Abstract:

Non-lethal gunshot wounds to the head region cause injuries that may heal, but often leave long-term damage and scarring. Gunshot trauma to the orbital region warrants closer observation to preserve remaining visual function.
I. Case History

- Demographics: 55 year old Black Male
- Chief Complaint: Pt lost most recent pair of glasses, and is currently only using reading glasses. When using the reading glasses, he is unable to see far away if he looks up. Occasionally experiencing pull/strain with right eye at variable times, but is not experiencing any diplopia.
- Ocular History:
  - Trauma, OD X 30 years ago, with history of gunshot which ricocheted from the lateral canthus into oral-maxillary region. Pt also received strabismus surgery following rupture of lateral rectus.
- Medical History
  - (-) Hypertension
  - (-) Diabetes
- Medications
  - No systemic medications

II. Pertinent findings

- Clinical
  - Entering VAs without correction
    - OD: Count fingers at 3 feet (Eccentrically viewing)
    - OS: 20/25 -2
    - Pinhole: No improvement
  - Retinoscopy
    - OD: -3.50 – 1.50 x 020
    - OS: -1.75 -0.75 x 180
  - Subjective Refraction
    - OD: -5.50 -1.50 x 020 VA: 20/500
    - OS: -0.25 -1.00 x 090 VA: 20/20
    - ADD: +1.75 VA 20/20 at 40 cM
  - Pupils: PERRL, 2+ APD OD
  - Hirschberg:
    - OD: light displaced nasally 1.5 mm, inferiorly 1mm
    - OS: aligned
  - Extraocular muscles:
    - Full range of motion OS, slight inferior, inferior/temporal restriction OD, (-)pain/diplopia
  - Visual Fields:
    - OD: Full to kinetic finger movement, with pupil nasally displaced for fixation
    - OS: Full to finger counting
  - Goldmann Applanation Tonometry @ 9:45 am
    - OD: 20 mmHg
- OS: 20 mmHg

**Physical**
- Slit Lamp Exam
  - Periorbital:
    - OD: small scar by lateral canthus
    - OS: clear
  - Lids/Lashes: Capped glands OU
  - Conjunctiva: Limbal melanosis OU
  - Cornea: Trace punctate keratitis OU
  - Iris: Flat, (-) NVI OU
  - Angles: 4X4 N/T OU
  - Anterior Chamber: Deep and quiet, (-) cells/flare OU
- Dilated Fundus Exam
  - Lens
    - OD: 1+ NS, 1+ CC, PSC inferior to visual axis
    - OS: 1+ NS, 1+ CC
  - Vitreous
    - OD: Vitreous condensation inferiorly
    - OS: Syneresis
  - Optic Nerve
    - OD: 0.75, with diffuse pallor
    - OS: 0.70, 2.0 mm Optic nerve, pink/healthy rim
  - Macula
    - OD: Macular scar with elevated fibrous tissue and traction inferior/laterally extending to temporal periphery 9:00
    - OS: flat
  - Posterior Pole/Vessels
    - OD: Superior arcade intact, inferior arcade obstructed by elevated fibrous tissue.
    - OS: (-) hemes/A/V crossing changes; A/V ratio 2/3
  - Periphery
    - OD: Reticular degeneration 6:00, (-) holes/tears/RD
    - OS: (-)holes/tears/RD
- Diagnostic Imaging Obtained
  - Fundus Photos
  - OCT Optic Disc
    - OD: unreliable due to patient fixation
    - OS: ss 8/10. RNFL 89. No thinning noted in any quadrants.
    - Symmetry 2%
  - OCT 5 Line Raster of fibrotic scar tissue OD
III. Differential Diagnosis

- Choroidal Neovascular Membrane [CNVM] secondary to Choroidal rupture
- Choroidal Neovascular Membrane secondary to Chorioretinitis sclopetaria
- Retinal Detachment
- Traumatic macular scar secondary to CNVM

IV. Diagnosis and Discussion

- Elaboration of Choroidal rupture [CR] vs. Chorioretinitis sclopetaria [CS]
  - Choroidal rupture is the break in the choroid, Bruch’s membrane, and retinal pigment epithelium [RPE] layers, whereas chorioretinitis sclopetaria also involves the above mentioned layers including a break in the retina. While choroidal ruptures can occur from any blunt trauma, chorioretinitis sclopetaria is specific for trauma caused by a high velocity projectile object which passes adjacent to/through the orbit without penetration of the globe.
  - Direct trauma from CR typically occurs peripherally, parallel to the ora serrata and most often, temporally to the optic nerve rather than nasally. When chorioretinal scarring takes place, it often likens to a crescent shaped yellow line eventually evolving into white streaks with pigmented margins. Indirect trauma causes ruptures within the posterior pole with breaks concentric to the optic nerve.
  - CS injuries are high velocity—grazing the orbital globe but never penetrating it. The direct force of the bullet makes a full thickness break of the retina and underlying uveal layers. The characteristic white membrane is often mistaken for sclera which shows through, but is actually proliferative tissue healing within the injured area, carved by the path of the bullet. The appearance of the fibrinous changes is also referred to as chorioretinitis proliferans. Due to the proximity to the optic nerve, the sheer force on impact causes pressure waves and indirectly disrupts the vascular supply, resulting in pallor of the optic nerve. The speed of impact causes stress resulting in macular choroidal rupture and consequently, poor vision, if not loss of vision. The optic neuropathy is often associated with other signs including peripapillary pigment changes and relative afferent pupillary defect.

- Elaboration of Strabismus
  - Traumatic rupture of extra-ocular muscles is particularly uncommon, and especially rare for the lateral rectus muscle in isolation, as the eye becomes esotropic. Most prevalent is rupture of the medial rectus, followed by the inferior rectus, superior rectus, then lateral rectus. In addition, involvement of the corresponding cranial nerves can become another complication, especially when strabismus manifests.
Several complications that can arise from strabismus surgery include slipped muscles, stretched scars, incarcerated muscles, scleral perforation, and surgical errors.

One potential risk factor with strabismus surgery is the development of diplopia, which may result from over/under correction, in addition to other risk factors concerning any type of invasive surgery.

- **Unique Features**
  - Bullet wounds, also known as missile injuries, can be guided upon impact. Upon entering the human skull near the orbital region, bullets may traverse the facio-orbital plane going superiorly through anterior skull base or inferiorly to the maxillofacial region—the latter being less common. This phenomenon where the bullet never enters the globe was originally termed chorioretinitis plastic sclotetaria in 1902 by Goldzieher.

- CS is without penetration of the globe, but the bullet does have to have an exit point. If the barrier to the anterior skull base and/or maxillofacial plane is compromised, the risk of infection is high due to the open communication between air and the brain, orbit, and nasal cavities ensuing possible meningitis and CSF rhinorrhea. Surgical intervention is required immediately with antibiotics and decongestants.

V. **Treatment & Management**
- For our patient, the direct impact from the bullet sustained a traumatic macular scar and vision is best corrected to 20/500 in the right eye. Monocular precautions were advised.
- Due to patient’s monocular status, borderline IOPs, and large C/D ratio in the remaining left eye, the patient is scheduled to return for baseline glaucoma work-up and testing.
- There were no complaints of diplopia despite the right eye being hypertropic and exotropic—Patient was asked to return with any new symptoms of diplopia

VI. **Conclusion**
- **Clinical Pearls**
  - Chorioretinitis Sclopetaria is a rare ocular finding that results from a high velocity object, without penetration of the globe. If all other surrounding structures are intact, it is only necessary to monitor the eye as the eye will be able to heal by itself.
- **Diagnosis**
  - Careful case history is required to determine the cause of trauma to the eye. For gunshot wounds, CT scans will be the most useful in order to visualize any remaining fragments and/or fractures. If able, an MRI and carotid angiography will be necessary to diagnose CSF rhinorrhea and traumatic aneurysms.
When the retina is affected from blunt trauma, many patients will present with hemorrhages that will require time for the blood to resorb. With any trauma, it is necessary to evaluate the integrity of the globe to ensure there are no extraocular muscle restrictions, hyphema, angle recessions, elevated pressures, and retinal defects.

The gold standard to monitoring ruptures is the use of contrast dye with imaging—either a Fluorescein Angiography [FA] or Indocyanine Green Angiography [ICG]. ICG may benefit upon acute ruptures because the dye is limited to the choroid space, and may provide better views even with hemorrhage.

Since CS has a natural tendency to heal and scar on its own, noninvasive techniques also can also be utilized for frequent follow ups. The fundus camera with use of several different filters can provide a lot of information to the different layers of the retina due to their wavelength properties. Fundus auto fluorescence measures lipofuscin, which is inherently produced by the RPE. If a rupture is present, the retina hypofluoresces but the margins will hyperfluoresce. Optical coherence tomography is also useful in providing information about the different layers of the retina, especially highlighting areas with edema.

- Treatment and Management
  - After the break has been located, many patients do well with regular follow ups and do not require treatment. However if the development of CNVM begins to occur, patients may need treatment and have several options at hand:
    - 1) Laser Photocoagulation
    - 2) Photodynamic Therapy
    - 3) Pharmacologic Therapy, utilizing anti vascular endothelial growth factor [VEGF]
    - 4) Surgery, including pars plana vitrectomy, access retinotomy, and extraction of CNVM.
  - When the orbit is affected, the extraocular muscles may require consultation with a strabismus surgeon, however, patients will need to be followed if prism correction is indicated to correct any residual diplopia.

- Complications
  - The biggest difference between CR and CS is the healing process. As CR heals, hemodynamic properties including oxygenation, blood flow, metabolic activity and biochemical state of the retina tissue can be beneficial in helping form chorioretinal scars, but lack of these factors may result in CNVM. In this case, the fibrovascular activity with glial cell proliferation can extend towards the vitreous over time, causing tractional retinal detachments. In CS, the fibrous tissue proliferates soon after the trauma and the firm adherence to the sclera is a tight barrier, limiting subretinal space. The lack of potential space prevents growth of vessels and risk of retinal detachments.
In CS, the globe will stay intact, but visual prognosis is very poor. Although the presentation may seem extreme, the likelihood of retinal detachment is very low, and attempting to interfere with the eye’s own healing process may do more than good. Many cases describing CS occur in young adults. With a Bruch’s membrane that is more elastic, and vitreous that has not begun syneresis, the likelihood of detachment is very little. When the vitreous is liquefied in a patient with CR, the vitreo-retinal interface is loose, and the pigmented margins adhered become at risk for detachment.

Patients who have CR are at risk for serosanguinous retinal detachments when CNVM develops. The biggest goal is to prevent CNVM from occurring and detecting it early if it should occur. However, depending on the location of the rupture—foveal vs. juxtafoveal vs. extrafoveal—the visual prognosis varies and there is a chance vision may stay intact.

Follow up

Although the likelihood of retinal detachments is low for CS, there was one reported case study of CS occurring much later after the trauma occurred, but the patient’s vitreous was already detached—a rare finding amongst the demographics of other patients who have had CS. It may be imperative to taper the follow up schedule, but still monitor the patient.

Patients with choroidal ruptures should be monitored closely for at least 2 years, with frequent follow ups with dilation because many CNVMs will occur within the first year. In patients with suppressed CNVM, there is the potential for CNVM to reactivate, leading to visual loss in 5% of patients.

Conclusion

The incidence of Chorioretinitis sclopetaria is very rare. For those who are lucky, a true chorioretinitis sclopetaria means the globe is still intact. Even though the vision may not be preserved, monitoring and treating adjacent structures is crucial to prevent infection.

Choroidal ruptures occur in about 5 to 10% of blunt ocular trauma. Even though this incidence is low, it is still a chance not worth taking because the effects can be very severe. While treatment is available if CNVM should progress, the most important thing is to catch it when it does develop and refer to a retinal specialist for further testing and treatment.

Depending on the type of trauma, and whether it results in choroid rupture or chorioretinitis sclopetaria, extraocular muscle involvement may necessitate a referral to a strabismus surgeon. However, the resulting binocular sequelae may require follow ups if diplopia is present.
VII. Nota bene

- Etymology: Sclopetaria, is from the Latin word sclopteum referencing a Roman long weapon. The English definition of the verb sclow, describes the act of scratching or clawing.

VIII. References


Fraser E, Haug S, McDonald R. Clinical Presentation fo Chorioretinitis Sclopetaria. Retinal Cases & Brief Reports. 2014, 8: 257-259


