are removed in viscocanalostomy as opposed to the corneoscleral or uveal trabecular meshwork, which are retained. This technique therefore sheds light on the possible biological mechanisms involved in the development of steroid-induced glaucoma and offers a safe and effective treatment option for such patients.

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Endogenous Scedosporium apiospermum Endophthalmitis

Scedosporium apiospermum is the asexual form of Pseudallescheria boydii, a ubiquitous saprophytic filamentous fungus. Neutropenia predisposes patients to infection with this organism. Endogenous endophthalmitis from S apiospermum is a rare but grave sequela.

We present 3 cases of endogenous S apiospermum endophthalmitis and histopathologic findings.

Report of Cases. Case 1. A 59-year-old woman with pre-B-cell acute lymphocytic leukemia developed neutropenia (absolute neutrophil count, <100 cells/mm$^3$) and blurred vision in her left eye. She received intravenous piperacillin sodium–tazobactam sodium, amphotericin B, vancomycin hydrochloride, acyclovir sodium, and sulfamethoxazole–trimethoprim. Her vision deteriorated, and skin lesions appeared on the right arm and left hip. Results of peripheral blood and cutaneous and pulmonary biopsy cultures were negative.

Visual acuity was 20/20 OD and 20/400 OS, with central scotoma and pain in the left eye. There was vitritis with preretinal exudation and surrounding areas of focal retinitis and retinal hemorrhages (Figure 1A). Vitreous aspiration and intravitreal administration of amphotericin B (5 µg/0.05 mL) were performed in conjunction with intravenous voriconazole treatment (6 mg/kg). Four days later, 20 colonies of S apiospermum were identified, sensitive only to voriconazole (minimum inhibitory concentration [MIC], 0.5 µg/mL) and resistant to amphotericin B (MIC, >16 µg/mL), flucytosine (MIC, >64 µg/mL), and itraconazole (MIC, 2 µg/mL). The patient received 2 subsequent intravitreal injections of voriconazole (100 µg/0.1 mL), a vitrectomy with intravitreal voriconazole (150 µg), and 3 weekly intravitreal injections of voriconazole (100 µg). Cutaneous blood and lung cultures yielded S apiospermum, and voriconazole monotherapy was continued (4 mg/kg intravenously twice daily in the hospital and then 200 mg orally twice daily at home). Initial and repeated vitreous voriconazole levels (fungus testing laboratory, University of Texas, San Antonio) were evaluated by high-performance liquid chromatography and exceeded the MIC (Table). The patient’s visual acuity progressed to no light perception with eye pain, and she chose to undergo enucleation. Only the initial ocular culture had positive findings; results of all subsequent cultures were negative.

Limited exenteration was performed because of gross scleral extension. Histopathologic examination demonstrated a disorganized and necrotic retina with inflammatory infiltrate and scleral thickening (Figure 1B). Morphologically normal-appearing S apiospermum organisms were identified (Figure 1C and D). The patient died 6 months later of overwhelming sepsis.

Case 2. A 37-year-old woman with pre-B-cell acute lymphocytic leukemia developed pain and redness in her left eye. She had profound neutropenia and systemic sepsis with pulmonary nodules. Visual acuity was 20/20 OD and 20/25 OS with conjunctival injection, chemosis, and decreased abduction in the left eye; the results of the remainder of the anterior and posterior examination were normal in both eyes. Magnetic resonance imaging showed nonspecific temporal, orbital soft-tissue enhancement. Intravenous vancomycin, imipenem, piperacillin sodium–tazobactam sodium, and liposomal amphotericin B treatment resulted in resolution of her ocular symptoms. Results of repeated magnetic resonance imaging were normal.

Fever and sepsis persisted. Intravenous voriconazole (4 mg/kg twice daily) and azithromycin were added. Four days later the patient developed dull pain in the left eye with decreased vision (visual acuity, 20/100). Examination showed conjunctival injection, vitritis, a yellow-white preretinal mass over the temporal macula, and a flocculent whitish vitreous mass in the inferotemporal macula. The papillomacular bundle demonstrated similarly colored yellow-white infiltrates with surrounding intraretinal hemorrhages.

The patient underwent vitreous aspiration and injection with vancomycin (1 mg/0.1 mL), ceftazidime sodium (2 mg/0.1 mL), and amphotericin B (5 µg/0.05 mL), followed by vitrectomy and injection of vancomycin (1 mg), ceftazidime sodium (2 mg), and voriconazole (100 µg). Four days later, vitreous cultures identified 4 colonies of S apiospermum sensitive only to voriconazole (MIC, 0.25 µg/mL) and resistant to amphotericin B (MIC, >16 µg/mL) and caspofungin acetate.
MIC, 8.0 µg/mL). Initial and repeated vitreous voriconazole levels exceeded the MIC (Table).

The patient developed inferior rhegmatogenous retinal detachment, repaired with scleral buckle, vitrectomy, and silicone oil. Her retina attached and her endophthalmitis stabilized, but the patient died shortly thereafter of multiorgan system failure. Numerous blood and intraoperative vitreous culture results were negative.

Autopsy was performed. Gross examination showed a vitreous abscess, intraretinal fungal plaque, retinal necrosis, and proliferative vitreoretinopathy (Figure 2A). Retinal disorganization (Figure 2B) and fungal invasion (Figure 2C) were extensive. Lung specimens showed diffuse infiltration by multiple fungal organisms consistent with S. apiospermum (Figure 2D).

**Case 3.** A 21-year-old woman with Wegener granulomatosis treated with prednisone and cyclophosphamide developed fever, myalgias, malaise, and headache with stiff neck. Magnetic resonance images demonstrated diffuse meningeal enhancement, and cerebrospinal fluid demonstrated 4+ white blood cells without organisms. Results of blood and cerebrospinal fluid cultures were negative. The patient reported subjective vision loss for 1 week and developed bilateral vitreous infiltration despite treatment with intravenous amphotericin B, fluconazole, ganciclovir, and broad-spectrum antibiotics.

Visual acuity was 20/30 OD and 20/70 OS. Fundus examination demonstrated 1+ to 2+ vitritis with prominent infiltrates extending from the optic discs bilaterally, obscuring the central macula in the left eye.

![Figure 1](http://archophth.jamanetwork.com/pdfaccess.ashx?url=/data/journals/ophth/9992/)

**Figure 1.** Clinical and histologic photographs from patient 1. A, Fundus photograph of the left eye showing dense vitritis, vitreous abscess, and yellow-white fungus–containing plaque obscuring the view of the optic nerve and macula. B, Retinal necrosis over the optic nerve and macula as well as scleral thickening caused by fungal infection. Note the normal retina superiorly with retinal necrosis and inflammatory infiltrate inferiorly (hematoxylin-eosin, original magnification ×10). C, View through plaque showing large, branching, septate fungi (*Scedosporium apiospermum*) (Gomori methenamine-silver stain, original magnification ×20). D, High-power view of C, demonstrating morphologically normal *S. apiospermum* fungi throughout (original magnification ×40).

### Table. Intraocular Voriconazole Concentrations

<table>
<thead>
<tr>
<th>Patient</th>
<th>Aqueous</th>
<th>Vitreous</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre 1.64</td>
<td>2.61</td>
</tr>
<tr>
<td></td>
<td>Post 2.67</td>
<td>2.69</td>
</tr>
<tr>
<td>2</td>
<td>Pre NA</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>Post NA</td>
<td>2.76</td>
</tr>
</tbody>
</table>

Abbreviation: NA, not applicable.

Pre indicates prior to intravitreal voriconazole treatment after 4 days of intravenous voriconazole (6 mg/kg twice daily in patient 1 and 4 mg/kg in patient 2). Post indicates 4 days after intravitreal voriconazole (100 µg/0.1 mL).
The patient received bilateral intra-vitreal injections of amphotericin B (5 µg/0.05 mL) and a vitrectomy in the left eye, followed by weekly intravitreal itraconazole (5 µg/0.05 mL) injections during the next month. Vitreous cultures isolated *S apiospermum*, sensitive to itraconazole (MIC, 0.5 µg/mL) but resistant to amphotericin B (>16 µg/mL) and miconazole nitrate (>4 µg/mL). At no point was any visual recovery observed.

An unrelenting neurologic deterioration paralleled the visual status. Despite intrathecal injections of itraconazole, the patient became progressively lethargic and died shortly thereafter.

**Comment.** We describe 3 patients with endogenous *S apiospermum* endophthalmitis involving 4 eyes that lost substantial vision despite early diagnosis and appropriate therapy. Disseminated *S apiospermum* has mortality exceeding 90%, consistent with the deaths noted in all 3 affected patients in this report.4

Most *S apiospermum* organisms are sensitive only to itraconazole and voriconazole.3 Voriconazole achieves therapeutic vitreous levels after systemic administration.6 Vitreous concentrations up to 25 µg/mL were safely tolerated in rats,7 and doses of 200 µg/mL are safely tolerated in humans.8 To our knowledge, ocular voriconazole levels have not previously been documented in *S apiospermum* endophthalmitis. Herein, both aqueous and vitreous voriconazole levels exceeded the MIC after systemic therapy and exceeded the MIC by 10-fold after intravitreal injections. Despite this, normal-appearing fungi were identified on histopathologic examination.

Vitreous culture secured the systemic diagnosis, highlighting the role of ophthalmologic evaluation in immunocompromised patients. Resistance to amphotericin B is increasing, and voriconazole might be a reasonable first-line alternative against most fungi and molds with the exception of Zygomycetes.9

![Figure 2. Ophthalmic and lung histopathologic photographs from patient 2. A, Gross photograph of the left eye showing a vitreous abscess with a 10 × 8-mm yellow-white fungal plaque covering the optic nerve and macula, retinal necrosis, and proliferative vitreoretinopathy. Note the cut edge of the scleral buckle in the upper left of the figure. B, View through plaque showing retinal necrosis and disorganization caused by fungal invasion (hematoxylin-eosin, original magnification ×10). C, View through plaque showing large, branching, septate fungi (Gomori methenamine-silver stain, original magnification ×20). D, Lung tissue demonstrating numerous, morphologically normal–appearing, large, branching, septate fungi (hematoxylin-eosin, original magnification ×40).](http://archopht.jamanetwork.com/pdfaccess.ashx?url=/data/journals/ophth/9992/ on 06/01/2017)

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Primary Orbital Peripheral T-Cell Lymphoma: Histologic, Immunophenotypic, and Genotypic Features

Primary orbital peripheral T-cell lymphoma is an exceedingly rare neoplastic disorder. Advances in laboratory methods and molecular pathology have greatly improved our ability to accurately diagnose this lymphoid malignant neoplasm. We report a case of primary extranodal peripheral T-cell lymphoma arising within the orbit. Atypical features of the clinical course are described.

Report of a Case. A 44-year-old man developed progressive diplopia and retro-orbital pain. Uncorrected visual acuity was 20/20 in both eyes. Examination findings included hypertropia in the left eye, esotropia, and proptosis in the right eye (Figure 1). Orbital magnetic resonance imaging showed bilateral enlargement of the extraocular muscles, more pronounced on the right. Thyroid ultrasonography disclosed mild thyromegaly, but results of serum thyroid functions tests were normal. The patient was diagnosed as having thyroid-related immune orbitopathy and high-dose oral prednisone was prescribed, with prompt resolution of symptoms and proptosis. However, prednisone was poorly tolerated and its use was discontinued, leading to a recurrence of symptoms.

Neuro-ophthalmology consultation noted mild hypertropia and 2 mm of proptosis in the right eye. A second round of thyroid function testing, erythrocyte sedimentation rate, rapid plasma reagin, antinuclear antigen, and rheumatoid factor findings were all normal. Mag-