



Perfused Central Retinal Vein Occlusion in the Setting of Intense Exercise and Dehydration

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Introduction

Perfused or nonischemic central retinal vein occlusion (CRVO) presents with retinal venous dilation in all four quadrants, disc edema, and scattered intraretinal hemorrhage visible on fundoscopy.¹ Nonischemic CRVO features mildly blurred vision, while ischemic CRVO features markedly decreased visual acuity along with extensive retinal capillary non-perfusion.² While CRVO primarily affects older individuals, patients under 50 years old account for approximately 10-15% of CRVO cases.³ Classic atherosclerotic risk factors, such as hyperlipidemia, hypertension, and diabetes, may be present in younger patients; however, several non-traditional risk factors are more likely present, including glaucoma, hyperviscosity or hypercoagulability syndromes, and oral contraceptive use.^{4,5} Although instances of nonischemic and ischemic CRVO due to intense exercise have been reported,⁶⁻¹⁴ it is important to keep this observed association in the differential diagnosis of causes of CRVO.

Spontaneous resolution of CRVO in younger individuals without systemic steroid administration is infrequently reported. In one case of a 25-year-old runner with vision loss due to nonischemic CRVO in the setting of oral contraceptive use, the observed disc edema and retinal venous tortuosity resolved within two months after discontinuing oral contraceptives and refraining from long-distance running.¹⁰ In a series by Rouhani et al., five younger patients had spontaneous reversal of nonischemic CRVO within a few months following onset.¹³

We report a case of prompt spontaneous improvement of a mild, nonperfused CRVO that developed in one eye of a young healthy woman during excessive exercise and relative dehydration and no other risk factors.

Case Report

A 38-year-old otherwise healthy female presented following two distinct episodes of photopsias and blurred vision in both eyes, more pronounced in the left eye. Each bilateral episode lasting approximately 1-2 hours.

She first noticed these symptoms during a 50-minute high-intensity interval training (HIIT) workout class that included a combination of running and weightlifting, with no improvement following conclusion of the exercise class. On exam, best-corrected visual acuity (BCVA) was 20/20 in each eye. Intraocular pressure was 13 mmHg in the right eye and 14 mmHg in the left eye. Dilated fundus examination was normal in the right eye but showed marked venous tortuosity and scattered intraretinal hemorrhage in the left eye (Figures 1A,B). Optical coherence tomography (OCT) showed disorganization of the inner and outer retinal layers in the papillomacular bundle of the left eye without macular edema (Figure 1C). Fluorescein angiography (FA) revealed no delayed filling, no ischemia, and no neovascularization (Figure 1B).

She had no personal or family history of glaucoma, hypertension, hyperlipidemia, diabetes, hypercoagulable disorders, and no medication history of oral contraceptive or anabolic hormone use. The events occurred during the summer months, when excessive exercise and relative dehydration combined with warm weather conditions may have contributed to the transient vascular compromise. A diagnosis of mild perfused CRVO in the left eye without macular edema was made.^{1,2,15}

Given the patient's relatively younger age and the atypical presentation of CRVO in this population, an extensive workup was initiated, and she was referred to the emergency department for further evaluation and rehydration. However, she opted out of a visit to the emergency department. The outpatient diagnostic workup included screening for syphilis and HIV, given their ability to mimic a wide range of ocular diseases. Additional evaluation included chest radiography and vascular imaging of the head and neck. Follow-up with her primary care physician was recommended, including a complete blood count (CBC) with differential to assess potential hypercoagulable states. She was advised to increase oral hydration and pause strenuous exercise.

Laboratory testing revealed a slightly decreased activated partial thromboplastin time, with an otherwise unremarkable CBC. Testing for syphilis, HIV, and tuberculosis was negative. Protein C and protein S levels, PT/PTT, antithrombin III, thyroid-stimulating hormone, and antinuclear antibodies were within normal limits. Imaging studies, including chest X-ray and MRI of the head and orbits, showed no evidence of acute intraorbital or intracranial pathology. Chest radiography and vascular imaging was also normal.

One month later, the venous tortuosity and intraretinal hemorrhage (Figure 2A) in the left eye improved, while the right eye remained stable. The BCVA remained 20/20 and IOP was 16 mmHg in each eye. Ten months later, the venous tortuosity had completely resolved with no residual symptoms (Figures 2B,C). The BCVA remained 20/20 and IOP was 14 mmHg in both eyes. Repeat FA was not performed. The patient resumed her exercise routine while remaining mindful of proper hydration. Her symptoms did not recur.

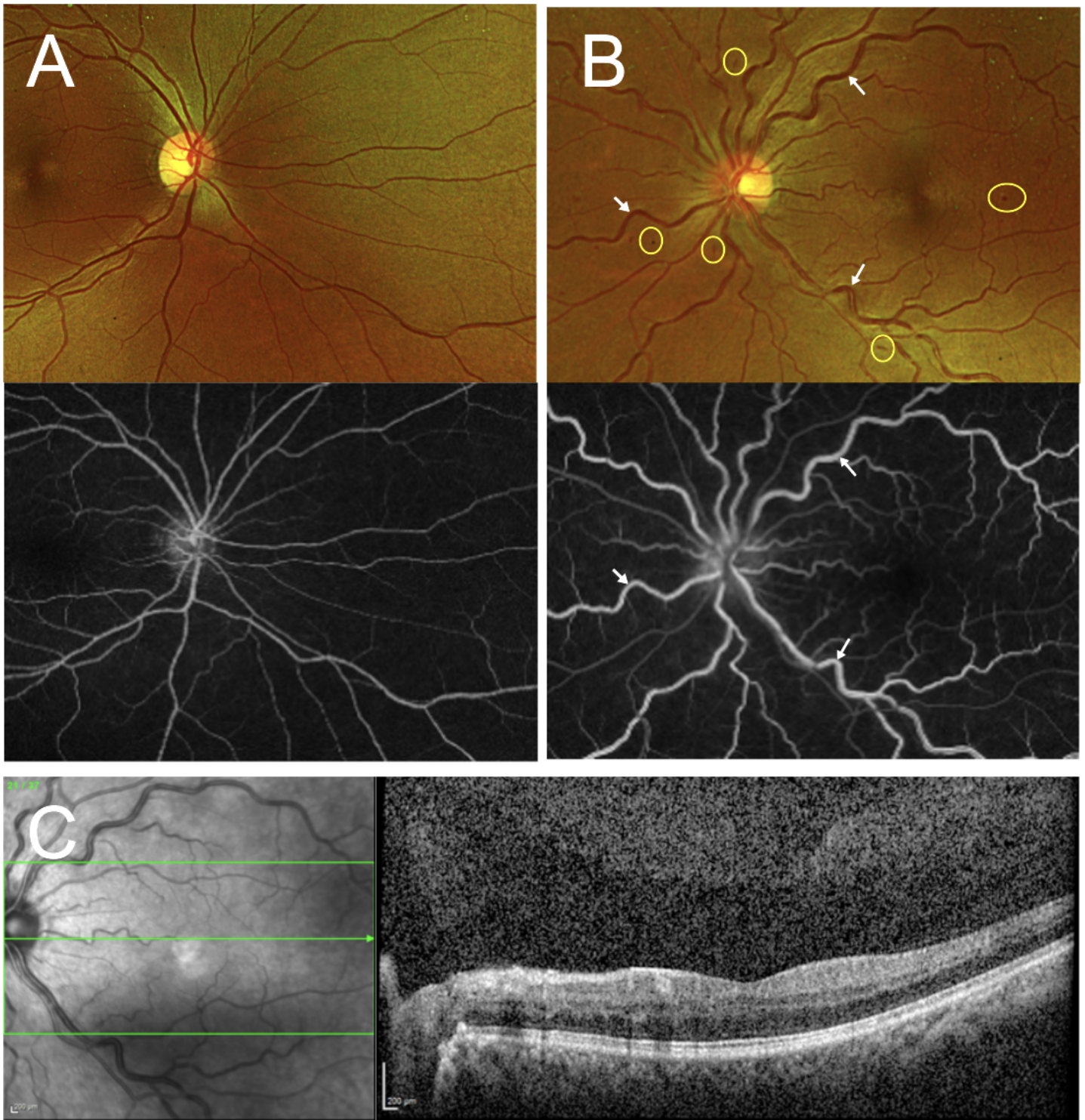


Figure 1. Tortuous and engorged retinal veins were present in the left eye with scattered intraretinal hemorrhage and outer retinal changes, including small peripapillary pigment epithelial detachment and some mottling, following intense exercise. A. Fundus image and fluorescein angiography of the normal right eye. B. Fundus image and fluorescein angiography of the left eye, with arrows pointing to retinal venous tortuosity and yellow circles denoting scattered intraretinal hemorrhage. C. Horizontal optical coherence tomography image of the

macula of the left eye demonstrates disorganization of the retinal layers and thickening of the peripapillary retinal nerve fiber layer without macular edema.

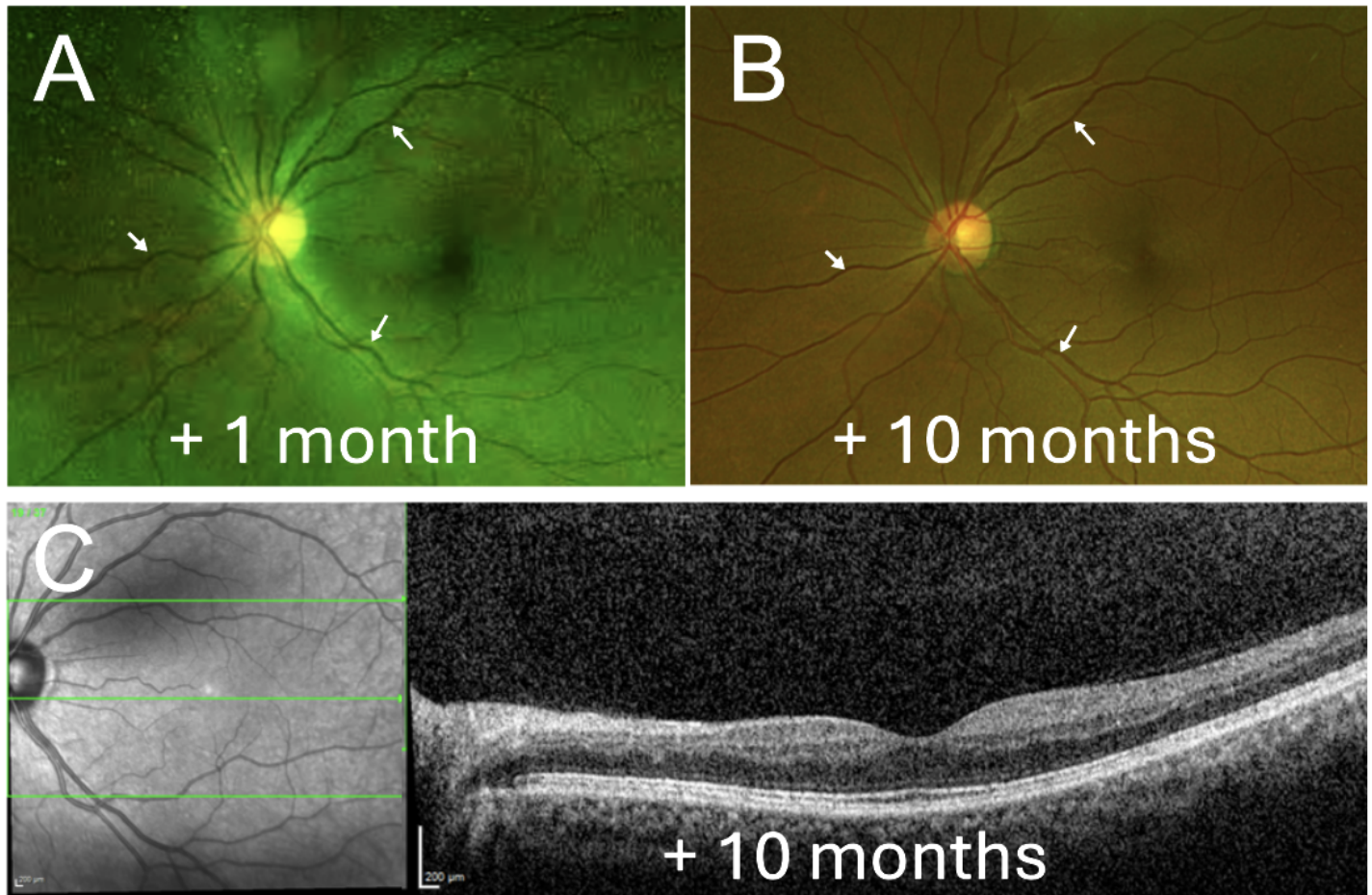


Figure 2. One and 10 months after presentation, there was clear improvement in the venous tortuosity and intraretinal hemorrhage in the left eye. A. At one month, there was significant resolution of fundus findings, with arrows pointing to improved retinal venous tortuosity. B. At ten months, there was complete resolution of the retinal venous tortuosity (arrows). C. The optical coherence tomography images demonstrate improved organization of the peripapillary and parafoveal retinal layers.

Discussion

We present a case of an otherwise healthy 38-year-old female who developed a mild perfused CRVO, likely triggered by dehydration and excessive physical exertion, that improved spontaneously following oral rehydration and pausing HIIT. She had no other risk factors.

A limited number of published studies have reported that intense exercise and associated dehydration can contribute to the development of a CRVO in younger patients.^{3,5,7,11,17,18} CRVO in younger adults may spontaneously resolve over time with a much more favorable visual outcome than older adults.¹¹

Intense physical activity may contribute to dehydration, which increases blood viscosity, stagnates blood flow, and increases erythrocyte aggregability. When an individual is dehydrated, hematocrit levels and platelet counts may increase, resulting in hyperviscosity and susceptibility to venous stasis and thrombosis including in the central retinal vein.^{11,16} The mild perfused CRVO and associated retinal venous tortuosity and intraretinal hemorrhage that developed in our patient may have developed due to the hyperviscous state that occurred during HIIT. Lack of marked laboratory abnormalities in our patient may have allowed prompt resolution without pharmacotherapy following oral rehydration and refraining from further exercise.

Conclusion

This case highlights the development of a mild perfused CRVO in a younger female during intense exercise in a HIIT class and associated relative dehydration. There were no other known other risk factors for CRVO in this woman. Excessive physical exertion and dehydration, particularly during the summer months, may be a modifiable risk factor to decrease the incidence of CRVO in young adults.

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Statement of Ethics

This case report adheres to patient confidentiality and ethical principles in accordance with the guidelines of the Declaration of Helsinki and relevant local regulations. Consent was obtained from the patient for the publication of this case report.

Conflict of Interest Statement

The authors declare no conflicts of interest related to this topic.

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