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CASE REPORT PEER REVIEWED | OPEN ACCESS

Subconjunctival deferoxamine for corneal rust deposits associated with ocular siderosis: A case report

Rachel Tandias, Elizabeth Rossin, Emma Davies

ABSTRACT

Introduction: Ocular siderosis is a vision-threatening condition resulting from intraocular iron toxicity. This case re-establishes a role for subconjunctival deferoxamine, a chelating agent uncommonly used in ophthalmology, as an adjunctive treatment for ocular siderosis.

Case Report: A 37-year-old healthy male presented two months after an injury at work with intermittent pain and blurry vision in the right eye. Presenting visual acuity (VA) was 20/100 in the right eye. With delayed presentation, the patient already had ocular siderosis with corneal rust deposits and retinal damage. The patient underwent pars plana vitrectomy (PPV) with surgical view impaired by corneal deposits and intraocular metallic intraocular foreign body (IOFB) that disintegrated upon attempted removal. At six months postoperatively, VA was 20/70 in the right eye, and examination revealed worsened diffuse, pigmented subepithelial deposits in the central cornea, iris atrophy, cotton wool spots, optic nerve pallor, and a residual IOFB in the anterior vitreous, consistent with worsened ocular siderosis. Superficial keratectomy was performed in combination with repeat PPV to improve surgical visualization and aid in IOFB removal. An amniotic membrane was placed and a subconjunctival injection of deferoxamine was administered. The cornea was well-healed with significantly improved siderosis and no epithelial defects on 2-week postoperative follow-up. Visual acuity was 20/60 at last follow-up two months postoperatively after second surgery.

Conclusion: In treating ocular siderosis, subconjunctival injection of deferoxamine can be a useful addition to surgical IOFB removal to prevent the accumulation of iron deposits in the anterior segment of the eye.

Keywords: Deferoxamine, Intraocular foreign body, Ocular siderosis

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INTRODUCTION

Ocular siderosis, or siderosis bulbi, refers to the degenerative changes and toxic effects resulting from retention of an iron-containing foreign body within the eye. Iron deposition and oxidation in intraocular tissues can lead to vision-threatening complications, including corneal rust deposition, iris heterochromia, pupillary mydriasis, cataract formation, secondary glaucoma, and retinal pigment epithelium atrophy [1–3]. Firstline therapy involves removal of the retained IOFB to prevent further siderotic damage to intraocular structures [4].

Deferoxamine is a chelating agent commonly used to treat systemic iron overload. The compound has a high affinity for free iron ions and binds trivalent iron in hemosiderin and ferritin, thus limiting free radical formation and oxidative stress in tissues [5]. A number of

older studies investigated the use of topical deferoxamine for corneal rust ring removal in animal and human eyes [6–10]. Experiments in animal models suggested that serial subconjunctival injections of deferoxamine could prevent the development of siderosis and halt penetration of extrabulbar iron past the sclera [11–13]. Despite these promising studies in animal models and humans, the use of deferoxamine remains limited in ophthalmology.

In this case report, we discuss the clinical manifestations and management of ocular siderosis resulting from an occult metallic foreign body in the vitreous. Further, we suggest a role for subconjunctival injection of deferoxamine as a useful tool in preventing the reaccumulation of iron deposits in the anterior segment following IOFB removal.

CASE REPORT

A 37-year-old healthy male glass worker presented with intermittent pain and blurry vision in the right eye for two months. He recalled that the pain started when he was at work but denied overt trauma. Visual acuity (VA) was 20/100 in the right eye and 20/20 in the left eye with intraocular pressures of 21 and 22 mmHg in the right and left eyes, respectively. The right pupil was fixed and dilated, and a slit-lamp examination revealed a healed corneal scar with an underlying iris defect, diffuse corneal rust deposit, and iris heterochromia. The view to the fundus was hazy and attributed to brown pigment on the surface of the crystalline lens (Figure 1). A computed tomography scan of the orbits showed a 2 mm radiodense foreign body in the anterior inferior aspect of the right globe, consistent with a metallic IOFB. The IOFB was removed by 25-gauge PPV with combined cataract extraction and intraocular lens placement. Intraoperatively, the patient's cornea was noted to be hazy and the IOFB fragmented into multiple pieces while grasping it, which together prohibited assured removal of the IOFB.

At postoperative month 6, the patient was found to have VA of 20/70 in the right eye with a relative afferent pupillary defect. Slit lamp examination of the right eye revealed diffuse, subepithelial reticulated rust deposits in the central cornea, patchy iris atrophy, and a residual metallic foreign body in the anterior vitreous. Fundus examination showed new cotton wool spots and optic nerve pallor. After a discussion regarding the risks, benefits, and alternatives of surgery, the patient elected to proceed with repeat surgical intervention. Superficial keratectomy was performed with removal of the central corneal epithelium to improve the surgical view prior to 23-gauge PPV and IOFB removal. Intraoperative B-scan ultrasonography was utilized to confirm no further residual metallic foreign bodies. A double-layered amniotic membrane graft was sutured to the ocular surface with a running 10-0 nylon suture at the limbus. A subconjunctival injection of compounded deferoxamine 10 mg was administered, followed by subconjunctival injections of cefuroxime and dexamethasone. A temporary lateral tarsorrhaphy was performed. Two weeks postoperatively, the lateral lid sutures and amniotic membrane graft were removed at the slit lamp without complication. The cornea was found to be well-healed with significantly improved iron deposits and no epithelial defects. At two months postoperatively, patient's VA improved to 20/60 right eye with continued significantly improved iron deposits (Figure 2).

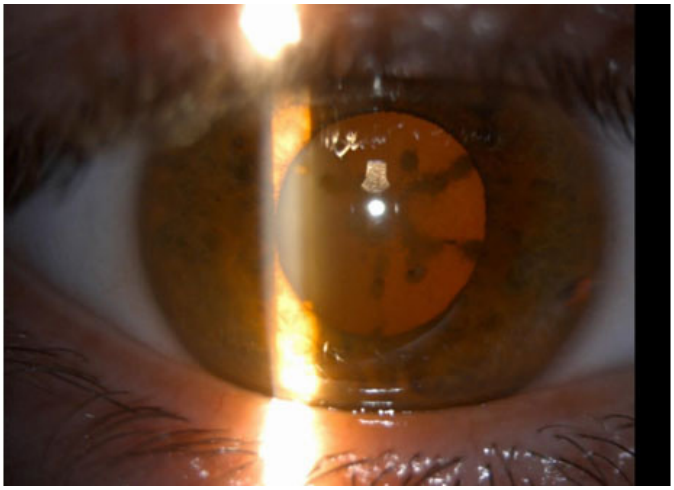

Figure 1: Slit lamp photograph of patient's right eye at presentation with diffuse rust deposit in cornea (seen by reddish haze in cornea in slit lamp beam), reddish pigment on anterior capsule, and iris heterochromia.

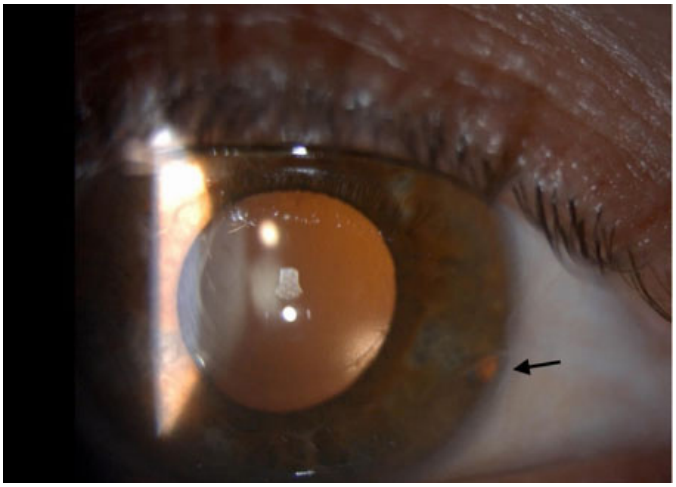

Figure 2: Slit lamp photograph of patient's right eye two months postoperatively with improved rust deposit in cornea (seen by clarity of cornea in slit lamp beam), persistent iris defect nasally (denoted by arrow), stable iris heterochromia, and pseudophakia.

DISCUSSION

The clinical manifestations of intraocular iron toxicity observed in cases of ocular siderosis may extend from

the cornea anteriorly to the retina and optic nerve posteriorly.

In the present case, the findings of a full-thickness corneal scar and iris transillumination defect in combination with clinical findings consistent with siderosis led to the diagnosis of an occult IOFB. Subepithelial rust deposits were observed in the present case, though iron granules may be deposited in any layer of the cornea and may be associated with a rust-colored stromal hue. Iris heterochromia develops over the course of months due to iron deposition in the iris stroma and epithelium, often in conjunction with a tonically dilated pupil. Lens findings include focal, rusty-brown nodules of subcapsular cataract and discoloration of the lens epithelium. Posterior segment effects include cystoid macular edema, diffuse pigmentary changes, vessel attenuation, retinal ischemia, and retinal detachment [1–3]. The pathophysiology of tissue damage is related to oxidative stress and the production of free radicals catalyzed by trivalent iron ions.

Initial management of siderosis involves surgical IOFB removal, as chronic iron exposure is progressively toxic to ocular structures. In the current case, combined phacoemulsification and PPV was performed due to the presence of a visually significant cataract on presentation. On reoperation, a superficial keratectomy was performed to remove the subepithelial corneal rust deposits and improve surgical visualization. Subconjunctival deferoxamine was used to chelate any retained iron particles and prevent reaccumulation of pigmented deposits in the ocular tissues. Deferoxamine was safe and effective in promoting transparency of the re-epithelialized cornea on short-term follow-up and was not found to delay wound healing. Use of deferoxamine is currently limited in ophthalmology, and it is not widely available on formulary. Of note, the deferoxamine used in the current case was compounded on site by the pharmacy at our institution.

This case report highlights that compounded deferoxamine may be utilized in cases with severe deposition of iron in the anterior segment without complications. Although there is no way of knowing whether iron would have reappeared in his anterior segment without deferoxamine use we can say that the use of deferoxamine at his surgery did not have any negative consequences and his cornea remains clear postoperatively.

CONCLUSION

We propose that subconjunctival injection of deferoxamine can be utilized as an adjunctive therapy to surgical IOFB removal to treat ocular siderosis affecting the anterior segment. We found that deferoxamine was safe and effective in promoting transparency of the cornea on short-term follow-up.

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Author Contributions

Rachel Tandias – Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Elizabeth Rossin – Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the

work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Emma Davies – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission
The corresponding author is the guarantor of submission.

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Conflict of Interest
Authors declare no conflict of interest.

Data Availability
All relevant data are within the paper and its Supporting Information files.