

Central retinal artery occlusion, a non-negligible thrombotic ocular complication of pediatric venoarterial extracorporeal membrane oxygenation: a case report

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Dear Editor,

Central retinal artery occlusion (CRAO) is an acute ophthalmic emergency, characterized by sudden vision loss due to retinal ischemia in areas corresponding to arterial occlusion sites. Diagnosis primarily relies on fundus fluorescein angiography (FFA) and optical coherence tomography (OCT), which show delayed retinal artery filling time hours to days after occlusion and increased hyperreflectivity of the inner retina. Mechanistically, obstruction at any location from the common carotid artery to intraretinal arterioles can induce corresponding zone ischemia. Emboli can be found in the retinal artery system in 20%-40% of CRAO eyes, while most acute cases are secondary to embolism of the internal carotid, aortic arch or heart^[1].

CRAO constitutes a leading cause of acute blindness in ophthalmic pathologies, demonstrating significantly higher prevalence among middle-aged and elderly male populations with systemic vascular comorbidities. In the past five years, epidemiological studies from Germany, Korea, Japan and other places have shown that the incidence of CRAO is much higher in people over 50 years old, and the incidence

rate exponentially increased with age^[2]. However, CRAO in pediatric populations remains exceptionally rare, with no documented cases linked to venoarterial extracorporeal membrane oxygenation (VA-ECMO) therapy in children reported to date. This case report highlights that we clinicians should maintain vigilance for CRAO development in pediatric patients post-VA-ECMO, taking preventive measures to mitigate irreversible vision loss and ultimately improve clinical outcomes if necessary.

CASE PRESENTATION

CRAO is a critical ophthalmic emergency characterized by acute-onset and painless vision loss resulting from ischemic infarction of the inner retinal layers. Most cases occur in middle-aged and elderly people, predominantly caused by thrombus originating from the proximal vasculature and cardiac vessels^[3]. In this report, we present a case of CRAO complicated by venoarterial extracorporeal membrane VA-ECMO support.

Ethical Approval This study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from the patient's parents.

A 6-year-old girl presented with cardiogenic shock caused by fulminant acute myocarditis. She received VA-ECMO support *via* right internal carotid artery cannulation. Sixteen days after VA-ECMO treatment, the patient presented with monocular vision loss. Ophthalmic examination revealed no light perception in her right eye. Fundus photography (FP) showed extremely narrowed retinal arteries, retinal edema, and cherry red spot in the macular (Figure 1A). OCT confirmed the inner retinal edema which suggested infarction (Figure 1B). Magnetic resonance imaging (MRI) demonstrated left basal ganglia infarction with hemorrhage (Figure 1C). VA-ECMO related CRAO and intracerebral bleeding were considered and prompt ocular massage, anterior chamber paracentesis, as well as sublingual nitroglycerin were administered. After 2mo, FP and OCT revealed retinal edema regression, optic nerve pallor, and inner retina atrophy (Figure 2A, 2B). Partial absorption of intracerebral hemorrhage was observed in MRI (Figure 2C). Regrettably, the patient's vision had no improvement.

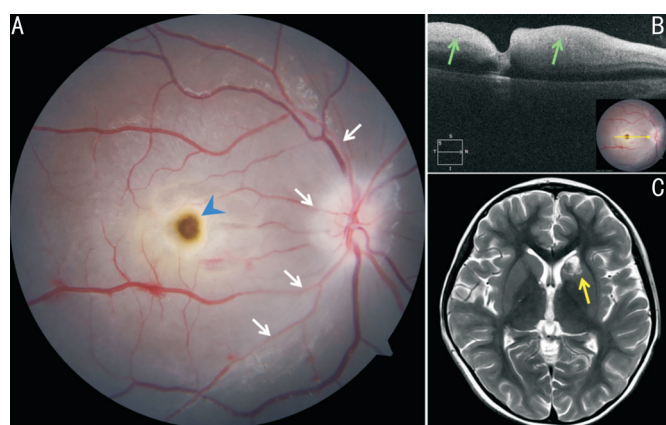


Figure 1 FP (A), OCT (B) and cranial MRI (C) results after the deterioration of the patient's eyesight A: The white arrow pointed to the extremely narrowed retinal arteries diffuse retinal whitening, and the blue one pointed to cherry red spot in the macular of FP image; B: The green arrow pointed to retinal edema near the optic disk in OCT; C: The yellow arrow pointed to the infarction area within the brain parenchyma. FP: Fundus photography; OCT: Optical coherence tomography; MRI: Magnetic resonance imaging.

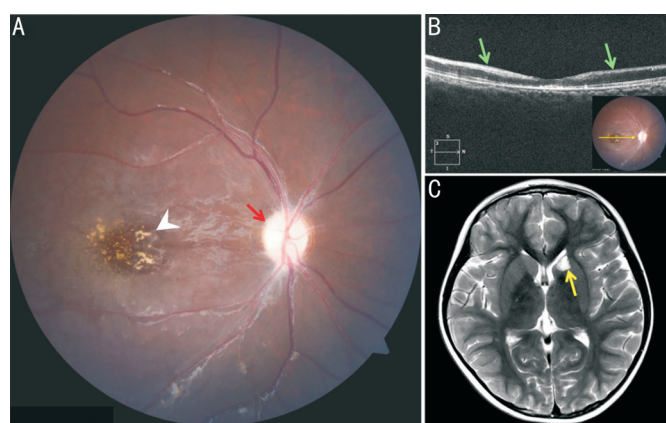


Figure 2 FP (A), OCT (B) and cranial MRI (C) results after 2-month treatment A: The red arrow pointed to the pale optic disk and the white one pointed to the fading cherry erythema; B: The green arrow pointed to the regression of the retinal edema; C: The yellow arrow showed partial resorption of the cerebral hemorrhage. FP: Fundus photography; OCT: Optical coherence tomography; MRI: Magnetic resonance imaging.

DISCUSSION

CRAO is an anatomical subtype of arterial occlusions of the retina. The severity of visual loss in the arterial occlusions of the retina is pathophysiologically determined by the diameter of the obstructed vessel, the duration of occlusion and the location of the artery involved^[4]. CRAO represents a critical vascular insult to the retinal circulation, defined by abrupt cessation of arterial blood flow that precipitates hypoperfusion-induced infarction of retina tissue, typically manifesting as profound irreversible monocular visual deficit^[1-2,5]. The elevated thrombotic risk in middle-aged and elderly populations stems from age-related pathophysiological alterations in vascular

structure and hemorheological profiles^[6]. Several diseases such as systemic arterial hypertension, diabetes mellitus and open angle glaucoma may result in abnormalities in blood clotting or blood viscosity with advanced age acting as a critical risk amplifier for these conditions^[7-9].

The central retinal artery is the first branch of the ophthalmic artery, which is the first branch of the internal carotid artery. This structure anatomically suggests a potential risk of CRAO in patients undergoing VA-ECMO *via* internal carotid artery cannulation^[10-11]. Although ophthalmic artery is an important branch of internal carotid artery, no serious ECMO-related thrombotic ocular complications has been reported previously^[12].

Pediatric VA-ECMO usually occurs through internal carotid artery cannulation. However, clinical reports of CRAO complications post-VA-ECMO in pediatric cases remain exceptionally rare^[13]. Inadequate anticoagulation predisposes VA-ECMO patients to the concomitant development of bleeding and thrombosis, which collectively represent the most frequent complications^[14]. Multiple studies have shown nearly 50% rates of intracranial hemorrhage or infarction in adults who have received VA-ECMO^[14]. Totally 16% of these patients with neurologic events had received VA-ECMO for refractory cardiac arrest, a condition that is more prone to neurologic complications which is similar to the pediatric patient in this report^[14]. Pediatric vasculature exhibits significantly underdeveloped structural and functional maturity compared to adult counterparts. Narrower vessel diameter and weaker physiological regulatory capacity increase the possibility of embolic complications after VA-ECMO. Prophylactic strategies should account for this dual vulnerability-structural confinement plus regulatory insufficiency - through personalized anticoagulation protocols in clinical practice. Importantly, our case gives a warning that pediatric VA-ECMO may lead to CRAO and irreversible visual loss, which deserves more attention of both critical care doctors and ophthalmologists.

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Conflicts of Interest: Zhang ZB, None; Zhang X, None; Yang H, None; Chen B, None.

REFERENCES

- 1 Scott IU, Campochiaro PA, Newman NJ, *et al.* Retinal vascular occlusions. *Lancet* 2020;396(10266):1927-1940.
- 2 Mac Grory B, Schrag M, Bioussé V, *et al.* Management of central retinal artery occlusion: a scientific statement from the American heart association. *Stroke* 2021;52(6):e282-e294.
- 3 Hayreh S. Central retinal artery occlusion. *Indian J Ophthalmol* 2018;66(12):1684.

- 4 Daxer B, Radner W, Fischer F, *et al.* Aetiology, diagnosis and treatment of arterial occlusions of the retina-a narrative review. *Medicina (Kaunas)* 2024;60(4):526.
- 5 Bowling B. *Kanski's Clinical Ophthalmology, A Systematic Approach*. 8th ed. Elsevier; Sydney, Australia. 2016:549-556.
- 6 Manderstedt E, Lind-Halldén C, Halldén C, *et al.* SERPINH1 variants and thrombotic risk among middle-aged and older adults: a population-based cohort study. *J Thromb Haemost* 2024;22(3): 869-873.
- 7 Bucciarelli P, Passamonti SM, Gianniello F, *et al.* Thrombophilic and cardiovascular risk factors for retinal vein occlusion. *Eur J Intern Med* 2017;44:44-48.
- 8 Li D, Zhou M, Peng X, *et al.* Homocysteine, methylenetetrahydrofolate reductase C677T polymorphism, and risk of retinal vein occlusion: an updated meta-analysis. *BMC Ophthalmol* 2014;14:147.
- 9 Dong N, Xu B, Tang X. Plasma homocysteine concentrations in acute and convalescent changes of central retinal vein occlusion in a Chinese population. *Invest Ophthalmol Vis Sci* 2014;55(7):4057-4062.
- 10 Mazzeo TJMM, Freire RCM, Filho LF, *et al.* Central retinal artery occlusion secondary to presumed traumatic carotid artery dissection in a healthy child. *Int J Retina Vitreous* 2022;8(1):56.
- 11 Zhu LB, Xu N, Li Y. Monocular central retinal artery occlusion caused by bilateral internal carotid artery hypoplasia complicated with patent foramen ovale: a case report and review of literature. *Eur J Med Res* 2021;26(1):55.
- 12 Thiagarajan RR, Barbaro RP, Rycus PT, *et al.* Extracorporeal life support organization registry international report 2016. *ASAIO J* 2017;63(1):60-67.
- 13 Bao YG, Li XB, Wang KX, *et al.* Central retinal artery occlusion and cerebral infarction associated with Mycoplasma pneumonia infection in children. *BMC Pediatr* 2016;16(1):210.
- 14 le Gall A, Follin A, Cholley B, *et al.* Veno-arterial-ECMO in the intensive care unit: From technical aspects to clinical practice. *Anaesth Crit Care Pain Med* 2018;37(3):259-268.