

Get out of a Scrape! An Approach to Corneal Foreign Bodies and Abrasions for the Primary Care Physician

Victoria Squizzato¹, Glenn Brown^{2,3*} and Stephanie Baxter⁴

¹Department of Family Medicine, McMaster University, Hamilton, Ontario, Canada

²Department of Family Medicine, Queen's University, Kingston, Ontario, Canada

³Department of Anesthesiology and Perioperative Medicine, Queen's University Kingston, Ontario, Canada

⁴Department of Ophthalmology, Queen's University, Kingston, Ontario, Canada

*Corresponding author: Glenn Brown, Queen's University, Department of Family Medicine 220 Bagot Street, Kingston, ON K7L 5E9, Canada, Tel: (613)533-9300, extn. 73959; E-mail: glenn.brown@dfm.queensu.ca

Rec date: Jan 25, 2015 Acc date: June 6, 2015 Pub date: June 12, 2015

Copyright: © 2015 Victoria S, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Work-related injuries (WREIs) to the eye are common. Many are minor but, if not treated quickly, can lead to vision-threatening complications. Others are severe, but even with expert management sight can be lost. This article promotes an understanding of the physician's role in the prevention, assessment, and treatment of WREIs. By far the most common WREIs are corneal foreign bodies (CFBs) and abrasions, which this article primarily focuses on. Foreign bodies (FBs) visualized under slit lamp microscopy can be removed with a moistened cotton tip or bent 25-gauge needle followed by antibiotic and tetanus prophylaxis. Pain associated with corneal abrasions can interfere with daily functions including return to work. Adequate pain relief may be achieved using oral nonsteroidal anti-inflammatories. Patching is not recommended because it does not improve comfort and may impair healing. Non-complicated CFBs need only to be seen once by an ophthalmologist 4-6 days after the initial presentation.

Keywords: Work-related eye injuries; Corneal abrasion; Corneal foreign body; Topical antibiotics; Nonsteroidal anti-inflammatory drugs; Analgesics; Tetanus

Introduction

Despite standards, regulation, and the availability of high-grade ocular protection, WREIs continue to be a common presentation to the emergency department despite being an easily preventable injury. In the US, there are approximately 2000 cases of WREIs that require medical attention every day [1]. Many are minor, but if not treated quickly, can lead to vision-threatening complications. Others are severe, but even with expert management sight can be lost. The majority of all eye injuries occur in males 20-34 years of age [2] working primarily in manufacturing [3,4], construction [3,4], agriculture [3], and the steel industry [2-4]. The most common mechanical causes of WREIs are welding, drilling, cutting, hammering, and splashing of chemicals [3]. A case-crossover study found that situational factors also increase the risk of incurring a WREI such as performing an unfamiliar task, using faulty equipment, rushing, or poor workspace illumination [3]. The most common WREIs are superficial FBs [2,4,5], corneal abrasions [4,5], chemical burns [2,5], and blunt trauma [5]. This article focuses primarily on the evaluation and management of CFBs and corneal abrasions.

Fortunately, most cases of CFBs and corneal abrasions can be appropriately managed by primary care physicians. However, limited training in ophthalmology may lead to suboptimal patient care and inappropriate use of ophthalmology outpatient clinics. This article discusses the management of non-complicated corneal injuries and how to recognize complicated cases that require referral to an ophthalmologist.

Methods

PubMed, CINAHL, MEDLINE, and the Cochrane Library were searched up to January 19, 2015 using combinations of the key words work-related eye injuries, corneal abrasion, corneal foreign body, corneal injury, topical antibiotics, nonsteroidal anti-inflammatory drugs, analgesics, and tetanus. Relevant journal articles, meta-analyses, randomized controlled trials, reviews, and textbook passages were reviewed. Also searched were the Cochrane Database of Systematic Reviews, the National Guideline Clearinghouse, Agency for Healthcare Research and Quality Evidence Reports, Bandolier, Up-to-date, and Essential Evidence Plus. Search dates: June 14 to 27, 2011.

Results

History

Many patients with WREIs present with eye pain, tearing, and sensitivity to light. However, symptoms suggestive of intraocular penetration can be minimal.

The diagnosis is often suggested by the history provided by the patient, with special attention to the circumstances, specifically the mechanism, materials, and the velocity. Metal-on-metal hammering injuries are most commonly responsible for penetrating injuries with a retained intraocular foreign body (IOFB) [6]. Often there is a history of eye trauma, specifically metal-on-metal work such as using a hammer and chisel, metal drill, or grinding tool [3]. Patients may have blepharospasm, FB sensation, or blurry vision. Important diagnoses to consider are corneal abrasion, CFB, and IOFB. Corneal abrasions and non-penetrating CFBs can be effectively managed in the emergency department with ophthalmology follow-up. However, IOFBs must be

identified quickly and referred to ophthalmology emergently, because associated endophthalmitis and retinal detachment have a tendency towards rapid progression resulting in severe visual loss [7].

Physical examination

Although symptoms with all three conditions may be similar, the physical examination will provide clues to the diagnosis. Visual acuity is the most easily measured element of visual function and should always be assessed before administration of any diagnostic test or treatment. This should be followed by a penlight examination of the pupils. Penetrating trauma should be suspected if a pupil is dilated, nonreactive, or irregular. If the patient is unable to tolerate the examination due to pain, topical anesthetic drops may be used to relieve pain and blepharospasm. Using a slit lamp, all external structures should be examined and the lids everted to check for debris on the tarsal conjunctiva and in the fornices. However, manipulation of the lids is contraindicated if an IOFB is suspected. If a CFB is noted, examination with a slit lamp is critical to determine the depth of its penetration. If it is found to be deep, full thickness or penetrating into the anterior chamber referral to an ophthalmologist is paramount.

A lack of a FB or abnormal pupillary findings on exam is not sufficient to rule out an IOFB in patients with a history of metal-on-metal work. Examination with fluorescein will further aid diagnosis. An epithelial defect appears green under cobalt blue light after the instillation of fluorescein, which could occur with all three conditions. However certain patterns may provide clues. Pooling may indicate an abrasion, whereas a thin outlined shape may indicate an embedded CFB. Multiple linear abrasions is suggestive of a FB lodged on the tarsal conjunctiva. Fluorescein streaming away from an abrasion (positive Seidel test) indicates penetrating ocular trauma. Of note, the Seidel test is specific but not sensitive as very small IOFBs may be self-sealing giving a false negative result.

Investigations

The clinician should have a low threshold for a CT scan of the orbit. If CT is not available, an emergent referral to an ophthalmologist for dilated fundus examination should be made.

Extraction

Given that a slit lamp and topical anesthetic drops are available, it is appropriate for non-specialists to attempt removal of superficial CFBs. The presence of a full-thickness CFB is considered an open-globe injury and should be managed by an ophthalmologist. Removal should be attempted with the least traumatic means available, i.e. a moistened cotton tipped applicator. If this fails, then a hypodermic needle or an ophthalmic burr may be used. Although effective, some evidence suggests a burr can cause extended corneal damage, which may delay healing and increase the risk of infection [8]. However, the spoon shape of a bent needle can be used to remove the CFB while minimizing corneal trauma. The instrument should be used in a tangential plane with the physician's hand braced on the patient's zygomatic arch. Use a higher magnification (1.6x) on the slit lamp to improve accuracy and minimize the risk of perforation. If attempted removal of a FB is unsuccessful or if the patient is uncooperative, defer management to an ophthalmologist urgently.

Further management

Although further management is lacking in clinical controlled trials, recommendations include systemic analgesics as needed, prophylactic topical antibiotics for corneal involvement, and tetanus booster as warranted [9].

Pain relief is one of the main goals of treatment to help the patient get rest, stop rubbing the affected eye, and allow healing to occur. Typically, pain relief may be achieved with oral nonsteroidal anti-inflammatories (NSAIDs). Opioids are less commonly prescribed. There still is no consensus regarding the use of topical NSAIDs, although reductions in pain score and lower oral opioid requirements have been reported without adversely affecting the rate of healing or cause adverse corneal effects when used in the short term [10,11]. If used, patients should be cautioned to use topical NSAIDs for only the first 2-3 days when the pain is most intense because there are reports from small case studies of severe keratopathy, ulceration, corneal melts, and perforations, associated with their prolonged use [12].

The evidence does not support using an occlusive patch. A Cochrane Review concluded that treating simple corneal abrasions with a patch does not improve healing rates and does not reduce pain [13]. This was true for traumatic corneal abrasions and CFBs [14]. A more recent randomized control trial comparing pressure patching, bandage contact lens, and topical antibiotic alone also found no significant difference in either pain control or reduction of the abrasion area [15]. Furthermore, the use of a patch results in a loss of binocular vision and depth preception.

A topical antibiotic that has broad spectrum coverage against *Streptococcus* sp. and *Staphylococcus* sp. such as a fluoroquinolone is recommended to decrease the risk of keratitis secondary to the epithelial defect and contaminated FB [16]. If unable, over-the-counter bacitracin and polymyxin B ophthalmic may be an acceptable alternative. Finally, although the risk of *Clostridium tetani* infection is low if the cornea is not perforated [17], this presents an opportunity to remember to update a patient's tetanus vaccination.

Follow-up

Most CFBs heal without complication. Ideally, patients who are non-contact lens wearers with an injury outside of the visual axis need only be seen once by an ophthalmologist or optometrist 4-6 days after the initial presentation [18]. They should be seen sooner if there is an IOFB, the CFB is not completely removed or they develop worsening eye pain, irritation, redness, or decreased visual acuity [18]. However, in locations where specialist follow-up is unavailable, a primary care physician can ensure the cornea has reepithelialized by a negative fluorescein test 4-6 days later.

Conclusion

Most corneal injuries are industrial accidents and can cause significant morbidity in terms of vision loss and time off work. It is necessary for the primary care physician to initiate appropriate emergent measures that can preserve vision and reduce complications. After FB removal, the remaining corneal abrasion usually heals rapidly and without serious sequelae. Due to a lack of evidence from clinical trials, management of corneal injuries is subject to variation.

Further Reading

For a more detailed discussion, an online module on WREIs created by the authors may be freely accessed at <https://meds.queensu.ca/central/community/wrei>.

Financial Disclosures

The Ontario Workplace Safety and Insurance Board's Champions Educational Grant for Queen's University supported a summer studentship for Victoria Squissato.

References

- Centers for Disease Control and Prevention; National Institute for Occupational Safety and Health. Workplace safety and health topics, eye safety.
- Xiang H, Stallones L, Chen G, Smith GA (2005) Work related eye injuries treated in hospital emergency departments in the US. *Am J Ind Med* 48: 57-62.
- Chen SY, Fong PC, Lin SF, Chang CH, Chan CC (2009) A case-crossover study on transient risk factors of work-related eye injuries. *Occup Environ Med* 66: 517-522.
- Harris PM (2008) Nonfatal occupational injuries involving the eyes, 2004. US Bureau of Labor Statistics.
- Ho CK, Yen YL, Chang CH, Chiang HC, Shen YY, et al (2007) Epidemiologic study on work-related eye injuries in Kaohsiung, Taiwan. *Kaohsiung J Med Sci* 23: 463-469.
- Wickham L, Xing W, Bunce C, Sullivan P (2006) Outcomes of surgery for posterior segment intraocular foreign bodies-a retrospective review of 17 years of clinical experience. *Graefes Arch Clin Exp Ophthalmol* 244: 1620-1626.
- Yeh S, Colyer MH, Weichel ED (2008) Current trends in the management of intraocular foreign bodies. *Curr Opin Ophthalmol* 19: 225-233.
- Liston RL, Olson RJ, Mamalis N (1991) A comparison of rust-ring removal methods in a rabbit model: small-gauge hypodermic needle versus electric drill. *Ann Ophthalmol* 23: 24-27.
- Chern KCN (2002) *Emergency ophthalmology: a rapid treatment guide*. McGraw-Hill Professional.
- Goyal R, Shankar J, Fone DL, Huges DS (2001) Randomised controlled trial of ketorolac in the management of corneal abrasions. *Acta ophthalmologica Scandinavica* 79: 177-179.
- Kaiser PK, Pineda II R (1997) A study of topical nonsteroidal anti-inflammatory drops and no pressure patching in the treatment of corneal abrasions. *Ophthalmology* 104: 1353-1359.
- Guidera AC, Luchs JI, Udell IJ (2001) Keratitis, ulceration, and perforation associated with topical nonsteroidal anti-inflammatory drugs. *Ophthalmology* 108: 936-944.
- Turner A, Rabiou M (2006) Patching for corneal abrasion. *Cochrane Database Syst Rev* 2.
- Le Sage N, Verreault R, Rochette L (2001) Efficacy of eye patching for traumatic corneal abrasions: a controlled clinical trial. *Ann Emerg Med* 38: 129-134.
- Menghini M, Knecht PB, Kaufmann C, Kovacs R, Watson SL et al. (2013) Treatment of traumatic corneal abrasions: a three-arm, prospective, randomized study. *Ophthalmic Research* 50: 13-18.
- Macedo Filho ET, Lago A, Duarte K, Jung LS, Hofling Lima AL, et al. (2005) Superficial corneal foreign body: laboratory and epidemiologic aspects. *Arq Bras Oftalmol* 68: 821-823.
- Benson WH, Synder IS, Granus V, Odom JV, Macsai MS (1993) Tetanus prophylaxis following ocular injuries. *J Emerg Med* 11: 677-683.
- Brissette A, Mednick Z, Baxter S (2014) Evaluating the Need for Close Follow-up After Removal of a Noncomplicated Corneal Foreign Body. *Cornea* 33: 1193-1196.