

Aerospace Medicine Clinic

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You're the flight surgeon covering weekend duty at the local Military Urgent Care Center. A 25-year-old active duty male student naval aviator presents for persistent unilateral blurred vision in his left eye that has been present for 4 d, first noticed upon waking. He admits to seeing small "stars" that flash on occasion. He denies floaters, pain, itching, redness, tearing, and trauma. He also denies headache, nausea, and vomiting. He has never experienced this before and is otherwise healthy. He has no significant past medical history and no medication use including over-the-counter, vitamins, or other supplements. He has no history of prior eye surgery or contact lens wear.

When a patient presents with an eye complaint, it is important to remember the pathway that light takes as it enters the front of the eye, moves through the globe, is transformed and transmitted via the optic nerve, and then ultimately reaches the primary visual cortex of the occipital lobes.⁸ This knowledge, including the common presentations of pathology for each structure, can be used to help create a differential diagnosis.

1. Which is the correct anatomical pathway of light as it travels from the front to the back of the eye?
 - A. Cornea, lens, aqueous humor, vitreous humor, retina.
 - B. Cornea, aqueous humor, lens, vitreous humor, retina.
 - C. Cornea, vitreous humor, lens, aqueous humor, retina.
 - D. Cornea, aqueous humor, vitreous humor, lens, retina.

ANSWER/DISCUSSION

1. B. Light travels first through the cornea, then the aqueous humor, lens, vitreous humor, and, finally, the retina.

2. After obtaining a thorough history from the patient, what should you do next?
 - A. Immediately refer to an ophthalmologist.
 - B. Prescribe eye drops to alleviate symptoms.
 - C. Perform a thorough eye examination, including fundoscopic exam.
 - D. Issue a downchit and follow up in 1 wk to reassess.

ANSWER/DISCUSSION

2. C. Before referring to another provider, prescribing medication, or issuing a downchit, it is important to perform a thorough eye exam. On visual assessment, the pupils are equal, round, and reactive to light. Extraocular movements are intact and there is no afferent pupillary defect. The appearance of the sclera, cornea, eyelids, and conjunctiva were found to be normal. A blue light from a Wood's lamp or slit lamp with fluorescein application shows no corneal abnormalities. Intraocular pressure is normal in both eyes: OD (right eye) 16 mmHg, and OS (left eye) 14 mmHg. The patient is unable to read the large "E" on the Snellen chart with his left eye. Upon further evaluation of his vision, his visual acuity is OD 20/20, and OS 20/400.

A fundoscopic examination can be performed at bedside with a direct ophthalmoscope. There are two types of direct ophthalmoscopes: traditional and PanOptic.² The PanOptic ophthalmoscope has the larger field of view of the two, measuring 25°, allowing the user to view a larger area of the retina, five times that of the traditional ophthalmoscope.⁵

When using either ophthalmoscope, it is helpful to keep in mind the following tips for optimal viewing. First, focus

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Fig. 1. Actual image of the patient's left eye taken with a wide-angle camera and obtained during the aviation optometry exam.

the ophthalmoscope on a distant object. Second, be sure to use a dimly lit room and the half-dim scope light setting to maximize pupil size. Third, tell the patient to look at a point straight ahead. Fourth, approach the patient temporally at a 15° angle, level with the eye being examined, and follow the red reflex into the eye. Fifth, adjust the focus to improve the clarity of the retinal anatomy using the focusing wheel. Sixth, if unable to find the optic disc, follow a blood vessel centrally. Finally, in order to visualize more of the periphery, pivot the device slowly or ask the patient to look up, down, and side to side.^{3,5} If needed, dilate the eye for a much better chance to see the retinal anatomy.

Looking into your patient's right eye using the PanOptic direct ophthalmoscope, you determine that the retina appears to be unremarkable. When you look into the left eye, you see what is depicted in **Fig. 1**.

3. Based on your findings, including both the history and physical exam, what is the most likely diagnosis of this patient?
 - A. Retinal detachment.
 - B. Papilledema.
 - C. Central retinal artery occlusion.
 - D. Central retinal vein occlusion (CRVO).
 - E. Optic neuritis.

ANSWER/DISCUSSION:

3. D. This patient has a CRVO. His presentation of acute, painless, and persistent visual blurring is consistent with the finding of a classic "blood and thunder" appearance on funduscopic exam.⁹ Due to a blockage in the retinal vein, there are dilated tortuous veins visualized in all quadrants of the retina with diffuse scattered retinal hemorrhages.^{1,9} Edema and hemorrhages obscure the visibility of the optic disc.¹ CRVO may be associated with glaucoma, diabetes, hypertension, hyper-coagulable states, or thrombocytopenia.

Retinal detachment would be the most likely condition for any patient presenting with painless vision loss as well as "stars"

and "floaters" in the vision.⁵ Retinal detachments can present with complaints of a curtain falling over the eye if the fovea is detached, but peripheral detachments also have complaints of flashes and floaters.⁹ The retina is seen in an ophthalmoscopic exam as a wavy, folded, and raised dull gray area.^{1,9} The optic disc is normal in appearance.¹ Irreversible central vision loss from a "fovea off" retinal detachment can occur after 24–48 h.⁵

Papilledema would have bilateral elevated and edematous optic discs with indistinct margins.¹ Papilledema is likely to be accompanied by signs of increased intracranial pressure with a headache and/or nausea and vomiting.

Central retinal artery occlusion presents with a sudden painless decrease in vision due to a thrombotic plaque or embolus occluding the central retinal artery.⁹ On funduscopic examination, the retina will overall appear very pale due to lack of arterial blood flow, with a "cherry-red spot" at the location of the fovea.⁹

Optic neuritis is a loss in vision that occurs due to inflammation of the optic nerve, which may be related to multiple sclerosis, vaccination reactions, meningitis, sarcoidosis, or infection.⁹ The nerve is tender, with painful ocular movements and decreased visual acuity. The fundus typically appears normal, and the optic nerve may appear normal or may be swollen with elevated and blurred margins.^{1,9} A computerized color vision test will typically reveal decreased blue cone sensitivity in the affected eye.

4. Now that this patient has been diagnosed with CRVO, what is the best course of management?
 - A. Perform a lumbar puncture to determine the etiology.
 - B. Consult immediately with ophthalmology, including aeromedical evacuation if required.
 - C. Order a head MRI with orbital details.
 - D. Treat immediately with intravitreal injections of anti-thrombin medication.
 - E. All of the above.

ANSWER/DISCUSSION

4. B. Consult immediately with ophthalmology, including aerovac if required. Immediate ophthalmology diagnosis and treatment may give the best chance of visual recovery. Ophthalmology will perform injection treatments as needed and evaluate with retinal/fundus photography, macular ocular coherence tomography, and fluorescein angiography. Ophthalmology will attempt to find the underlying disease that caused the CRVO and will order labs, including fasting blood sugar, Hemoglobin A1c, complete blood count, prothrombin time/partial thromboplastin time, erythrocyte sedimentation rate, lipids, rapid plasma reagent, fluorescent treponema absorption, antinuclear antibodies test, and hypercoagulability studies.

The U.S. Air Force Waiver Guide states that central retinal vein occlusion and branch retinal vein occlusion are disqualifying for all aviation duty in the U.S. Air Force. An Aeromedical Consultation Service evaluation is required for aviators for all initial waivers for CRVO and branch retinal

vein occlusion. The probability of waiver approval is dependent on final visual acuity, visual field, and absence of other significant pathology or complications. For a waiver to be considered, the Aeromedical Consultation Service requires: consideration of any potentially underlying disease etiologies, a list of all waivable conditions, a history of disease, and a full ophthalmology exam.⁷ Per the Air Force Waiver Guide, central retinal venous occlusion is potentially waivable provided the condition is fully resolved without residual visual defects; any residual defects are considered disqualifying for all I/IA individuals. A waiver is possible for all II/III individuals and air traffic controllers/ground-based controllers even with some residual visual defects.⁷

The U.S. Navy Aeromedical Waiver and Reference Guide states that waivers for CRVO may be considered when the condition is considered resolved and stable, the member meets all vision standards for aviation class with no further required injections, and is found “fit for full duty” by the ophthalmologist. The Naval Aerospace Medical Institute must review all ophthalmology notes, tests, and scans performed for waiver adjudication. Applicants are typically not waived for a history of CRVO.⁶

Per the U.S. Army Waiver Guide, all flight personnel must be correctable to 20/20. Waiver for visual acuity outside standards is considered on a case-by-case basis in designated personnel provided the central and peripheral retina is normal, no other ocular conditions exist, and all other visual standards are met. A waiver requires a full optometry/ophthalmology consultation. Applicants must correct to 20/20, both near and far, with uncorrected distant visual acuity of 20/70 or better and uncorrected near visual acuity of 20/40 or better.¹⁰

The Federal Aviation Administration Guide for Aviation Medical Examiners requires that a pilot’s distant vision be 20/20 or better, with or without correction, in each eye separately to hold a first- or second-class certificate. The standard for near visual acuity (16”) is 20/40 in each eye separately. Pilots ages 50 or older also have an intermediate visual standard measured at 32” of 20/40 or better in each eye separately. Third-class medical certificates require 20/40 or better for near and distant vision. There is no intermediate vision standard for third class certification.⁴

This individual responded well to intravitreal bevacizumab (Avastin) injections with an improvement in symptoms from 20/400 to 20/40, a remarkable improvement. No underlying vascular or coagulopathy was identified in his lab work. Unfortunately, his vision was not correctable to 20/20 and he did not meet visual standards for flight duty in any of the military services. He is currently undergoing a medical board and awaiting a decision on recommendation for retention.

The Federal Aviation Administration Guide for Aviation Medical Examiners requires that all pertinent medical information and a current status report be submitted to the Federal Aviation Administration for consideration of Special Issuance for any vascular occlusion/retinopathy condition. Currently the patient is pursuing a statement of demonstrated ability for his vision for a class I medical certification.⁴

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