

Reversibility of retinal ischemia due to central retinal artery occlusion by hyperbaric oxygen

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Purpose: Ischemic retinal damage can be reversed by hyperbaric oxygen therapy (HBOT) as long as irreversible infarction damage has not developed. However, the time window till irreversible damage develops is still unknown. The study aim was to evaluate the effect of HBOT and determine possible markers for irreversible retinal damage.

Materials and methods: Retrospective analysis of 225 patients treated with HBOT for central retinal artery occlusion (CRAO) in 1999–2015. One hundred and twenty-eight patients fulfilled inclusion/exclusion criteria: age >18 years, symptoms <20 hours, and best-corrected visual acuity (BCVA) <0.5 logMAR.

Results: Time delay from symptoms to treatment was 7.8 ± 3.8 hours. The BCVA was significantly improved after HBOT, from 2.14 ± 0.50 to 1.61 ± 0.78 ($P < 0.0001$). The proportion of patients with clinically meaningful visual improvement was significantly higher in patients without cherry-red spot (CRS) compared to patients with CRS at presentation (86.0% vs 57.6%, $P < 0.0001$). The percentage of patients with final BCVA better than 1.0 was also significantly higher in patients without CRS vs patients with CRS at presentation (61.0% vs 7.1%, $P < 0.0001$). There was no correlation between CRS and the time from symptoms. HBOT was found to be safe, and only 5.5% of patients had minor, reversible, adverse events.

Conclusion: HBOT is an effective treatment for non-arteritic CRAO as long as CRS has not formed. The fundus findings, rather than the time delay, should be used as a marker for irreversible damage.

Keywords: HBOT, hyperbaric oxygen, central retinal artery occlusion, cherry-red spot, CRAO, retinal ischemia

Introduction

Central retinal artery occlusion (CRAO) is a serious, relatively common, ophthalmologic condition with a poor prognosis. The incidence of acute CRAO is estimated at 8.5 in 100,000 people.¹ The natural history of the disease is devastating, with 92% of patients left with poor visual acuity of counting fingers or less, and only 8% may experience improvement.^{2–4}

The retina is the organ that has the highest oxygen consumption rate per size in the human body, utilizing 13 mL/100 g/min, and is therefore very sensitive to ischemia. Animal studies have shown total retinal ischemia, or anoxia, can be fully reversed if the retina is reoxygenized within 97 minutes of onset.⁵ As opposed to animal models, in humans, there is no clear timeline until irreversible anoxic retinal damage occurs. Some authors suggest elapsed time of around 6–6.5 hours⁶ but due to the large variability between patients, types of occlusion, and residual perfusion, this time frame is not reliable and thus another biologically based marker is needed.

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