Navigated 577-nm subthreshold micropulse retinal laser treatment for peripapillary pachychoroid syndrome

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ABSTRACT

Purpose: To report a case of peripapillary pachychoroid syndrome (PPS) successfully treated with navigated subthreshold micropulse laser (SML).

Observations: A 65-year-old male was referred to our retina service complaining a worsening vision in the left eye (LE) over the past 6 months. A complete ophthalmological evaluation including best corrected visual acuity (BCVA) measurement, spectral-domain optical coherence tomography (SD-OCT) and fluorescein angiography (FA) was performed. SD-OCT showed a thicker nasal choroid and peripapillary intraretinal cysts in both eyes, and macular subretinal fluid (SRF) in the LE. FA illustrated a bilateral peripapillary hyperfluorescent areas, with some macular focal leaking points in the left eye. A diagnosis of PPS was made, and considering the worldwide shortage of verteporfin, Navigated 577-nm SML was performed in the LE on the leaking areas shown on the FA. At the 3- and 6-months follow-up the SRF reabsorbed and BCVA improved from 20/32 to 20/20.

Conclusions and importance: SML can be considered an efficacious treatment option in patients with PPS. Prospective studies with longer follow-up in a bigger cohort are needed to confirm the optimal treatment strategy in PPS.

1. Introduction

Peripapillary pachychoroid syndrome (PPS) was recently described as a distinct variant of the pachychoroid disease spectrum (PDS) disorders.1

It typically affects elderly male patients, and it is characterized by peripapillary choroidal thickening associated with nasal macular intraretinal fluid (IRF) and/or subretinal fluid (SRF). Choroidal folds and optic disc edema can also be present.2

Choroidal changes are thought to be underlying the pathogenesis of PDS, and dilated peripapillary pachyvessels along with mottled choroidal hyperpermeability are typical features of PPS.2

Several treatment options have been proposed including observation, photodynamic therapy (PDT), focal macular laser treatment, anti-vascular endothelial growth factor (VEGF), oral or topical carbonic anhydrase inhibitors, topical and intravitreal steroids.3,4 Nevertheless, to date there is no evidence regarding the optimal clinical management and treatment for this distinct phenotype within PDS.

We hereby present a case of PPS successfully treated with navigated subthreshold micropulse laser (SML).

2. Case presentation

A 65-year-old male was referred to our retina service at Eye Clinic University of Campania, complaining of worsening vision in the left eye (LE) over the past 6 months. A complete ophthalmological evaluation was carried out. Best corrected visual acuity (BCVA) was 20/20 in the right eye (RE) and 20/32 in the LE. Anterior segment evaluation was unremarkable in both eyes and intraocular pressure was within normal limits (<20 mmHg). Fundus examination under mydriasis revealed mild pigmentary changes at the posterior pole in both eyes (Fig. 1A and C). Swept source-optical coherence tomography (SS-OCT, DRI OCT Triton, Topcon Medical System Oakland, New Jersey, USA) radial Bscan disclosed a bilateral thicker nasal choroid along with intraretinal peripapillary cystoid spaces in both eyes, and a macular neurosensory retinal detachment in the LE (Fig. 1B and D). Optical coherence tomography angiography (OCTA, SS-OCTA, DRI OCT Triton, Topcon Medical System Oakland, New Jersey, USA) confirmed the absence of
any pathological vascular network in both eyes at the level of the choriocapillaris slab (Fig. 2 A and B). Fundus autofluorescence (DRI OCT Triton, Topcon Medical System Oakland, New Jersey, USA) illustrated bilateral mottled hyperautofluorescence of the retinal pigment epithelium (RPE) in the peripapillary region (Fig. 3 A and B) and early and mid-phase fluorescein angiography (FA, FF 450 plus Zeiss, Dublin, USA) further confirmed areas of peripapillary hyperfluorescence with some perimacular focal leakage points LE>RE (Fig. 3 C–F).

Based on the clinical picture a diagnosis of PPS was made in both eyes but only the LE where the macular subretinal fluid was associated with visual loss was selected for the treatment. Considering the worldwide shortage of verteporfin, Navigated 577-nm SML was performed on the leaking areas temporal to the optic disc shown on the FA (yellow circles, Fig. 3 F). Using a power of 300 mW and 200 ms duration, 562 no-spacing 100 μm diameter spots were delivered with microsecond pulsing treatment 5% duty cycle.

At the three months follow-up visit, BCVA improved to 20/25 and tracked spectral-domain (SD)-OCT B-scan acquired with enhanced-depth imaging modality (Spectralis OCT; Heidelberg Engineering) revealed a partial resolution of the subfoveal SRF whereas intraretinal cystoid spaces were still present (Fig. 4 A and B). At the six-month follow-up visit BCVA further improved to 20/20 and there was no macular neurosensory retinal detachment (Fig. 4 C). As expected, the yellow SML treatment did not cause any retinal scar detectable on either colour picture or FAF images (Fig. 5 A and B).

3. Discussion and conclusion

To the best of our knowledge this is the first report to evaluate the efficacy of navigated 577-nm yellow SML in a patient with PPS. This distinct phenotype within the PDS can present with variable severity. Some cases with only mild peripapillary IRF/SRF and without foveal involvement can be incidentally diagnosed, while others may be characterized by a significant visual loss due to the chronic SRF accumulation in the subretinal foveal space.\(^1\)

The peripapillary predilection associated with a nasal thicker choroid, and the peripapillary IRF/SRF distinguish PPS from typical central serous chorioretinopathy (CSC).\(^5\) Both PDS disorders are characterized by a dysfunctional pachychoroid, which results in a fluid accumulation under the subretinal space.

PDT has been proved to be the most effective treatment strategy in patients with chronic CSC.\(^5\) Moreover, results from the PLACE trial suggest that half-dose PDT is superior to high-density SML in patients with chronic CSC.\(^5\) Xu and coauthors analyzed the long-term anatomic
Fig. 3. Baseline fundus autofluorescence (FAF) and fluorescein angiography (FA) evaluation. (A and B) FAF images illustrate mottled hyperautofluorescence of the retinal pigment epithelium (RPE) in the peripapillary and perimacular regions. (C–F) Early (30\degree) and mid (50\degree) phases FA show scattered RPE window defects with peripapillary hyperfluorescence ring with late leakage in both eyes. The yellow circles (F) indicate the leaking areas where the laser spots were delivered.
and visual outcomes in patients with PPS, showing that the overall visual function was relatively favorable over time. Several treatment strategies were investigated including focal laser, PDT and anti-VEGF, oral or topical carbonic anhydrase inhibitors.

Iovino et al. further confirmed PDT as a valuable treatment option in patients with PPS, reporting a treatment success in 64% of cases.

PDT is believed to induce a remodelling of the choroidal vascular endothelium due to the formation of free radicals after photoactivation, causing a shrinking and reduction of the total choroidal volume. On the other hand, therapeutic benefit of the micropulse laser is thought to be derived by inducing thermal stress on RPE cells, avoiding any direct thermal damage to the retinal tissues. The 577 nm yellow wavelength maintains a negligible uptake by macular xanthophyll and has the highest absorption rate for oxyhemoglobin to melanin absorption ratio, and therefore it is less scattered compared to conventional 532 nm laser.

Additionally, the Navilas® laser system uses a digital imaging concept that allows a computer-assisted application of the laser, thus limiting the risk of overlapping spots.

Due to the worldwide shortage of verteporfin we opted for a Navigated 577-nm SML treatment. As demonstrated, we had a complete resolution of the foveal SRF associated with an improvement of the BCVA at 3 and 6-month follow up.

Considering that chronic disease causes permanent retinal damage with associated RPE atrophy, we decided to treat the patient although the visual acuity was relatively good. In conclusion, navigated SML can be considered a valuable treatment option in patients with PPS and foveal SRF. Nevertheless, prospective studies with longer follow-up and a bigger cohort are needed to further confirm the efficacy and safety of this relatively novel treatment strategy.

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Authorship

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

Declaration of competing interest

The authors declare no competing interests.

Fig. 4. Spectral-domain optical coherence tomography angiography (SD-OCT) evaluation of the left eye before and after treatment. (A) Baseline SD-OCT Bscan (white line on near infrared) of the left eye with enhanced-depth imaging mode illustrates the macular subretinal fluid (SRF) and peripapillary intraretinal cysts. (B) At the 3-month follow-up visit, tracked SD-OCT Bscan shows a complete reabsorption of the foveal subretinal fluid and a persistence of a shallow nasal SRF and intraretinal cysts. (C) At the 6-month follow-up visit, tracked SD-OCT Bscan illustrates a complete resolution of the neurosensory retinal detachment with persistent peripapillary intraretinal cysts.

Fig. 5. Six-month follow-up colour and fundus autofluorescence (FAF) images of the left eye. (A) Left eye colour picture shows pigmentary changes in the peripapillary area and along the temporal superior and inferior vascular arcades with no differences compared to the baseline imaging. No traces of laser induced scars are visible. (B) FAF image illustrates an increased hyperautofluorescence of the retinal pigment epithelium in the perimacular region due to the reabsorption of the subretinal fluid. No traces of laser induced scars are visible. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)
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