Outcomes of 27-Gauge Vitrectomy-Assisted Choroidal and Subretinal Biopsy

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BACKGROUND AND OBJECTIVE: To report the initial experience of 27-gauge vitrectomy-assisted choroidal and subretinal biopsy

PATIENTS AND METHODS: Retrospective, interventional case series. Eighteen eyes of 18 patients undergoing 27-gauge vitrectomy-assisted choroidal (n = 16) or subretinal biopsy (n = 2). Clinical and lesion characteristics, cytopathology, histology, gene expression profiling (GEP), visual acuity (VA), complications including vitreous hemorrhage (VH), development of rhegmatogenous retinal detachment (RD), and need for additional surgeries were analyzed.

RESULTS: Indications were choroidal melanoma (n = 10), indeterminate choroidal (n = 5), and subretinal lesions (n = 3). Mean lesion height was 3.33 mm ± 1.55 mm (range: 0.80 mm to 6.75 mm) and largest diameter was 8.63 mm ± 4.14 mm (range: 3 mm to 15.5 mm). Mean number of intralesional biopsy passes required was 1.76 ± 0.83 (range: one to four). During a mean follow-up of 7.4 months ± 2.7 months (range: 4 months to 14 months), VA was unchanged (0.5 logMAR ± 0.6 logMAR vs. 0.7 logMAR ± 0.84 logMAR; P = .07). Pathologic diagnosis was obtained in 16 of 18 eyes (88.9%), and GEP data were collected for all 11 choroidal melanomas. Post-biopsy VH occurred in 13 of 18 eyes (72.2%) and was severe enough to require a concurrent limited vitrectomy in six eyes (33.3%). These eyes had a greater lesion height compared to eyes not requiring a vitrectomy (4.08 mm ± 1.68 mm vs. 2.76 mm ± 1.43 mm; P = .04). A rhegmatogenous RD requiring repeat surgery developed in two of 18 eyes (11.1%).

CONCLUSION: The authors concluded that 27-gauge vitrectomy-assisted choroidal and subretinal biopsy established a diagnosis in 88.9% of eyes in lesions 0.8 mm or larger.


INTRODUCTION

Obtaining intraocular biopsy specimens is critical for diagnosis and management when there is diagnostic uncertainty based on conventional examination techniques, or in cases where a tissue diagnosis is required. Improved prognostic accuracy in ocular tumors such as uveal melanoma has also made tissue sampling for cytogenetic testing desirable.1,2

This necessitates an intraocular tumor biopsy in order to obtain a tissue sample for genetic testing or cytopathologic confirmation.1,2 Chorioretinal biopsy can be performed by a variety of external (transscleral fine needle aspiration biopsy [FNAB] or transscleral external biopsy via incisional chorioidectomy) and internal (transvitreal FNAB or transvitreal vitrectomy-assisted biopsy) approaches. A transvitreal vitrectomy-assisted retinochoroidal biopsy obtains a larger sample compared with FNAB, potentially reducing the risk of insufficient tissue sampling for prognostic testing and genetic misclassification.3-6 Although performed under direct visualization, it is challenging to assess the vitreous cutter probe depth within the choroidal tumor and chorioretinal biopsy does confer a greater risk of iatrogenic morbidity including subretinal hemorrhage, vitreous hemorrhage, retinal detachment and the possibility of extrascleral extension.4,7-14

First described in 2010 by Oshima et al., and recently introduced commercially, the 27-gauge microincision vitrectomy system offers advantages compared to larger gauges in terms of smaller scleral wounds, decreased postoperative pain and inflammation, and faster visual recovery.15 Although the

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efficacy of transvitreal retinochoroidal biopsy with a 25-gauge vitrector system has been demonstrated, no series regarding outcomes of 27-gauge vitrectomy-assisted transvitreal choroidal or subretinal biopsy have been published since the commercial introduction of this technology by several different manufacturers.

The purpose of this investigation is to conduct a retrospective chart review to report our initial experience, clinical outcomes, and safety profile of a 27-gauge microvitrectomy system during choroidal and subretinal biopsy for a variety of indications at our tertiary referral ocular oncology center.

PATIENTS AND METHODS

This was a retrospective analysis of clinical records for all patients who underwent 27-gauge microvitrectomy-assisted choroidal biopsy from December 1, 2014, to January 14, 2016. This study was approved by the Duke University Institutional Review Board and adhered to the tenets set forth in the Declaration of Helsinki. All patients offered biopsy were informed of known and potential risks. Informed consent was obtained from all patients prior to treatment. Patients were identified from surgical operative reports and were included if they underwent 27-gauge microvitrectomy cutter-assisted choroidal or subretinal biopsy.

Patients undergoing choroidal or subretinal biopsy for choroidal melanoma, suspected choroidal metastatic lesions, and subretinal infiltrates suspicious for lymphoma were reviewed. Patients were excluded if the lesion was too anterior to permit the microvitrectomy cutter-assisted biopsy using the wide-field viewing system, or if a vitreoretinal surgical procedure was contraindicated.

Baseline tumor data included location (pre-equatorial or post-equatorial), largest basal diameter, and tumor height measured by B-scan ultrasonography. The biopsies were performed either alone or in combination with episcleral plaque brachytherapy placement.

Data were gathered regarding clinical and genetic features of the tumor. Clinical and lesion characteristics; adequacy of specimen for diagnostic outcomes (cytopathology, histology, gene expression profiling [GEP] for metastasis prognosis); best-corrected visual acuity (BCVA) (logMAR) outcomes; complications, including persistent or recurrent vitreous hemorrhage (graded as dense if it was diffuse or overlying the macula versus mild if was a local blood clot at the biopsy site), subretinal hemorrhage, increased serous retinal detachment, rhegmatogenous retinal detachment, regrowth or spread of the tumor, and need for additional surgical procedures were reviewed.

Biopsy Technique

All biopsies were performed by a single vitreoretinal surgeon (PM). In each case, retrobulbar or general anesthesia was administered. All surgeries were performed using the Constellation Vitrectomy 27+ Total Plus Pak vitrectomy system (Alcon, Fort Worth, TX). In eyes undergoing episcleral plaque placement (n = 10), the biopsies were performed after plaque positioning was confirmed with the dummy plaque but prior to placement of the active Iodine-125 plaque.

A conjunctival peritomy was opened in cases undergoing plaque placement, which also allowed proper closure of the sclerotomies after surgery and visualization of any possible macroscopic spillover of cells. The insertion of the three 27-gauge trocars was performed in a standardized fashion 3.5 mm to 4 mm from the limbus depending on the lens status (pseudophakic: n = 7; phakic: n = 11). The vitreous cutter was first primed and air was aspirated to move the fluid column just beyond the most distal connector (Video 1 available at www.Healio.com/osliretina).

When used (n = 16 eyes), the infusion line was connected to the inferotemporal cannula, intravitreal placement was confirmed, and the infusion was clamped to prevent passive influx of infusion into the cutter port. Using a noncontact wide-field indirect viewing system, the vitreous cutter was led through the vitreous cavity without cutting, leaving the vitreous body intact and through the retina into the center of the tumor at the area of highest elevation that was easily accessible, free of subretinal fluid, devoid of major retinal vessels, and as far from the foveal edge of the tumor as possible to reduce the risk of bleeding complications. Once the vitreous cutter had penetrated into choroidal tumor or retinal lesion, using a low cut-rate (300 cuts per minute), high suction (600 mm Hg), and biased open duty cycle, it was engaged for 10 seconds or until tissue was observed in tubing by the assistant. During this time while the cutter was engaged, tissue samples were taken by gently rotating the tip within the tumor. The vitreous cutter used was a dual pneumatic cutter with two air lines connected to the machine. The port was closed by removing one connector as the vitrectomy probe was removed from the eye to minimize the risk of incarcerating vitreous.

Following removal of the probe from the eye, the infusion line was unclamped and the intraocular pressure (IOP) was raised to between 60 mm Hg and 80 mm Hg to minimize perioperative bleeding and then slowly normalized. Contents of the cutter probe and distal tubing were actively refluxed into a microcentrifuge tube using the proportional reflux setting under direct visualization. With the operating microscope, tumor fragments were visible in the...
Figure 1. A 64-year-old male with a 3.7-mm choroidal lesion temporally (A) overlying subretinal fluid on optical coherence tomography (B) and with low-to-medium reflectivity on B-scan (C), which was confirmed to be a choroidal melanoma following 27-gauge vitrectomy-assisted choroidal biopsy. Intraoperatively (D), there was a small amount of vitreous hemorrhage following the biopsy (E) and adequate sample was confirmed visually (F). The vitreous hemorrhage was observed and had completely resolved by 3 months (G). Pathology was consistent with malignant melanoma (H), and gene expression profiling revealed it was a class 1B tumor.

microcentrifuge tube, confirming that an adequate sample had been obtained. If an adequate sample was not visualized, or if there was excessive heme not allowing visualization of tumor fragments, a repeat biopsy was performed. If no tissue was observed due to a suspected blockage of the vitreous cutter by the first tissue block, the vitreous cutter was withdrawn from the tumor, flushed to rule out blockage by tumor fragments, and the biopsy was repeated.
The sample was divided and sent in 0.9% normal saline for cytopathologic examination at the Department of Pathology, Duke University. For suspected cases of melanoma, a small sample of floating cells with minimal saline were transferred into a RNA-stabilizing transport medium and immediately secured for mailing in dry ice for gene expression profile genetic testing (DecisionDx-UM Gene Expression Profile Test; Castle Biosciences, Friendswood, TX).

The IOP was gradually lowered to 25 mm Hg and the light pipe and vitreous cutter were then reinserted to determine the status of any hemorrhage overlying the biopsy site. In cases where the vitreous hemorrhage was mild, or localized over the biopsy site, it was observed (Video 2 available at www.Healio.com/osliretina). In eyes with a dense vitreous hemorrhage or a vitreous or subhyaloid hemorrhage overlying the macula, it was removed by performing a limited vitrectomy (Video 3 available at www.Healio.com/osliretina). Preretinal heme overlying the retinotomy sites was not removed, as it forms a plug that often helps to seal the retinotomy site. After confirming that there was no further bleeding upon lowering the IOP, the retinal periphery was examined and all cannulas were removed. The sclerotomies were sutured with 8-0 vicryl suture and treated with double freeze-thaw cryotherapy. No prophylactic treatment was specifically applied to the biopsy site and no internal tamponade was used in the choroidal biopsy cases.

### TABLE 1
Baseline Clinical and Lesion Characteristics at Diagnosis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Number of Eyes</th>
<th>Number of Patients</th>
<th>Age at Biopsy</th>
<th>Gender</th>
<th>Eye</th>
<th>Tumor Location</th>
<th>Initial Treatment</th>
<th>Follow-Up (Months)</th>
<th>Lesion Size</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Male</td>
<td></td>
<td></td>
<td></td>
<td>Average</td>
<td>Range</td>
<td>Choroidal melanoma 12 eyes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Female</td>
<td></td>
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<td></td>
<td>7.4 months ± 2.7 months</td>
<td>4 months to 14 months</td>
<td>Lymphoma Two eyes</td>
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<td>Hemangioma One eye</td>
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<td>Metastatic lung adenocarcinoma One eye</td>
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<td></td>
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<td></td>
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<td>Indeterminate Two eyes</td>
</tr>
</tbody>
</table>
Statistical Analysis

Data were entered into a database (Microsoft Excel 2013; Microsoft, Redmond, WA) and were analyzed using SPSS statistics version 20.0 (IBM, Armonk, NY). Descriptive statistics and categorical variables were reported as mean and standard deviation, 95% confidence interval, and range. Nonparametric statistics were used, including an independent samples Mann-Whitney U test. Early Treatment Diabetic Retinopathy Study (ETDRS) visual acuities (VAs) were converted to logMAR equivalents. The logMAR acuities before biopsy were compared with postoperative and the last follow-up values. VAs too poor to be assessed with Snellen charts were converted using the following convention: counting fingers = 1.7; hand movements = 2.0; light perception = 2.7; and no light perception = 3.0. A $P$ value of less than .05 was considered statistically significant.

RESULTS

Baseline Clinical Characteristics

Eighteen eyes of 18 patients were included in the analysis. Mean age was 63.2 years ± 13.1 years (median: 68 years; range: 32 years to 85 years). Twelve patients (66.7%) were female. Mean follow-up was 7.4 months ± 2.7 months (range: 4 months to 14 months), and 95% confidence interval (CI) limits were 5.5 months to 12 months. Preoperative VA was 0.5 logMAR ± 0.6 logMAR (range: 0 logMAR to 2 logMAR) and remained unchanged at final follow-up: 0.7 logMAR ± 0.84 logMAR (range: 0 logMAR to 3 logMAR; $P = .07$). A decrease in VA of three or more Snellen lines at 3 months’ follow-up was seen in five eyes (27.8%).

Indications for performing the biopsy were choroidal melanoma (n = 10), an indeterminate choroidal lesion (n = 4), and an indeterminate subretinal lesion (n = 3). Mean lesion height was 3.33 mm ± 1.55 mm (range: 0.80 mm to 6.75 mm; 95% CI, 2.41 mm to 4 mm), and largest basal diameter was 8.63 mm ± 4.14 mm (range: 3 mm to 15.5 mm; 95% CI, 3 mm to 15.5 mm).
Figure 2. A 56-year-old female presented with diffuse hypopigmented choroidal lesions (A) with the optical coherence tomography (OCT) showing large retinal pigment epithelium (RPE) elevations accompanied by intraretinal hyperreflective material (B) suspicious for intraocular lymphoma. A 27-gauge vitrectomy assisted choroidal and subretinal biopsy revealed malignant lymphoid cells immunopositive for PAX5 on immunohistochemistry (C), and haematoxylin and eosin stain showed malignant lymphoid in a background of necrosis (D) consistent with a high-grade B-cell lymphoma. Flow cytometry detected a CD5−/CD10−, kappa-restricted B-cell population. Morphologically, the lymphoma cells were pleomorphic with variable size and shape and increased apoptosis, PAX5+, and cyclin D1− with a high Ki67 proliferation rate. C-myc was variably positive. Treatment was initiated as primary a central nervous system lymphoma of orbit and, following three cycles of systemic rituximab and high-dose methotrexate, there was significant atrophy of the lesions (E) and flattening of the RPE elevations on OCT (F).
The lesions were located posterior to the equator (14 of 18; 77.8%), anterior to the equator (one of 18; 5.6%), at the equator (2/18, 11.1%), or diffuse (one of 18; 5.6%).

Mean number of passes required by the vitrectomy probe in the lesion to obtain a sample was 1.8 ± 0.8 (range: one to four). We did not experience any cases of endophthalmitis.

### Diagnostic Outcomes

There was adequate sample to obtain a pathologic diagnosis in 16/18 eyes (88.9%). The diagnosis included choroidal melanoma (n = 11 eyes) (Figure 1), lymphoma (n = two eyes) (Figure 2), hemangioma (n = one eye), and metastatic lung adenocarcinoma (n = 1 eye). Gene expression profiling data were obtained in all 11 choroidal melanoma eyes.

Among the two eyes without a definitive pathologic diagnosis, one eye had inadequate sample for diagnosis. This eye had an exudative retinal detachment associated with choroiditis and focal area of subretinal infiltration, suspicious for lymphoma. Pathology showed blood and scant bland pigment cells but was otherwise normal. The second eye had an indeterminate amelanotic choroidal lesion wherein cytopathology revealed nondiagnostic epithelioid cells with noncontributory immunohistochemical studies. During further follow-up, she was diagnosed with metastatic lung adenocarcinoma, subsequently confirmed on lung biopsy. The choroidal lesion responded to systemic chemotherapy and was determined to be a choroidal metastatic lesion.

### Ocular Complications of the 27-Gauge Transvitreal Chorioretinal Biopsy

#### Analysis of Vitreous Hemorrhage: At the preoperative examination, two eyes had a vitreous hemorrhage (11.1%). Thirteen eyes (72.2%) developed a vitreous hemorrhage following the choroidal or subretinal biopsy. Of these 13 eyes, six (46.2%) developed a vitreous hemorrhage that was considered dense and underwent a limited concurrent vitrectomy at the time of biopsy. Two such eyes required induction of posterior vitreous detachment intraoperatively to clear a dense macular subhyaloid hemorrhage. A complete vitrectomy was performed only in one eye undergoing a subretinal biopsy for a subretinal lesion suspected to be a granuloma.

Preoperative tumor height impacted the severity of biopsy-associated vitreous hemorrhage. Eyes with a vitreous hemorrhage dense enough to require a limited vitrectomy had taller lesions (4.39 mm ± 1.47 mm; range: 0.8 mm to 4.13 mm) compared to eyes that did not (2.64 mm ± 1.29 mm; range: 2.7 mm to 6.88 mm; P = .041).

Five eyes had a persistent vitreous hemorrhage at 3 months. Mean visual acuity for these five eyes was 0.58 logMAR ± 0.54 logMAR at 3 months compared to 0.19 logMAR ± 0.29 logMAR preoperatively (P = .08). The hemorrhage in four of these eyes was deemed mild (impacting vision two or less snellen lines) and was observed. One eye required a subsequent vitrectomy for a significant persistent vitreous hemorrhage. None of the other eyes had a recurrent vitreous hemorrhage during the follow-up period.

#### Analysis of Retinal Detachment: An exudative retinal detachment at the time of diagnosis was observed in eight eyes (44.4%). This exudative retinal detachment increased in two eyes (25%), decreased in two eyes (25%), and remained unchanged in four eyes (50%) postoperatively following the biopsy. Two eyes (11.8%) developed a rhegmatogenous retinal detachment postoperatively, requiring repeat surgery. In both eyes, vitrectomy was performed along with placement of an adjuvant scleral buckle, and the retinal breaks noted intraoperatively were unrelated to the biopsy site.

### DISCUSSION

In the present study, we demonstrate that 27-gauge vitrectomy-assisted choroidal and subretinal biopsy established a definitive diagnosis in 88.9% of eyes. GEP results were achieved in 100% of choroidal melanoma patients across a wide range of lesion sizes and thicknesses. Complications included varying severity of vitreous hemorrhage following the biopsy in 72% of eyes, of which approximately half required a concurrent limited vitrectomy to clear the hemorrhage. Two eyes (11.8%) developed a rhegmatogenous retinal detachment postoperatively requiring repeat surgery; however, the breaks were unrelated to the biopsy site.

Our diagnostic yield with the 27-gauge vitrectomy-assisted choroidal and subretinal biopsy was consistent with prior reports using 25-gauge vitreous cutters or a 27-gauge needle (Table 2). Using 25-gauge vitrectomy-assisted biopsy technique, Bagger et al. reported that the chromosome three status could be determined in 97.3% of patients with melanoma, and a histopathologic diagnosis could be obtained in 97.6% of eyes. Shields et al. reported adequate material for chromosome 3 analyses in 97% of postequatorial tumors with a transvitreal FNAB approach using a 27-gauge needle.16 Tumor location has been associated with biopsy failure, and vitrec-
tomy-assisted transvitreal retinochoroidal biopsy enables sampling under visual guidance, even of tumors located pre-equatorially.\(^4\)

Cohen et al. reported a significant effect of lesion height on the diagnostic yield, which dropped to 40% in lesions less than 1.99 mm thick.\(^{17}\) Using the 25-gauge needle FNAB, Singh et al. showed that smaller tumors (height < 2.5 mm; 5 mm to 16 mm in largest basal diameter) were more likely to have negative samples than larger tumors.\(^{18}\) McCannel et al. also reported yields of 53% in tumors smaller than 3 mm in height and of 91% in tumors larger than 5 mm.\(^{19}\) In a series of 38 patients using a 1.5-inch 27-gauge needle and transscleral FNAB, yield was 44%, 92%, and 90% in tumors with heights less than 3.0 mm, between 3.0 mm and 5.0 mm, and larger than 5.0 mm, respectively (\(P = .03\)).\(^{20}\) We were able to obtain a confirmatory diagnosis on lesions as thin as 0.8 mm in height, which is thinner than previously reported using vitreectomy-assisted transvitreal biopsy (Table 2).

The theoretical volume of FNAB is based on tumor height and the inner diameter of the 25- (0.26 mm) and 27- (0.21 mm) needles, whereas the volume of the vitreectomy-assisted chorioretinal biopsy is based on the inner diameters of the cutter shaft (0.297 mm) and the tubing (0.5 mm) combined with the lengths of the Alcon 27-gauge vitrector system.\(^3\) The effective probe length of the 27-gauge cutter (26 mm) is slightly shorter than the 25-gauge cutter (27 mm); however, we did not experience difficulty in reaching the tumor in any case. We did observe that in choroidal metastasis and choroidal hemangioma, the 27-gauge cutter appeared subjectively less stiff than the 25-gauge system and required more manipulation to push into the tumor. The smaller sphere of influence with the 27-gauge cutter is a potential advantage specially when using the cutter to biopsy smaller lesions.\(^{21}\) Although a quantitative comparison of specimen yield between FNAB, 25-gauge and 27-gauge vitrectomy-assisted chorioretinal biopsy was not performed, using the 27 gauge vitreous cutter, the tumor fragments in the specimen container were large enough to be visible to the naked eye so that the surgeon could confirm that sufficient tissue had been sampled. Limitations of direct visualization of the specimen are that it is often difficult to determine if the harvested tissue is not just necrotic debris or hemorrhage and is of adequate size and it is ideal to have a pathologist or cytologist evaluate the specimen microscopically in the operating room to ensure adequacy of the sample.

The most common complication associated with a vitrectomy-assisted chorioretinal biopsy is a vitreous hemorrhage, with a reported incidence ranging between 6% and 96.5% (Table 2).\(^4\) In a series of 448 patients undergoing 25-gauge vitrectomy-assisted choroidal biopsy, Grixiti et al. reported that 15 eyes (3.3%) underwent vitrectomy for complications of the biopsy, including persistent vitreous hemorrhage (\(n = 12; 2.7\%\)), rhegmatogenous retinal detachment (\(n = 2; 0.4\%\)), and endophthalmitis (\(n = 1; 0.2\%\)).\(^{22}\) In their series, the incidence of persistent hemorrhage (subretinal hemorrhage or vitreous) requiring surgical intervention (1%) and rhegmatogenous retinal detachment (1%) were both much lower than in our current series. This could partly be attributed to the small sample size and the influence of learning curve in our series.\(^{18}\) In a series of 123 patients, using 25-gauge vitrectomy-assisted chorioretinal biopsy, Bagger et al. reported that 7.1% of eyes developed a retinal detachment during the follow-up of 26 months, and vitreous hemorrhage was observed in 96.5% of cases 1 day after surgery.\(^4\) Repeat surgery for retinal detachment and persistent vitreous hemorrhage was performed in 3.5% and 5.9% of patients, respectively. In our smaller series, two eyes (11.1%) underwent repeat surgery for retinal detachment and one eye (5.5%) underwent repeat vitrectomy for persistent vitreous hemorrhage. However, the breaks found during repeat surgery were not at or related to the biopsy site.

Our rates of intraoperative and postoperative vitreous hemorrhage (72.2%) are slightly lower than the 96.5% reported using the 25-gauge vitrectomy system.\(^4\) This could potentially be attributed to the smaller-gauge instrumentation and our electing to clear the premacular blood during the same surgery when the vitreous hemorrhage was dense. We identified taller pretreatment tumor height to be associated with a more severe post-biopsy vitreous hemorrhage. This is consistent with a recent series of 32 eyes with tumors larger than 5 mm in thickness undergoing a transvitreal FNAB using a 23- or 25-gauge needle, where 21 eyes developed a vitreous hemorrhage, of which six eyes (18.8%) required a vitrectomy.\(^{23}\) In the current study, vision at 3 months was stable compared to the preoperative visit, and a single eye required repeat surgery for a persistent dense vitreous hemorrhage. Although macroscopically it can be difficult to distinguish between blood and pigmented tumor cells, vitrectomy for vitreous hemorrhage following plaque irradiation for uveal melanoma seems to be safe after tumor regression.\(^{24}\)

Our technique offers advantages of improved visualization and illumination control, being easier to
teach to trainees, and the ability to record the surgical video using the wide-field viewing system. Another advantage is the ability to obtain tissue from very small tumors, as these are patients in whom future targeted therapies may benefit the most.\textsuperscript{20,25} Although performed under direct visualization, accurately assessing the depth of cutter probe penetration into the choroidal tumor once embedded past the guillotine can often be a challenge and technologies like intraoperative OCT can help offer real time visualization of the cutter depth into the tumor.\textsuperscript{26} The constant development in tumor biology and cytogenetic tests may make it desirable to store samples from the uveal melanomas for subsequent additional testing in relation to treatment and research. The enhanced yield from the current vitrectomy-assisted chorioretinal biopsy technique allows for an adequate sample to be obtained with a single procedure and a portion of tissue can be potentially banked for future analysis.

This study has several limitations, many of which are inherent to its retrospective nature, the small sample size, and limited follow-up. One such limitation is selection bias, as the included cases were selected for completion with 27-gauge instrumentation without direct comparison to 25-gauge instrumentation, indirect ophthalmoscope directed FNAB, or an extrascaleral approach. The surgical technique was relatively standardized, with a single surgeon and single surgical site; however, the effect of a learning curve contributing to decreased tissue yield and increased complications cannot be ruled out. We did not account for the additive cost and time associated with the setup and operation of the vitrectomy system compared to FNAB, although the cost of disposable packs is significantly higher with the vitrectomy system. With an increase in the overall number of biopsies being performed in ocular oncology, both for diagnosis and tumor prognostication, vitreoretinal surgeons are often being called on to do these procedures. They are more familiar with use of vitrectomy and wide-field viewing systems and are often less comfortable with using the indirect ophthalmoscope to direct FNAB. Another important limitation is that because of the relatively short follow-up duration in the current study, any long-term complications related to the 27-gauge vitrectomy-assisted biopsy, including extraocular or orbital extension of the tumor through the biopsy site or incision, could not be addressed.\textsuperscript{27,28}

In summary, we report the short-term clinical outcomes of 27-gauge vitrectomy-assisted choroidal and subretinal biopsy. This technique established a diagnosis in 88.9% of eyes, in lesions as thin as 0.8 mm. Vitreous hemorrhage was more common in lesions 4.39 mm or larger and could be simultaneously cleared offering quicker visual rehabilitation. Larger clinical studies with longer-term follow-up and comparative evaluation of outcomes, cost analysis, and long-term complications are warranted to better understand the reason for failure of insufficient samples in about 10% of eyes, as well as to further elucidate the potential advantages and shortcomings of 27-gauge microvitrectomy assisted biopsy compared to traditional biopsy techniques.

REFERENCES


