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Video

Infrared live imaging and navigated laser for nematode photocoagulation in a child with diffuse unilateral subacute neuroretinitis (DUSN)

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ABSTRACT

Purpose: To report the application of an infrared fundus imaging and navigated laser system to photocoagulate a nematode in diffuse unilateral subacute neuroretinitis (DUSN).

Observations: A 14-year-old boy with DUSN was treated with systemic albendazole and corticosteroids. Laser photocoagulation of the visible nematode was performed using a navigated laser in live infrared fundus view (Navilas 577s, OD-OS GmbH, Berlin, Germany). While the localization of the nematode was difficult in regular fundoscopy due to the light-shy helminth, it could be well localized and targeted with the infrared live video mode and navigated laser system. No inflammatory flare-up was observed after the nematode was killed.

Conclusions and Importance: Laser photocoagulation and systemic antihelminthic therapy are an established treatment for DUSN. Infrared imaging and navigated laser systems seem useful in targeting and killing mobile nematodes.

1. Introduction

Diffuse unilateral subacute neuroretinitis (DUSN) is a chorioretinal inflammatory disease caused by helminths that was first described by Gass et al., in 1978.[1] Nematodes migrate through the subretinal space, leading to focal or diffuse alterations of the pigment epithelium, vitritis and retinal vasculitis. DUSN can lead to irreversible visual loss due to retinal and/or optic atrophy.[2] The nematodes are visible in less than half of the patients.[3] In such patients oral albendazole is the mainstay of treatment.[4] However, if the nematodes can be detected in fundoscopy, killing them with laser photocoagulation is an additional option.[3] Visual improvement has been reported for treatment in the early stage of the disease,[5] before irreversible damage has occurred in later stages.[6]

Owing to the mobility of the nematode under light illumination, it may be difficult to identify the nematode in fundoscopy and even more difficult to target it with laser photocoagulation. Driving the living worm away from the macular region into more peripheral areas with targeted lighting before laser photocoagulation of the nematode has been reported.[7] Furthermore, a scanning laser ophthalmoscope (SLO) has been used to visualize nematode worm motility through the use of blue and red laser imaging, allowing for increased patient comfort during imaging. Moraes et al. reported the use of simultaneous SLO imaging and microperimetry stimuli to chase the worm out of the macular region before performing laser photocoagulation.[8]

In this case report, we describe a novel strategy for imaging nematodes using the infrared camera mode and live view of a navigated retinal photocoagulation device that allows targeting of a specific retinal area and compensating for eye movements with its eye-tracking feature.

2. Case report

A 14-year old boy presented to our department with a history of progressive visual loss in his left eye since one and a half years. In the past, he had undergone multiple examinations by various ophthalmologists with extensive workup for chorioretinitis of unclear origin, including extensive laboratory testing and magnetic resonance tomography. The medical history revealed a trip to Thailand four years ago, a history of bilateral squint surgery in early childhood, a treatment course of isotretinoin for acne two years ago and methylphenidate 5 years ago. His best-corrected visual acuity (BCVA) was 25/20 in the right eye and

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20/100 in the affected left eye. Automated 30° perimetry of the left eye showed severe sensitivity loss, with a small residual paracentral island. On clinical fundus examination, the right eye revealed normal findings (Fig. 1A), whereas on the left eye multiple patchy chorioretinal scars with pigment epithelial reactions and only very subtle vitritis were visible (Fig. 1B). The unilateral findings were suggestive of DUSN. Indeed, the nematode was localized in the temporal midperiphery of the fundus images (Clarus 500, Carl Zeiss Meditec AG, Jena, Germany) under high magnification (Fig. 1B and C). Because of its shape and size (approximately 700 μm), we assumed DUSN due to a Toxocara spp. larvae infection. Serology for toxocara spp., gnathostoma and other tissue-invasive helminths were negative. Oral treatment with albendazole 400 mg twice daily for 30 days and concomitant corticosteroid treatment (prednisone tapering with 30 mg/day, i.e. 0.5 mg/kg body weight, for 3 days, 20 mg/day for 3 days, 10 mg/day for 3 days, and 5 mg/day for 5 days), together with pantoprazole 20 mg/day for the same duration) were initiated.

The following day, the nematode was not found in the previous position, but it had moved to a more inferotemporal region. Photocoagulation of the nematode was performed using the infrared camera live mode of a navigated laser system (Navilas 577s, OD-OS GmbH, Berlin, Germany) with a VOLK Area Centralis contact lens for optimized visibility. Visualization using the live infrared light video allowed the identification and targeting of the otherwise light-shy parasite (Fig. 2A). The nematode was identified as a brighter structure against the retinal background and was coagulated using a tight pattern of 4 x 4 spots of 300 μm for 20 ms with 400 mW (Fig. 2B, suppl. Video 1).

Supplementary video related to this article can be found at https://doi.org/10.1016/j.ajoc.2024.102102.

No inflammatory flare-up was observed at the one-week follow-up visit after the laser and initiation of the antihelminthic treatment and throughout the whole follow-up period, presumably due to the additional systemic corticosteroid treatment. At the last follow-up (six months after laser and anti-helminthic/corticosteroid treatment), the vitreal infiltration had completely resolved, and no new chorioretinal lesions or nematodes were found (Fig. 2C and D). BCVA had improved to 20/50.

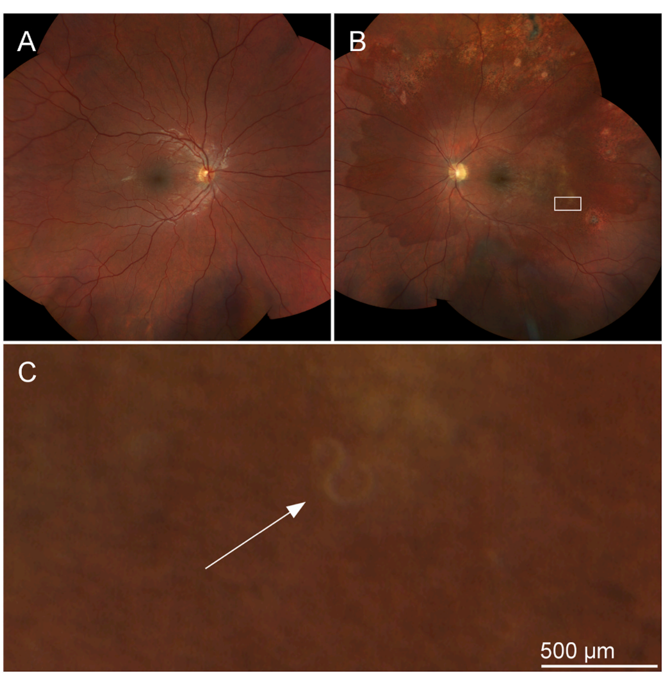

Fig. 1. Ultra-widefield images (Clarus) of the normal right eye (A) and the affected left eye (B) showing multiple chorioretinal lesions with pigment epithelial changes due to diffuse unilateral subacute neuroretinitis (DUSN) with a visible nematode (C, magnification of the rectangular area from B) in the temporal extramacular area.

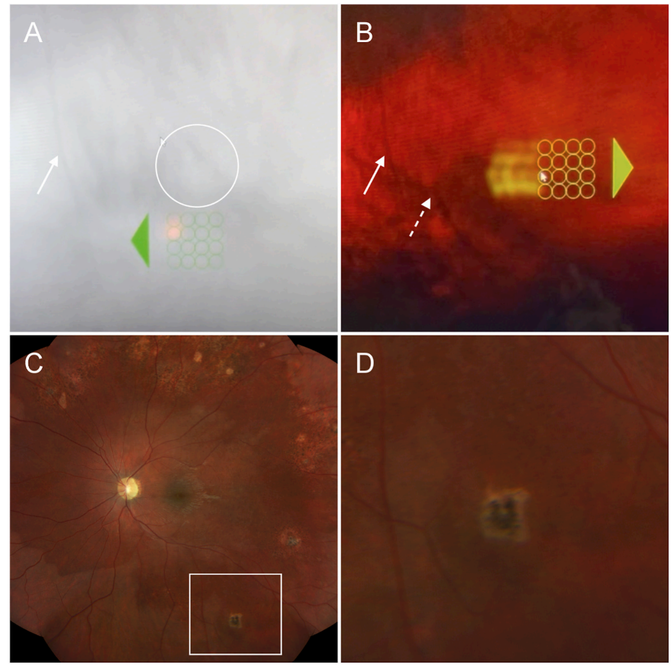

Fig. 2. Infrared live-view still image (A) immediately before laser treatment and flash fundus image immediately after treatment (B). The nematode, which has migrated to a more inferotemporal region since the pictures of Fig. 1 were captured, is encircled and visible as a slightly brighter structure. Localization was based on characteristic vessels (arrow) and a bifurcation (dashed arrow), which were also visible during the laser procedure, but not in the video. Ultra-widefield images (Clarus) at the last follow-up (six months after laser and anti-helminthic/corticosteroid treatment) revealed no new chorioretinal lesions or nematodes (C), but showed the pigmented laser scars (D, i.e., magnification of the rectangular area from C).

3. Discussion

In unilateral chorioretinitis, the spectrum of potential underlying inflammatory and infectious etiologies is broad. DUSN should be actively searched for, including repeated fundus exams and serology for the most common suspected parasites that can infiltrate the posterior segment of the eye (Toxocara canis/catis, Angiostrongylus cantonensis, Gnathostoma spp., Baylisascaris procyonis).[2,7] In our patient, IgE analysis and stool tests were not performed; however, such testing might be considered in patients with suspected DUSN. High-resolution ultra-widefield imaging may be helpful, since worms are small and very motile with a migration speed of up to 1mm/hour, so that they might not be visible at first sight.[10]

In our patient, the worm was initially identified using a Clarus LED-light based fundus camera, which provides high-definition composite ultra-widefield true-color fundus images.

As coagulation of a visible larva cannot exclude further nematodes in the eye or other tissues, we decided to administer concomitant systemic antihelminthic treatment. Optimal systemic treatment has not been established. The successful use of albendazole has been reported for DUSN.[2,4] We chose an albendazole dosage of 400 mg b.i.d. for 30 days which is higher than that in some previous reports for ocular DUSN.[4] Due to its low gastric resorption and in accordance with the treatment recommendations for other organ and tissue infections,[11] especially neurotoxocariasis,[9] we decided on this treatment regimen together with an infectiologist. As inflammatory reactions are common upon treatment, we added a tapering course of systemic corticosteroids.

Here, we present a strategy for the photocoagulation of light-shy nematodes using an infrared light video and laser navigation system in a young patient with DUSN. The procedure allowed a precise and painless treatment with enough time to localize the nematode worm, avoiding its migration away from the illumination field, as with conventional laser systems with fundoscopy based on the visible light spectrum.

4. Conclusion

Modern ultra-widefield and high-resolution imaging technology is helpful in allowing meticulous fundus examination to search for small and motile nematode larvae. Similarly, infrared live imaging and navigated laser for nematode photocoagulation is a helpful tool to provide more targeted laser application and greater patient comfort, especially in children.

Patient consent

The minor patient and his parent as legal guardian consented to publication of the case in writing.

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Authorship

All authors attest that they meet the current ICMJE criteria for authorship.

CRediT authorship contribution statement

Christof Hänsli: Writing – review & editing, Writing – original draft, Supervision, Software, Resources, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Cornelia Staehelin:** Writing – review & editing, Investigation. **Alexandra Bograd:** Writing – review & editing. **Christoph Tappeiner:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors have no financial disclosures.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.ajoc.2024.102102.

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