STUDENT ARTICLE

Red Flags for the Red Eye: When Simple Subconjunctival Hemorrhage Is Not So Simple

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ABSTRACT

Subconjunctival hemorrhage (SCH) is a common disorder seen in the pediatric clinic and emergency room. While most isolated SCHs are benign, other more vision-threatening and life-threatening causes are important to consider when assessing SCH in the pediatric population. This article reviews SCH, its common associations, and tips on evaluating for potential emergencies.

INTRODUCTION

Subconjunctival hemorrhage (SCH) is one of the most common causes of eye redness in patients of all ages.[1] In a review of visits to a tertiary eye emergency department, SCH ranks within the top 20 most common diagnoses.[2] Within the eye clinic, it accounts for 2.9% of all eye findings.[1] Causes of SCH can be divided into atraumatic and traumatic, with the majority considered spontaneous and idiopathic. However, since other ocular and systemic emergencies may present as SCH, pediatricians may need to differentiate between benign and more worrisome causes of SCH to determine whether further evaluation is warranted.

APPEARANCE

SCH is characterized by a well-defined area of redness over the white sclera with absence of pain, discharge, or vision change.[3] It is caused by damage to a subconjunctival vessel leading to accumulation of blood between the conjunctiva and episclera.[4] The fibrous connections between these layers loosen over time, which may account for a more diffuse appearance in adults

Figure 1: Chemosis with elevated, "ballooned" appearance

versus a more focal appearance in children.[4] The conjunctival blood vessels may blend with the hemorrhage and appear obscured. Significant bleeding may cause chemosis or an elevated, "ballooned" appearance (Figure 1). In cases of trauma, bleeding is seen more commonly over the temporal rather than nasal aspect of the globe because of the exposed conjunctival surface area over the temporal globe, protection of the nasal globe by the nasal bridge, and better visualization of oncoming projectiles from the nasal side due to better binocular vision in the central visual field.[5,6] Over time, gravity causes the blood to collect inferiorly, and dehemoglobinization replaces the red color with a yellowish tinge.

COMMON CAUSES

Most cases of SCH are classified as idiopathic since no significant history is often found.[6] Mild eye rubbing, coughing, or sneezing, easily forgotten by the patient, can be the trigger for hemorrhage. However a detailed history is crucial in avoiding an incomplete diagnosis. In older patients, the most common causes of spontaneous, atraumatic SCH include hypertension, Valsalva effect (including vomiting, coughing and sneezing), diabetes, and anticoagulant/antiplatelet therapy.[4,6] It is thought that weaker vessels walls accompanied by a predilection for spontaneous bleeding may add to the mechanism in the adult population. Additionally, acute hemorrhagic conjunctivitis, most commonly caused by enterovirus 70, was a common cause of SCH of all ages, but there has been a significant decline in these cases in recent decades.[7] Nevertheless, severe conjunctivitis remains a common cause of SCH in children.

The pediatric population has a unique risk profile. While atraumatic SCH from severe vomiting, coughing, or constipation is commonly seen,[8] it has been shown that trauma and contact lens usage make up a significant proportion when compared to the older population.[7] This may be due to the active nature of children and the relatively popularity of contact lenses in the younger population. There is a tendency for higher numbers of SCH in children in summer months suggesting that summer vacation may be an important causative factor in trauma-related eye injuries.[7]

DIFFERENTIAL DIAGNOSES

SCH can be associated with other ocular and systemic findings as discussed in the following sections:

OCULAR TRAUMA

When a SCH is noted in association with a history of significant trauma, deeper ocular injuries must be excluded. Eyelid lacerations accompanied by SCH should raise concern for additional globe and orbital involvement.

Corneal abrasions and *corneal foreign bodies* may present with additional tearing, decreased vision, and positive fluorescein staining under cobalt blue light. *Traumatic iritis* may present with blurry vision, photophobia, and fine white blood cells in the anterior chamber on slit lamp exam. *Hyphema*, an accumulation of blood in the anterior chamber, appears with blood layered inferiorly between the cornea and iris or may diffusely obscure the iris and pupil. A *traumatic retinal detachment* may present with a decreased peripheral visual field, with or without an afferent pupillary defect. Injuries associated with metal from *metal projectiles* (e.g., hammering) or explosions (e.g., fireworks) should prompt a CT scan to rule out intraocular or intraorbital foreign body. It is important to note that metallic projectiles with significant velocities may penetrate the eye without a visible entry wound. An extensive, *bullous SCH* may indicate an underlying *scleral laceration* and an open globe, which would require exploration and repair in the operating room. A significant SCH with proptosis and elevated intraocular pressure may indicate a *retrobulbar hemorrhage*, a condition that can compromise the optic nerve and necessitates emergent ophthalmology evaluation and management. Periorbital bruising and decreased extraocular movement may indicate *orbital and facial fractures*. If the conditions of open globe, retrobulbar hemorrhage or fractures are suspected, emergent CT imaging is warranted to assist in confirming these diagnoses. This is especially important in very young children where even short-term compromise of equal binocular vision can result in amblyopia (lazy eye).

NON-ACCIDENTAL TRAUMA (NAT)

Non-accidental trauma makes up a nebulous and small fraction of all presenting eye cases. Review of cases at a tertiary eye hospital in England noted 2 cases of battered baby syndrome out of 3210 cases of eye trauma within a 24-week period.[12] A separate study suggested that ocular changes were the presenting sign to the ophthalmologist in 6% of suspected NAT patients.[8] Conversely, in children diagnosed with NAT, the incidence of ocular findings can vary from 22% to 46%.[8] The presence of retinal hemorrhages is the most common ocular finding,[13] but SCH in NAT has been documented as well. One group identified three cases of spontaneous bilateral subconjunctival hemorrhage as the initial presentation of NAT.[14] One patient had facial petechiae, and all three patients had concerning skeletal x-ray findings. A separate review of 1466 inpatient consults to the child protection team at a tertiary children's hospital identified 14 cases where SCH was noted on exam.[8] None of these patients had history of excessive Valsalva, and none had retinal hemorrhages or conjunctivitis, but bruising in other areas of the body were documented in 79% of the cases. While the group could not determine the prevalence of NAT among all children who present with SCH per se, the group felt SCH could occur in isolation and without other overt signs of abuse and should remain in the differential diagnosis after all other causes have been ruled out. A review of pre-ambulatory children presenting to emergency departments or urgent care clinics with visible injuries found a number of skeletal surveys concerning for NAT despite the notation of "minor" injuries, including 33% of individuals with apparently isolated subconjunctival hemorrhage.[15]

Of note, the differential diagnostic approach in an early newborn should include normal SCH after vaginal delivery or cesarean section as uterine contractions during labor can cause thoracic or abdominal compressions and elevated episcleral venous pressure.[15] Nevertheless, non-accidental trauma should also be considered in any infant with SCH that lacks relevant history given the larger implications. Consultation with a child abuse specialist should be considered in such cases.

INFECTIONS

Conjunctivitis and keratitis may present with SCH, but are usually associated with discharge and decreased vision. The list of viral, bacterial and parasitic infections associated with conjunctivitis is broad and includes enteroviruses, coxsackievirus, herpes zoster, adenovirus, rubella, rubeola, hantavirus, *Bordetella pertussis*, *Haemophilus influenzae*, *Streptococcus pnuemoniae*, *Moraxella catarrhalis*, *Staphylococcus aureus,* Leptospira, Trichinella, and cerebral malaria.[8] SCH and periocular pain has been documented to precede pediatric herpes zoster ophthalmicus.[9] In the case of keratitis, new white lesions over the cornea may be noted by family members. *Pre-septal and orbital cellulitis* may present with periocular erythema, ecchymosis, or edema. Orbital cellulitis presents with fever and is often accompanied by a history of sinusitis or trauma, decreased extraocular movements, afferent pupillary defect, and proptosis. CT of the maxillary/face and head, a complete blood count (CBC), and blood cultures are appropriate tests in the diagnostic evaluation of orbital cellulitis.

CONJUNCTIVAL AND ORBITAL VASCULAR TUMORS[4]

SCH could be a sign of a periorbital vascular anomaly. Conjunctival vascular anomalies include Kaposi sarcoma, lymphangiectasias, lymphangioma, cavernous hemangiomas, and arteriovenous malformations. A history of recurrent SCH should alert the physician to a possible ruptured aneurysm due to hereditary hemochromatosis. Adnexal lesions such as anaplastic carcinoma of the lacrimal gland and orbital lymphoma have been associated with cases of recurrent SCH in older patients.

SYSTEMIC BLEEDING DISORDERS

Systemic bleeding disorders associated with SCH include thrombocytopenic purpura, hemophilia, anemia, leukemia, splenic disorders, and uremia.[4] Case reports have documented the presence of bilateral SCH as the initial presentation for congenital fibrinogen deficiency[10] and Kasabach-Merritt syndrome.[11] Obtaining a good history regarding easy bruising or frequent nosebleeds, or history of recurrent SCH, should prompt a work up for bleeding diatheses.

HOW TO APPROACH THE EYE EXAM

A detailed history and exam is paramount in obtaining the correct diagnosis. History should include inquiries concerning any trauma, Valsalva, or anticoagulation therapy. Issues associated with excessive bleeding, hypertension and diabetes are also important to know.

Examination should begin with a general physical exam and then a careful eye exam, starting from anterior to posterior. This should include visual acuity, eye pressure, pupil reactivity, extraocular movement, and confrontation to visual fields. An abnormality in any of these exam components would exclude an isolated SCH.

Visual acuity is usually assessed using the Snellen letter eye chart or an Allen chart displaying shapes for younger children. In the ER, a hand-held near vision card can provide an approximate near vision assessment. Visual acuity in infants may be evaluated by object tracking with each eye individually. Intraocular pressure is usually determined with a tonometer; however, a non-ophthalmologist can palpate the globes, which should feel slightly soft. If there is any concern for an open globe, intraocular pressure should be deferred.

Pupils should be examined for symmetry and equal reactivity to light. A swinging flashlight test is used to assess for an afferent pupillary defect which usually indicates a significant ocular or neurological defect. Similarly, limitation in extraocular movement of one or both eyes may indicate an orbital fracture or mass, or neurological issue.

Examination of the anterior segment is best performed by slit lamp since it magnifies the image, thus allowing visualization of subtle findings. If a slit lamp instrument is unavailable, use of a pen light can provide a gross assessment, especially if a hand-held magnifying lens is used in conjunction with it. The posterior segment exam can be accomplished by a primary care provider using a direct ophthalmoscope. The retina should appear attached and with an orange-red reflex. The optic disc should have sharp borders without hemorrhages. A pediatric eye exam can challenging for a primary care provider, but asymmetry in any part of the exam can help narrow the differential.[16]

TREATMENT, MANAGEMENT AND PROGNOSIS

Despite being a topic of research for decades, there is no treatment that can accelerate the rate of healing of SCH. The extravasated blood is typically reabsorbed over a period of 2 to 3 weeks without residual scarring or visual compromise. The hemorrhage may spread circumferentially, obeying the force of gravity before it fades. Patients should be aware that the coloring of the affected conjunctiva can progress from red to greenish yellow to yellow as the hemoglobin is catabolized.[17] For foreign body sensation, artificial tears may aid in minimizing discomfort. The appearance of a SCH can be startling, so patient reassurance is an integral part of management. Additional treatment and management depend on the presence of further findings. If the hemorrhage fails to resolve or is recurrent, workup for a more serious etiologies is warranted.

CONCLUSION

Pediatricians will often encounter the SCH in clinical practice. SCH is a very common and often harmless problem in of itself, but pediatricians should stay alert for potential underlying vision-threatening and life-threatening conditions, including deeper globe and orbital trauma, infections, bleeding diatheses, and non-accidental trauma. Ophthalmology consultation should be considered for more complicated cases, but the general pediatrician plays a crucial role in obtaining important information for the correct diagnosis and treatment.

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