Central Retinal Artery Occlusion

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Central Retinal Artery Occlusion

Hyperbaric Medicine
Primary Training Course

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Central Retinal Artery Occlusion
Outline

1. Briefly review pathophysiological and anatomical considerations in central retinal artery occlusion (CRAO)
2. Describe the mechanisms whereby HBO works
3. Outline an approach to HBO treatment of the patient with CRAO

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Central Retinal Artery Occlusion
Background

- Relatively rare condition first described in 1859.
- Incidence is ~ 1 in 100,000 - accounts for 1 in 10,000 outpatient ophthalmology visits
- Male predominance with mean age of 60-65
- Analogous to an acute stroke with end-organ ischemia
- Constitutes a medical emergency

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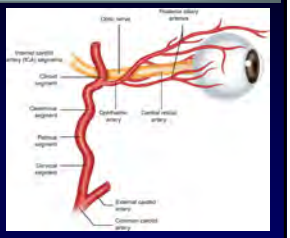
Central Retinal Artery Occlusion
Vascular supply of the eye

- The majority of blood flow to the orbit is supplied by the internal carotid artery.
- The external carotid may supply some blood flow but to a lesser extent.
- The ophthalmic artery is the 1st branch of the ICA.
- Supplies the orbital contents



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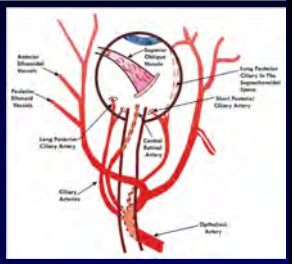
Central Retinal Artery Occlusion
Vascular supply of the eye

- The globe is supplied by:
  - the short and long posterior ciliary arteries
  - the anterior ciliary arteries
  - central retinal artery



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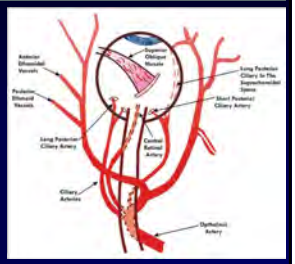
Central Retinal Artery Occlusion
Vascular supply of the eye

- Short and long posterior ciliary arteries supply:
  - Choroid
  - Outer layer of the retina



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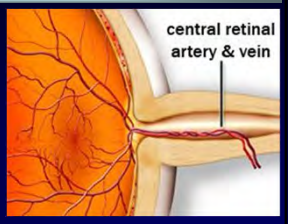
Central Retinal Artery Occlusion
Vascular supply of the eye

- Central retinal artery supply:
  - the optic disk
  - the inner retina
- Branches into superior and inferior branches and then nasal and temporal branches



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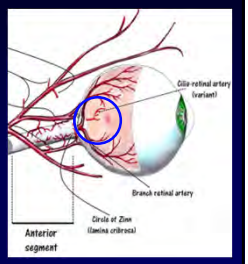
Central Retinal Artery Occlusion
Vascular supply of the eye

- The cilio-retinal artery is present in ~ 30% of people
- Contributes to part of the ciliary circulation
- Supplies the retina around the macula (papillomacular bundle)



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Central Retinal Artery Occlusion
Etiology

- Acute ischemia of the retina secondary to:
  - Embolus – most common (60%)
  - Thrombus
  - Vasospasm
  - Arteritis
  - Foreign bodies

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Central Retinal Artery Occlusion
Clinical Presentation

- Characterized by:
  - Acute profound painless monocular vision loss
  - Total vision loss is likely due to ophthalmic artery occlusion
  - Sparing of central vision – cilioretinal artery present

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Central Retinal Artery Occlusion
Clinical Presentation

- Alternate diagnosis should be considered if there is:
  - Pain
  - Increase or new vitreous floaters
  - Visual flashes
  - History of ocular or head trauma
  - Age < 40

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Central Retinal Artery Occlusion
Clinical Presentation

- Exam characterized by:
  - Visual acuity typically < 20/400
  - Light perception only (LPO) to count fingers
  - Pale or white appearance of the retina
  - Cherry-red spot near macular
  - "Boxcarring" or "cattle trucking" of arterioles
  - Afferent pupillary defect

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Central Retinal Artery Occlusion
Approach to the Patient

- Laboratory Studies:
  - CBC
  - ESR and CRP
  - Coagulation studies
  - Antiphospholipid antibodies
  - Lumbar puncture

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Central Retinal Artery Occlusion
Approach to the Patient

- Imaging Studies:
  - Fluorescein angiography
  - Echocardiogram
  - Carotid ultrasound
  - MRI

~ 1/3 of patients with acute/subacute incidental cerebral infarct

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Central Retinal Artery Occlusion
Additional Treatment Considerations

- Ocular massage
- Anterior chamber paracentesis
- Parenteral acetazolamide/mannitol
- Corticosteroids
- Pentoxifylline
- Inhalation of carbogen
- Fibrinolytics

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Central Retinal Artery Occlusion
Goal of HBO

Provide sufficient oxygen to the inner retina via the choroidal circulation to support the basic metabolic needs until effective circulation through the central retinal artery can be re-established.

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Central Retinal Artery Occlusion
Goal of HBO

- The choroidal circulation contributes ~ 60% of the retinal oxygen delivery
- During HBO 100% of the retinal oxygen needs can be met via the choroidal circulation.

$$Diffusion = \frac{\Delta p \cdot A \cdot C_s}{d \cdot \sqrt{MW}}$$

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Central Retinal Artery Occlusion
Goal of HBO

- Choroidal blood flow is not generally oxygen dependent
- No significant vasoconstriction during HBO

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Central Retinal Artery Occlusion
Other Effects of Hyperbaric Oxygen

- Increased RBC elasticity with improved flow through the microcirculation[1]
- Protects against oxygen free radicals during reperfusion[2,3]
- Attenuates cytokine induction[4]

1. Mathieu D. et al., (1984) Proceedings of the Eighth International Congress on Hyperbaric Medicine, Long Beach, California, pp 27-28.
2. Nylander G. et. al., *Plastic and Reconstructive Surgery*. 1985;76:596-601
3. Thomas, MP et. al., *American Heart Journal*, 1991; 120:791-800
4. Masatomo, Y and Mamoru, Y, *American J. Endocrinol Metab.* 278: E811-E816, 2000

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Central Retinal Artery Occlusion
Treatment

- Treatment should be initiated with the least delay
- "Time is vision"
- Should be considered a stroke
- Admit to stroke service if possible
- Initiate 100% normobaric oxygen

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Central Retinal Artery Occlusion
Treatment

- If significant improvement in vision with normobaric oxygen:
  - Provide 15 minutes of oxygen breathing each hour
  - Continue treatment until improvement in vision is stable after 2 hours, 96 hours of supplemental oxygen, or arterial patency documented on angiogram

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Central Retinal Artery Occlusion
Treatment Protocol

- HBO initiated with minimum delay if no response to normobaric oxygen
- Initial treatment at 2 ATA with pressure titration as required
- CRAO secondary to arterial gas embolism (AGE) use USN TT6

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Central Retinal Artery Occlusion
Treatment Protocol

- Repeat treatments q 8-12 hours as dictated by clinical response
- Duration of treatment dependent upon clinical response

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Central Retinal Artery Occlusion
Adjunctive Hyperbaric Oxygen Therapy

What is the Evidence?

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Central Retinal Artery Occlusion
Level of Evidence

- Literature Search:
  - Animal studies > human studies
  - Human studies - case reports/series
  - One retrospective controlled trial

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Central Retinal Artery Occlusion
Level of Evidence

American Heart Association
Evidence Based Medicine Category
IIb
acceptable and useful

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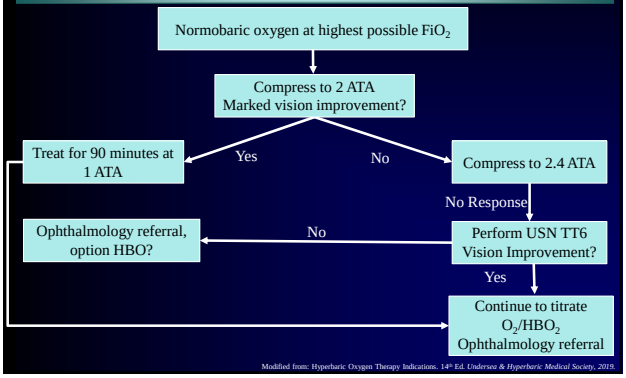
Central Retinal Artery Occlusion
…Treatment Flowchart



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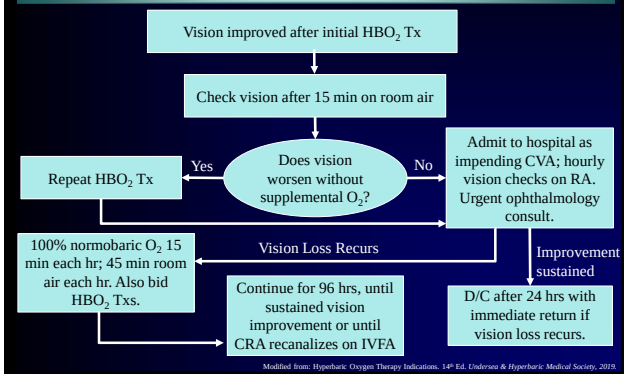
Central Retinal Artery Occlusion
…Recommended Follow-up Management



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Central Retinal Artery Occlusion
Summary

- HBO is a valuable adjunctive therapy in acute central retinal artery occlusion.
- HBO should be utilized as part of a multidisciplinary approach to patients with acute vision loss.
- HBO dosing should be guided by visual response and continued until improved visual acuity is sustained.

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