable for posterior vitreous detachment OU and a pigmented choroidal lesion along the superior-temporal arcade vessels OD, which measured 7.5 mm vertically by 11.0 mm horizontally by 2.2 mm in height on B-scan ultrasonography. This was noted to be similar to her previous findings, thus observation was elected.

Follow-up examination 1 year later showed interval growth of two focal nodules on the surface of the choroidal lesion with a measured increase in height to 3.1 mm. She also developed apical subretinal fluid. During the next year, the two focal nodules coalesced into a single larger nodule measuring 4.0 mm in height with an overall high internal reflectivity similar to the main lesion. Eventually, the patient developed a vitreous hemorrhage (VH) OD, decreasing her vision to count fingers. The differential diagnosis at that time included malignant transformation of the chronic choroidal lesion versus breakthrough subretinal bleeding from a hemorrhagic pigment epithelial detachment above the lesion. To obtain a definitive diagnosis, we proceeded with a transvitreal biopsy of the choroidal lesion OD using a 27-gauge PPV system (Constellation; Alcon, Fort Worth, TX).

Under direct visualization with a noncontact wide-angle viewing system, a core vitrectomy was initially performed to remove the VH and improve our view of the lesion. The patient already had a posterior vitreous detachment; thus, this was not induced. Afterwards, we installed a new 27-gauge vitreous cutter to minimize the risk of diluting our biopsy sample. We aspirated air to the distal connection joint of the vitreous cutter and then introduced it through the retina and into the choroidal tumor at its thickest portion (Figure). The cutter was then activated with a low cut rate (300 cuts per minute) and high aspiration (600 mm Hg). The infusion pressure was raised to prevent bleeding (60 mm Hg). As the cutter probe was carefully removed from the tumor, infusion pressure was momentarily lowered to avoid incarceration of the retina into the vitreous cutter's mouth. Once the cutter was free from the lesion, infusion pressure was raised back to 60 mm Hg and then slowly lowered with direct visualization of the lesion to confirm adequate hemostasis. We minimize the amount of time that the eye is kept at high intraocular pressure, as there have been reports of extraocular extension as a consequence.[2] The sclerotomy sites were sutured with 7-0 vicryl and treated with cryotherapy afterward.

The vitreous cutter tip was then placed into a specimen tube, and its contents were actively refluxed with care to minimize excess dilution of the sample with infusion fluid. Numerous fragments of tumor tissue were identified within the specimen tube, and a few of these were aspirated with a long 25-gauge needle and placed in RNA stabilization transport media. This was sent on dry ice for gene expression profiling (GEP) using an RNA-based assay, DecisionDx-UM (Castle Biosciences, Friendswood, TX).[3] The remaining specimen was diluted with CytoLyt (Hologic; Marlborough, MA) transport media for cytopathology evaluation.

Cytologic analysis revealed a mixed spindle B epithelioid type choroidal melanoma. GEP revealed a class 1A tumor that was negative for a preferentially expressed antigen melanoma (PRAME), suggesting a low metastatic risk. With this final diagnosis, the patient underwent brachytherapy soon afterward.

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Peter H. Tang, MD, PhD, can be reached at Byers Eye Institute, Department of Ophthalmology, Stanford University School of Medicine, 2452 Watson Court, MC #2286, Palo Alto, CA 94303; email: ptang@stanford.edu.

Ryan A. Shields, MD, can be reached at Byers Eye Institute, Department of Ophthalmology, Stanford University School of Medicine, 2452 Watson Court, MC #2286, Palo Alto, CA 94303; email: ras3@stanford.edu.

Prithvi Mruthyunjaya, MD, MHS, can be reached at Byers Eye Institute, Department of Ophthalmology, Stanford University School of Medicine, 2452 Watson Court, MC #2286, Palo Alto, CA 94303; email: prithvi9@stanford.edu.

Amy C. Schefler, MD, FACS, can be reached at Retina Consultants of Houston, 6560 Fannin Street, Suite 750, Houston, TX 77030; email: acsmd@houstonretina.com.

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