Pars plana vitrectomy in the management of ocular toxocariasis

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ABSTRACT

Purpose: This study aims to delineate the clinical characteristics, surgical details, and treatment outcomes of patients diagnosed with ocular toxocariasis (OT) who underwent pars plana vitrectomy (PPV).

Materials and Methods: A retrospective review of medical records was conducted for patients with OT who underwent PPV at a tertiary uveitis clinic between September 2021 and November 2023. Clinical evaluations, laboratory investigations, treatment modalities, and surgical details were analyzed. A 23-gauge PPV was performed due to persistent vitreous opacity despite medical treatment in all patients.

Results: Three pediatric patients with OT were included in this study. All patients presented with vitreous opacity and granuloma at the peripheral retina. Diagnosis relied on characteristic ophthalmologic manifestations and detection of serum or ocular anti-Toxocara antibodies. PPV facilitated the removal of vitreous opacities, traction bands, and inflammatory debris. Silicone oil was used as intraocular tamponade. Postoperatively, visual acuity improved in all cases, with no recurrent inflammation during follow-up.

Conclusion: PPV showed promising outcomes in managing OT, leading to significant improvements in visual acuity, resolution of traction bands, and disease stabilization. Further research is required to comprehend the long-term effectiveness and safety of PPV for OT, as well as factors that can predict treatment outcomes.

Keywords: Ocular toxocariasis, pars plana vitrectomy, granuloma, uveitis.

INTRODUCTION

Ocular toxocariasis (OT), caused by the larvae of Toxocara canis or Toxocara cati, is a parasitic infection that poses significant challenges in ophthalmic practice due to its potential to cause vision-threatening complications.[1,2] Over 90% of OT cases typically manifest unilaterally and predominantly impact children.[3] The diagnosis primarily depends on clinical evaluation, presenting in three specific forms: peripheral granuloma, posterior pole granuloma, and endophthalmitis.[4,5] Larval migration into the retina instigates the formation of granulomas, observed as concentrated yellowish-white masses either in the periphery or posterior pole, often accompanied by significant vitreous inflammation.[6]

In recent times, pars plana vitrectomy (PPV) has become increasingly recognized as a beneficial method in both the diagnosis and treatment of OT.[7-11] This surgical approach allows for the removal of vitreous opacities, granulomas, inflammatory debris, and tractional elements, thereby facilitating the resolution of inflammation and preventing or managing complications like epiretinal membranes and retinal detachment.[8,11]

This small case series delineates the clinical characteristics, surgical details, and treatment outcomes of patients diagnosed with OT who underwent PPV.

MATERIALS AND METHODS

This retrospective, interventional case series reviewed the medical records of patients with OT who underwent

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PPV at our tertiary uveitis clinic between September 2021 and November 2023. Complete ophthalmological examination including visual acuity (VA), slit-lamp and fundus examination, intraocular pressure (IOP), and spectral-domain optical coherence tomography (SD-OCT) imaging was performed in all visits. Patients' demographic features, ophthalmological examination findings, microbiological profiles, treatment modalities, and surgical details were collected. All patients were consulted to the pediatric infectious disease (PID) department for further investigation of OT. Enzyme-linked immunosorbent assay (ELISA) was used to detect anti-Toxocara antibodies in the serum samples of the patients.

All patients presented with vitreous opacity and granuloma at the peripheral retina. The diagnosis of OT relied on characteristic ophthalmologic manifestations and the detection of serum or ocular anti-Toxocara antibodies. The anterior chamber (AC) inflammation was graded according to Standardization of Uveitis Nomenclature Working Group criteria[12] and managed with topical 1% prednisolone acetate (every hour a day) and topical 1% cyclopentolate hydrochloride (twice a day). The OT was treated with oral albendazole and oral prednisolone in collaboration with a PID specialist before surgery. All patients underwent 3-port 23-gauge PPV (OS4 surgical platform; Oertli Instruments®, Berneck, Switzerland) by the same experienced surgeon (H.C.) due to persistent vitreous opacification and the risk of tractional detachment caused by vitreous bands located between and above the granulomas. During surgery, vitreous sampling was performed primarily for diagnostic purposes. The vitreous sample obtained was subjected to analysis for viral, bacterial, and parasitic pathogens, with particular attention to anti-Toxocara antibodies. During the surgery, a core vitrectomy was conducted, and the peripheral retina was examined using scleral indentation. In all patients, the condensed vitreous over the granulomas and the surrounding traction bands were meticulously removed. At the end of surgery, silicone oil was used as intraocular tamponade.

All patients furnished written consent forms for every invasive and non-invasive diagnostic procedure, treatment, and the publication of their medical case in a medical journal.

CASE SERIES

Case 1

A 17-year-old male patient presented with a complaint of vision loss and redness in the right eye (RE) that commenced four days ago. The patient mentioned having continuous contact with cats and dogs. In the past medical records, it was noted that an epiretinal membrane and scarred lesion were identified in the RE during the patient's examination 9 years ago. Following that, the patient was monitored and received follow-up care for the epiretinal membrane at an another clinic. The patient was referred to our clinic due to the development of vitreous condensation in his last examination. The VA in the affected eye was 20/400 at the presentation. The fine keratic precipitates and 2+ cells in the anterior chamber and lens opacity were observed on anterior segment slit-lamp examination. The fundus examination was compromised by intense vitreous opacity, hindering proper visualization. A lesion of 3 optic disc size was detected in the inferior peripheral retina, appearing blurred. The IOP was measured as 29 mmHg in the affected eye. The ophthalmological assessment of the left eye (LE) was normal. Serological work-up was investigated. The patient was referred to the PID department. The treatment with trimethoprim-sulfamethoxazole (800/160 mg twice a day for six weeks) and clindamycin (600 mg twice a day for two weeks) was initiated by the PID upon positive results of serum anti-toxoplasma IgM and IgG tests. Nevertheless, there was no improvement in clinical findings. Ten days later, serum anti-Toxocara canis IgG ELISA was resulted as positive. Therefore, the PID specialist added oral albendazole (400 mg twice a day) to the treatment plan. Then, the patient was commenced on oral prednisolone (64 mg/day) three days later. No improvement in vitreous condensation during follow-up prompted the planning of PPV for the patient. Phacoemulsification combined with PPV was performed. During surgery, an elevated lesion was noticed in the inferior peripheral retina, surrounded by pigmentation that resembled a Toxocara granuloma (Supplementary Video 1). There were also dense vitreous and tight vitreous bands present above the lesion. In addition, a vitreous traction band extended temporally from this lesion, and another granuloma lesion and retinoschisis-like area were detected in the peripheral retina at the extension site of this band. Peripheral vitrectomy was meticulously performed, followed by the application of a barrier laser around lesions in the peripheral retina. Silicone oil was injected at the end of the surgery. Analysis of the vitreous sample yielded negative results for Toxoplasma gondii and Toxocara canis. Postoperatively, VA in the RE increased to 20/200. Five months after the surgery, the patient underwent silicone oil removal, posterior capsulotomy, and synechiotomy. Over the one-year follow-up, recurrent infection was not developed and the size of the scarred lesions remained

stable (Figure 1). The final VA in the affected eye was 20/200.

Case 2

An 11-year-old male patient was referred to our clinic with a preliminary diagnosis of unilateral panuveitis. The patient experienced visual impairment and redness in the RE for three weeks. His past medical history was unremarkable. The patient, who lives in a rural area, had a history of suspected contact with cats and dogs. The VA in the affected eye was 20/2000. Slit-lamp examination revealed 4+ cells in the AC, fine-pigmented keratic precipitates, and posterior synechiae. Inflammatory debris resembling a string of pearls was observed in the anterior vitreous. The view of the fundus was obstructed by a dense opacity within the vitreous humor. The B-scan ultrasonography showed vitreous condensation in the RE. Ophthalmological examination of the LE was normal. The patient was hospitalized and the PID, neurology, and rheumatology departments were consulted for further investigation along with a full serological work-up. The patient was commenced on oral albendazole treatment (400 mg twice a day), based on the preliminary diagnosis of OT. Three days later, oral prednisolone treatment (1 mg/kg/day) was initiated. He had a positive ELISA result for serum anti-Toxocara canis IgG. Following prednisolone treatment, vitreous opacity decreased, and VA improved to 20/100. The patient was discharged from the hospital 10 days after admission, with the current treatment regimen to be continued. One week later, the VA in the affected eye was 20/63; nevertheless, lens-sparing PPV was performed for diagnostic and therapeutic purposes due to continued vitreous condensation. Following core vitrectomy, the vermiform-shaped granuloma of two optic disc size with hyperpigmented margins was observed in the inferior retina anterior to the equator (Supplementary Video 2). There was dense vitreous condensation tightly adherent to the lesion. Another granuloma, smaller in size, was noticed temporal to this one. In addition, segmental retinal vasculitis and multiple suspected granuloma-like lesions were identified in the inferior and temporal peripheral retina. Moreover, a hypopigmented area extending to the pars plana was noted in the inferonasal peripheral retina. During the examination of the peripheral retina with scleral indentation, numerous small-sized granulomas were observed. The tight vitreous bands over all lesions and between each other were removed. After that, a barrier laser was applied around all lesions. At the end of the surgery, silicone oil was injected into the vitreous, and a peribulbar injection of methylprednisolone acetate was administered. During follow-up after surgery, VA improved to 20/32. Oral prednisolone was gradually tapered. One month after surgery, albendazole treatment was stopped upon the recommendation of the PID specialist. Until the last visit, 4 months after the surgery, there was no recurrence of infection. The final VA was 20/32 in the RE and there were no alterations noted in the retinal findings (Figure 2). Silicone oil removal was planned.

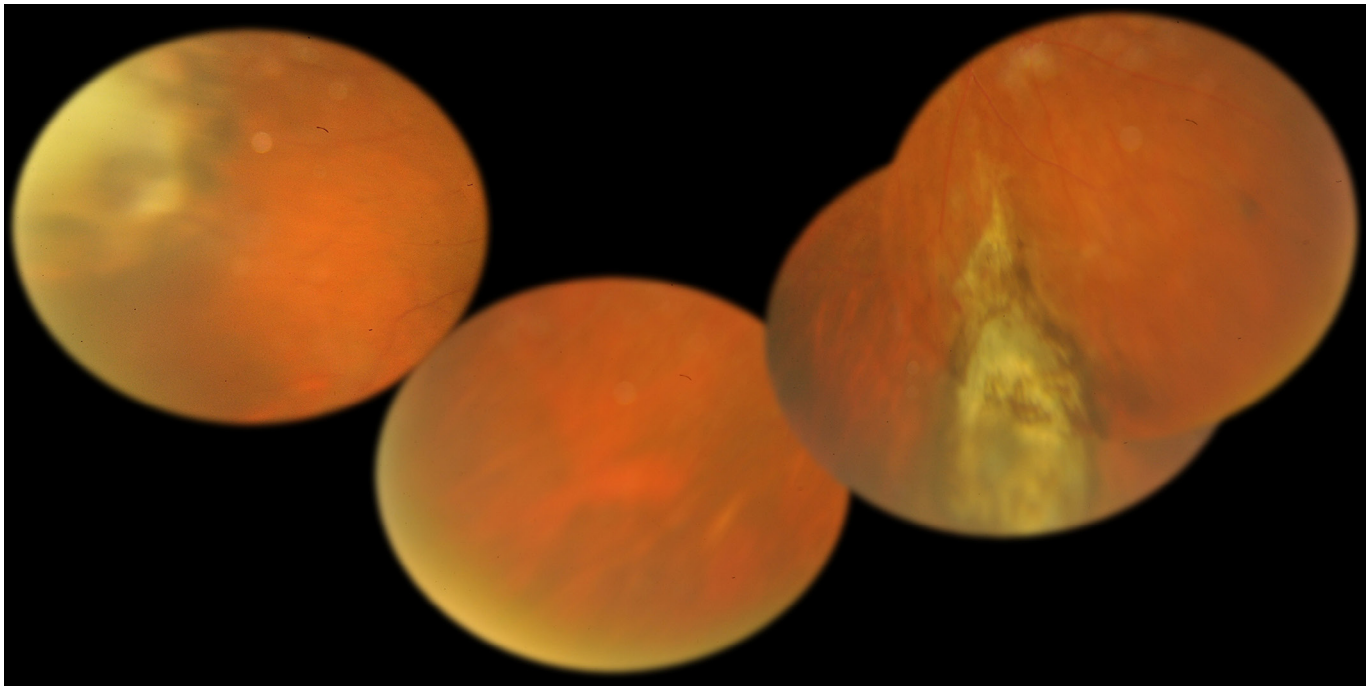

Figure 1: *Over the one-year follow-up, the size of the granuloma situated in the inferior retina remained unchanged.*

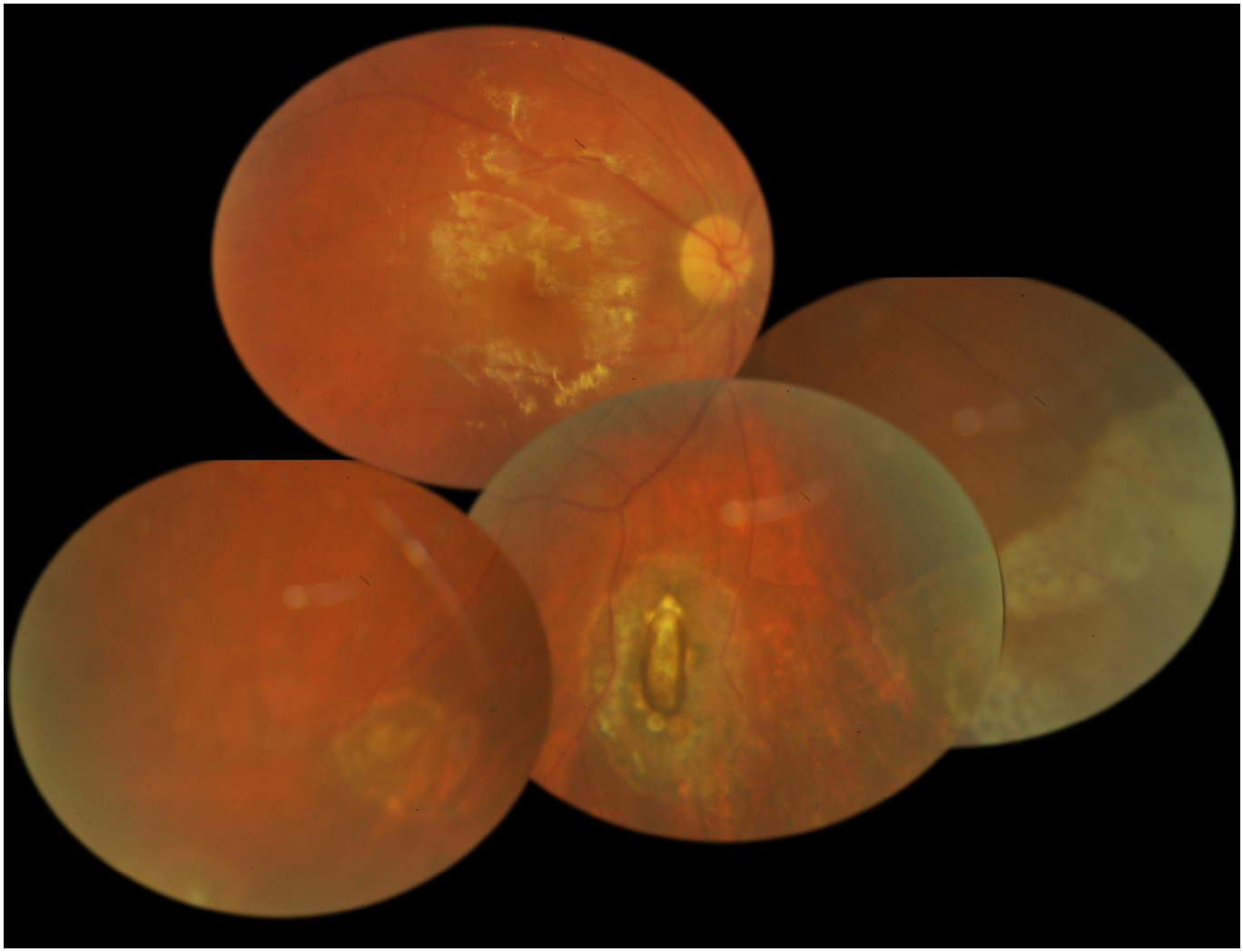

Figure 2: *The composite color fundus image revealed that the sizes of the granulomas remained stable and the surrounding barrier laser scars.*

Case 3

A 9-year-old male patient presented with a complaint of outward deviation and vision loss in the RE for 8 months. No other notable ocular or systemic medical history was reported. The patient had been residing on the farm since birth and had a history of contact with animals. His vision was counting fingers at one meter in the affected eye. Band keratopathy in the RE was observed through slit-lamp examination. In addition, there was vitreous adhesion leading to opacity of the posterior lens capsule. The fundus examination was hindered by significant vitreous opacity. The SD-OCT unveiled cystoid macular edema (CME) in this eye. The IOP was 15 mmHg in the RE and 17 mmHg in the LE. The examination of the LE revealed normal findings. The patient was hospitalized and a full serological work-up was requested. The patient was consulted with the PID specialist for further evaluation, following a preliminary diagnosis of OT. Oral azithromycin (10 mg/kg for one day and 5 mg/kg for 4 days) and oral albendazole (300 mg/day) therapy was initiated by the PID. Four days later, oral prednisolone (0.5 mg/kg/day) was added to the treatment. He tested positive for serum anti-Toxocara canis IgG antibodies with ELISA. During follow-up, VA was increased to 20/125 and CME was resolved. Nevertheless, one month after the presentation, PPV for diagnostic and therapeutic purposes was scheduled due to the unregressed vitreous opacity and suspect of a retinal tear in the inferior quadrant. During surgery, phacoemulsification with intraocular lens implantation was first performed. Following core vitrectomy and removal of the posterior hyaloid, there were yellowish-white granulomas and numerous infiltration foci of different sizes noticed in the inferior, inferonasal, and inferotemporal peripheral retina (Supplementary Video 3). A retinal tear was noticed posterior to the granulomas situated in the inferior retina. Peripheral vitrectomy was conducted using scleral

indentation to remove the densely adherent vitreous surrounding the entire peripheral retina and the vitreous bands located between the granulomas and foci. Laser was applied around the retinal tear and required areas. Silicone oil was preferred as intraocular tamponade. At the end of the surgery, a peribulbar methylprednisolone acetate injection was administered. Anti-Toxocara IgG positivity was detected with the Western blot (WB) technique in the vitreous sample. The day after surgery, the patient's vision improved to 20/125. The patient maintained regular follow-up visits at a clinic located in a different city. Two months after the presentation, in the last visit, we were informed by the ophthalmologist who examined that the patient's VA in RE was 20/100. Silicone oil removal was planned.

DISCUSSION

The OT is a potentially serious condition that is commonly identified in the pediatric age group and requires prompt diagnosis and appropriate treatment to prevent complications and preserve vision. The primary issue in patients with OT is ocular inflammation, leading to the formation of condensed vitreous and vitreoretinal tractional bands. Despite receiving medical treatment including corticosteroids and antiparasitic drugs, vitreous condensation may persist. The PPV has emerged as a promising diagnostic and therapeutic approach in managing OT, offering improved visual outcomes and resolution of associated complications.[9] This case series presents the clinical characteristics and outcomes of PPV in three pediatric patients diagnosed with OT.

The majority of cases with OT reported are unilateral, possibly due to the migration of a single larva into the eye.[13,14] OT is characterized by focal granuloma of the posterior pole in 25-50% of patients, peripheral granuloma in around 50% of patients, and diffuse endophthalmitis in less than 25% of cases.[15] Diagnosing OT can be challenging, and in most instances, it remains presumptive.[16] The standard diagnosis of human toxocariasis involves the identification of characteristic clinical signs and imaging findings along with the detection of serum antibodies against Toxocara larvae.[17,18] Nonetheless, serum antibodies against Toxocara are not always sensitive or specific for OT and may yield negative results despite the actual presence of Toxocara antigens in the eye.[19] Therefore, analysis of intraocular fluids for Toxocara antibodies can be beneficial in aiding diagnosis.[1] In this study, Case 1 presented challenges in diagnosis due to the presence of a long-standing scarred lesion and surrounding dense vitreous adhesions. This patient's tests for serum anti-Toxoplasma IgM and IgG were positive, followed by a positive result on the serum anti-Toxocara ELISA test. Despite undergoing systemic anti-Toxoplasma treatment, as well as systemic corticosteroid and albendazole therapy, there was no improvement in the findings. Nevertheless, the elevated lesion that became visible after the removal of condensed vitreous during surgery, along with the observation of other lesions using scleral indentation, led us to consider OT for diagnosis. The symptoms in Case 2 and Case 3 had a more recent onset. During the fundus examination of these patients, the lesions observed in the fundus displayed typical characteristics of toxocara granulomas. Both patients tested positive for serum anti-Toxocara ELISA. In addition, as a result of WB analysis of the vitreous samples obtained via PPV, anti-Toxocara antibody was detected in Case 3. Hereby, in all cases exhibiting clinical findings consistent with OT, the diagnoses were reinforced by the detection of antibodies in either the ocular sample or serum.

The primary objective of treating OT is to mitigate the inflammatory response within the eye and prevent the formation of proliferative membranes.[13] Currently, there is no established optimal treatment protocol for OT. Corticosteroids are the mainstay of treatment to control ocular inflammation.[20] While no evidence-based data is demonstrating the efficacy of antihelminthic drugs in parasite eradication, some studies have indicated the safety of these drugs in OT.[2,21,22] On the other hand, the necessity of albendazole treatment in patients with OT is still debated, as live intraocular larvae are rarely found in these patients.[11] Previous reports have documented larval migration in the retina, which can manifest as adjacent or distant lesions.[1,23,24] These findings may indicate that the larvae inside the granulomas are alive. It has been reported that corticosteroid treatment combined with antihelmintic drugs provides less recurrence.[1] Nevertheless, there is also a case report reporting that new lesions developed despite medical treatment.[25] In the presented cases, we preferred the combination of albendazole and corticosteroids for the medical treatment, in collaboration with the PID department. Despite the slight regression in ocular inflammation findings with medical treatment, surgical intervention was planned for the patients as vitreous opacity persisted.

Surgical interventions for the management of OT are typically reserved for postinflammatory complications such as persistent vitreous opacification, retinal detachment, traction bands, and epiretinal membranes.[20] Considering the risk of amblyopia in the pediatric age group due to media opacity and the potential adverse effects of long-term

corticosteroid use, it was deemed necessary to perform PPV. Moreover, it was aimed to remove inflammatory mediators and traction membranes from the eye and to investigate the presence of antibodies by analyzing vitreous samples obtained through PPV. However, there is controversy regarding the choice of surgical procedures during the intervention. One of the critical considerations is whether the granuloma will be excised or left in place. It has been suggested that granulomas left at surgery potentially cause recurrent inflammation.[16] In the case report published by Acar et al.[8], the authors utilized PPV to remove granuloma tissue for diagnostic purposes and obtained OT-related findings in the histopathological examination of the gliotic tissue. On the other hand, efforts to remove a retinal granuloma are often deemed challenging and may result in retinal damage.[7,10,11] Therefore, in this presented study, resection of the granulomas was not carried on.

Examining the peripheral retina using scleral indentation is also an essential aspect to consider when performing vitrectomy. During the surgery, we detected numerous granulomas and the presence of traction bands associated with these lesions in the peripheral retina. The existence of multiple granuloma lesions in the patient's fundus may suggest that the larva has migrated and is alive, as previously noted. In all cases, traction bands around the condensed vitreous over all lesions were meticulously removed. In addition, we also administered barrier laser photocoagulation around the lesions. Whether the larvae responsible for excessive inflammation in OT are presumed to be alive, laser photocoagulation and cryotherapy have been reported in the literature as methods to eliminate migrating larvae in the subretinal space.[24,26] In the presented study, our objective was to conduct barrier laser to prevent the potential development of retinal detachment. Moreover, a peribulbar injection of methylprednisolone acetate was performed to two patients to reduce inflammation. No patient experienced recurrent inflammation or postoperative complications such as retinal detachment throughout the post-surgical period, however further studies with larger sample sizes and longer follow-up periods are definitely necessary to elucidate the effect of surgical procedures.

Improvement in VA after PPV was reported ranging from 50% to 70.4% of OT cases in the literature.[9-11,27,28] Preoperative VA was associated with final VA, and macular involvement may affect the visual prognosis.[9,11,27] In this study presented, an increase in VA was observed in all three cases. None of the presented cases had a granuloma at the posterior pole or a band causing macular traction. Based on previous studies, it is plausible to consider that these factors contribute to visual improvement.

In conclusion, the findings of this study illustrate the improvement in VA, resolution of vitreoretinal traction, and disease stabilization after PPV. These findings are consistent with previous reports highlighting the benefits of surgical intervention in selected cases of OT. Further research is needed to elucidate the long-term efficacy, safety, and prognostic factors associated with PPV in OT, ultimately informing evidence-based guidelines and improving clinical practice.

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Supplementary Materials

Supplementary Video 1. This video shows the pars plana vitrectomy performed in Case 1.

Supplementary Video 1. There was a peripheral granuloma, along with a thickened posterior hyaloid and vigorous vitreous adhesions around this lesion in the inferior peripheral retina. In addition, tight vitreous attachments were observed between this lesion and another temporally located granuloma. During the surgical procedure, it is important to examine the peripheral retina using scleral indentation and to meticulously remove any debris or adhesions from the vitreous. Chronic inflammation, as seen in this case, can lead to the formation of schisis-like areas caused by thinning of the retina, which may then progress to retinal tears.

Supplementary Video 2. This video shows the pars plana vitrectomy performed in Case 2.

Supplementary Video 2. Inflammatory debris resembling a string of pearls were observed along with dense vitreous condensation. Two granulomas were detected in the inferior equatorial retina, with thickened posterior hyaloid and tight vitreous adhesions noted between and around these granulomas. Segmental vasculitis was also observed in the adjacent area. Numerous new granulomas and tight traction bands were present on the examination of the peripheral retina using scleral indentation. The decreased pigmentation of these granulomas in comparison to those in the inferior retina may indicate a more recent formation, potentially occurring after larval migration.

Supplementary Video 3. This video shows the pars plana vitrectomy performed in Case 3.

Supplementary Video 3. There were yellowish-white granulomas and numerous infiltration foci of different sizes noticed in the inferior, inferonasal, and inferotemporal peripheral retina. In addition, a retinal tear was observed posterior to the granulomas located in the inferior retina. Using scleral indentation, the densely adherent vitreous in the entire peripheral retina and the vitreoretinal bands connecting the foci were cleared. Laser treatment was administered around the retinal tear and the required areas.