CASE REPORT

The efficacy of hyperbaric oxygen therapy in the treatment of central retinal artery occlusion

Andreia Soares, Nuno L Gomes, Luís Mendonça, Carla Ferreira

SUMMARY

Central retinal artery occlusion (CRAO) is an ophthalmological emergency. Various treatment modalities have been tried, but none have shown to alter natural history of the disease. Hyperoxia can restore retinal oxygenation, and favourable results were obtained with hyperbaric oxygen therapy (HBOT).

CASE PRESENTATION

We report two patients with sudden visual loss due to CRAO treated with HBOT. Case 1: a 61-year-old female, presented with CRAO in her left eye (OS). She was submitted to eight sessions of HBOT (2.4 atmosphere absolute (ATA)). BCVA (Best corrected visual acuity) improved from counting fingers (CF) to 1.0.

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CASE PRESENTATION

We report two patients with sudden visual loss due to CRAO treated with HBOT. Case 1: the patient was referred to the Hyperbaric Medical Unit of Hospital Pedro Hispano, and was submitted to the first session of hyperbaric treatment at 2.4 ATA (atmosphere absolute) oxygen (100%), during 90 min, in a gas chamber. The first session was done 6 hours after the onset of symptoms. She was submitted to two additional daily sessions of 90 min, on each one of the next 3 days, and one additional session on the fifth day.
Novel treatment (new drug/intervention; established drug/procedure in new situation)

Case 2: ocular massage was performed and topical antihypertensive medication was prescribed. Immediate referral to the HBO centre was undertaken. The first HBOT session was performed 4 hours after the onset of the symptoms, in a gas chamber of the Hyperbaric Medical Unit of Hospital Pedro Hispano, at 2.4 ATA oxygen (100%). Two additional daily sessions (90 min) were prescribed in the next 2 days, followed by only one daily session for the next 5 days.

OUTCOME AND FOLLOW-UP

Case 1: patient was checked for any other disease which could cause vascular occlusion, and we found a value of 8.8% for HbA1c in laboratory tests, and the presence of ventricular extrasystoles on Holter (figure 3).

Three days after starting HBOT, BCVA OS improved to 1.0. Seven weeks after the initial visit, FA was repeated and showed normal fluorescein filling of the central retinal artery (figure 4). OCT was done in each one of the 3 days after the diagnosis, and was repeated after the 9th and 37th days (figure 1B). The thickness of the inner retina started to reduce on the third day after the diagnosis, and stabilised since the ninth day.

Case 2: patient was checked for any other disease which could cause vascular occlusion, laboratory examination showed hyperglycaemia and hyperkalaemia. The carotid echo-Doppler demonstrated atheromatous carotid disease, without significant dynamic repercussion, and echocardiogram found an enlargement of left auricle and hypertrophy of left ventricle, with mild aortic insufficiency.

Thirteen days after the initiation of therapy, the visual acuity of the left eye improved to 0.8. Ten days after the initial visit, control FA showed improvement in fluorescein filling of the central retinal artery (time arm-retina, 23 s). OCT was done in each one of the 3 days after the symptoms, 1 and 2 months after. The thickness of inner retina started to reduce in the 10th day and stabilised on the 14th day.

DISCUSSION

HBOT is a treatment modality that can be used in many ocular pathologies. With hyperbaric oxygenation, oxygen can reach both inner and outer retinal layers retina by the choroid. An early administration of HBOT is extremely necessary to prevent irreversible damage to the retina.1–4 The administration of supplemental oxygen in the treatment of CRAO must be continued until flow through the retinal artery has resumed to a level sufficient to maintain inner retinal viability under normoxic conditions.1 Ideally, the shorter the time delay until treatment, the better the likelihood of recovering ischaemic retina that is threatened but viable.1

In the clinical setting of CRAO, however, some residual retinal blood flow has been detected by angiography. This may help explain the variability in visual outcome with different time delays until treatment.

Literature suggests that HBOT can also reduce macular oedema.5 The thickness of the inner retinal layers of our patients showed a progressive reduction, comparing with their fellow eyes, consistent with the reduction of the oedema.

Figure 1 The first Spectral Domain Optical Coherence Tomography (SD-OCT) (A) revealed an increase in thickness and reflectivity of the inner retinal layers. The outer retinal layers are normal. The SD-OCT (B) performed 9 days after the diagnosis showed a normalisation of the inner retinal thickness.

Figure 2 The first fluorescein angiography showed a non-perfusion (delay for more than 3 min) of the central retinal artery, with near normal choroidal perfusion.

Figure 3 Twenty-hour Holter showed ventricular extrasystoles with ultrashort coupling interval (260 ms) and a non-sustained polymorphic ventricular tachycardia initiated by extrasystoles with short coupling interval.

Figure 4 The second fluorescein angiography (after 7 weeks) revealed a normal fluorescein filling of the central retinal artery arterioles and capillaries, started at 18 s. There is no retinal or macular ischaemia.
Based on American Heart Association classification of evidence, treatment of CRAO with hyperbaric oxygen treatment is level IIb. There is fair to good evidence to support its use. It is acceptable and safe, but lacks confirmation by level I studies. There are no alternative therapies with similar outcomes.1

Many studies have reported that HBOT is useful in the treatment of CRAO,3–12 but that are different opinions about the period of time when HBOT can be useful. Butler et al13 reported that the best evidence is a delay of <12 hours. Hertzog et al14 and Beiran et al15 described that HBOT is most useful when started within 8 hours of onset visual loss.

The Undersea and Hyperbaric Medical Society advises that HBOT should be started in the first 24 hours after the onset of the symptoms, and it is reported that results are better if it is done in the first 12 hours.13

Some authors describe that there are four important key factors to determine the HBOT success: time at HBOT is started, degree of vessel occlusion, the type of vessel that is occluded and the presence of an adequate PaO2 of oxygen. The aetiology of the occlusion is also related as an important factor.14 15

The major barrier to effective treatment for CRAO is the fact that people are rarely seen acutely and there is no consensus for treatment or guideline-based therapy.1

Our patients responded to the HBOT treatment well. The improvement may be related to the early timing of the treatment of our patients (6 hours) and the absence of other ophthalmological problem or precipitating factor.

Learning points

► Hyperbaric oxygen therapy (HBOT) seems to be an option for the treatment of central retinal artery occlusion (CRAO) that can be easily administrated.
► HBOT produce an improvement in vision if it is done in the first 24 hours after the onset of the symptoms.
► Further studies with more patients are necessary to determine the value and safety of this therapy in the treatment of CRAO, as well as the exact time window to perform HBOT.

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