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Case Report

Infectious crystalline keratopathy predominantly affecting the posterior cornea

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Abstract: A case of infectious crystalline keratopathy that affects mainly the posterior stroma is presented. Crystalline infiltrates presented after multiple epithelial defects and chronic topical steroid use following a penetrating keratoplasty in this patient. His epithelial defects persisted and given the deep location of the crystalline infiltrates, a penetrating keratoplasty was performed again. Slit-lamp photo demonstrates the crystalline plaque. Confocal microscopy also documents the aggregates of crystal-like structures. Histology slides are also presented that show the disruption of the stromal-Descemet interface and the predominance of pathology confined to the posterior stroma which has been documented in the literature as a rare finding.

Keywords: Crystalline, keratopathy, stroma, cornea, penetrating keratoplasty

Introduction

Infectious crystalline keratopathy (ICK) is an indolent, corneal infection that causes intrastromal opacities in the absence of corneal or anterior segment inflammation. It has most often been associated as a complication of corneal surgery or keratitis. Treatment involves aggressive antibiotic therapy although some cases require a penetrating keratoplasty if scar formation occurs in the central visual axis.

Most cases of ICK have been reported to have crystalline deposits in the anterior and sometimes, midstromal locations. There have been a few reports of posterior involvement of ICK however, in those reports, Descemet's membrane and the endothelium were intact. We report a case of ICK with predominantly posterior involvement of the cornea, with disruption of the stromal-Descemet interface and affected endothelium.

Case report

We report a case of a 76 year old male with the history of retinal detachment in his right eye (OD) s/p a scleral buckle, pars plana vitrectomy and sutured intraocular lens (IOL), Fuchs' Dystrophy s/p a Descemet stripping endothelial keratoplasty (DSEK) OD and s/p penetrating keratoplasty (PKP) x2 (in 2001 and 2004) in his left eye (OS), who has been on prednisolone acetate one drop daily in both eyes (OU). He initially presented to the tertiary academic center eye clinic with pain in his left eye after removing his rigid gas permeable lens. His vision was initially 20/40 OD, 20/400 sc OS (baseline 20/200 uncorrected; best-corrected vision one month earlier 20/25), with no afferent pupillary defect, full extraocular movements, confrontation visual fields and color vision. His anterior slit-lamp examination was pertinent for a clear graft OD; he had 1+ scleral injection OS, with intact PKP exhibiting a 0.75×1.2 mm epithelial defect with an adjacent 1 mm infiltrate in the inferotemporal quadrant, trace cells in the anterior chamber (AC) and a centered ACIOL. The corneal ulcer was managed with moxifloxacin and a bandage contact lens (BCL) for comfort. His symptoms greatly improved and his vision returned to his baseline.

He returned about 6 months later with a repeat epithelial defect in the left eye after falling asleep wearing his rigid gas permeable lens.

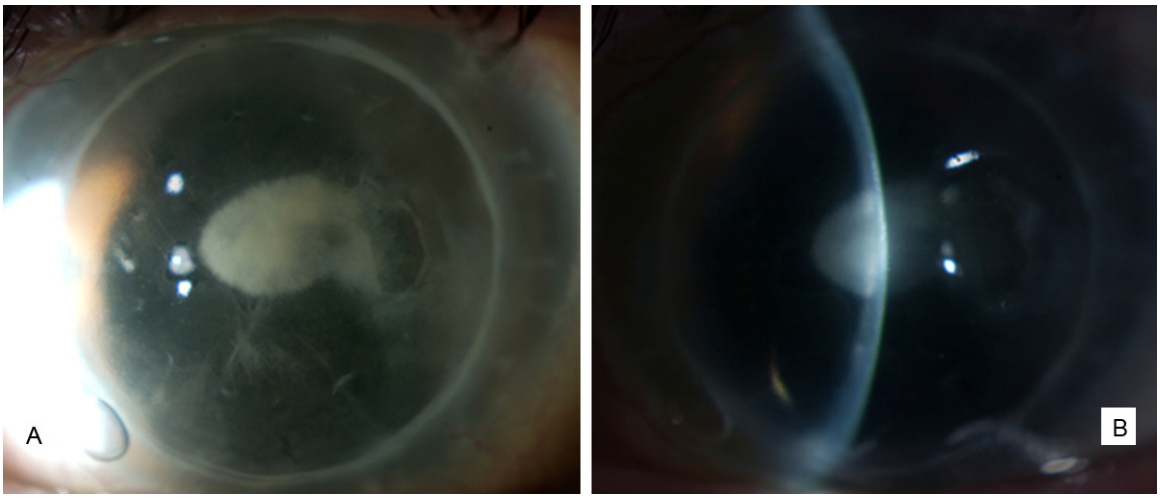

Figure 1. Slit-lamp photos. A. A photo showing the dense stromal plaque. B. Slit beam indicates the stromal plaque is deep in the posterior cornea.

His epithelial defect measured 2×1.5 mm at the same location of his initial defect, but lacking a visible infiltrate. There were trace stromal cells, but no keratic precipitates. He was started on moxifloxacin again with a BCL, and his defect healed within a month.

He returned for a scheduled follow-up visit about 3 months after his second epithelial defect, at which time the best-corrected vision in his left eye was 20/25. His slit-lamp exam showed a healed epithelial defect with residual epithelial irregularity, and microcystic edema at the temporal edge of the graft with subepithelial scarring. This was concerning for graft rejection and the dosing of his prednisolone acetate was increased to every two hours. He returned after tapering prednisolone acetate to his baseline one drop daily dose with a clear graft, however, he had a recurring epithelial defect now 1 mm in size at the same site of his initial defect. He was started on ciprofloxacin ointment and returned in two weeks with vision 20/40 OS. His slit-lamp exam showed corneal haze inferotemporally, and an epithelial defect resolving with keratic precipitates on the endothelium. Given concern for graft rejection, he received a subconjunctival triamcinolone acetonide injection.

He returned one week later with more left eye pain and visual acuity with correction of 20/400 OS. His corneal haze was increased and now he presented with a central, dense, deep stromal plaque (**Figure 1A**, **1B**). There was concern for a fungal versus bacterial infection and confocal scanning microscopy imaging was done (**Figure 2**). He was then scheduled for a penetrating corneal transplant and his corneal opacity was sent for pathology and microbiology culture.

Histological examination of the cornea (**Figure 3A**) revealed flocculent aggregates of granular material separating the deeper layers of the cornea with a conspicuous absence of neutrophilic inflammation. The overlying epithelium was thinned, consistent with re-epithelialization and there were bullae overlying the center of the lesion. Descemet's membrane had separated from the rest of the cornea, and exhibited a region of endothelial attenuation associated with retrocorneal fibrosis on one side. Gram stain revealed dense colonies of gram positive cocci (**Figure 3B**). The microbiology cultures were positive for group-A hemolytic streptococcus.

Discussion

We report a case of infectious crystalline keratopathy following repeated topical steroids and recurrent corneal epithelial defects where the colonies of bacteria are restricted predominantly to the deep cornea. Most case reports of ICK describe the bacterial colonies in the anterior stroma of the cornea [1-3]. James et al. suggested that the break in Bowman's membrane may play a role in mode of bacterial entry into the stroma [4], and suture tracks being the

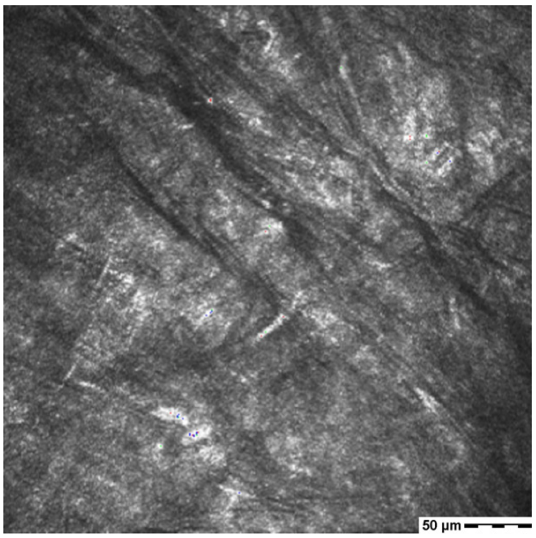

Figure 2. Confocal electron microscopy shows the crystal-like structures.

most probable mode in the case of penetrating keratoplasty. Samples et al. suggested that the advantageous environment for growth in the anterior stroma may account for the predilection of organisms to accumulate at that depth [3]. In fact, James et al. even suggested that the depth of crystal deposits may even help with diagnosis, as crystals found in the deep stroma are often seen in graft rejection [4], making ICK less likely.

Although these are valid observations, it has been noted previously that ICK can present in the posterior stroma as well. Pararajasegaram et al. reported a case of ICK following a penetrating corneal graft that revealed the presence of Gram-positive cocci lying between the stromal lamellae in the posterior third of the cornea, however no organism could be cultured from the biopsy [5]. This case ultimately required a replacement graft. Similarly, Lubniewski et al. reported two cases of ICK following penetrating keratoplasty that were also located in the posterior stroma with Descemet's membrane intact [6]. Since crystalline infiltrates persisted despite intravitreal and topical antibiotics, a replacement penetrating keratoplasty was required in both of those cases, as well [6].

In all of these cases of ICK involving the posterior stroma, it is noted that Descemet's membrane remained intact and the endothelium was unaffected. In fact, even in Gorovoy et al.'s

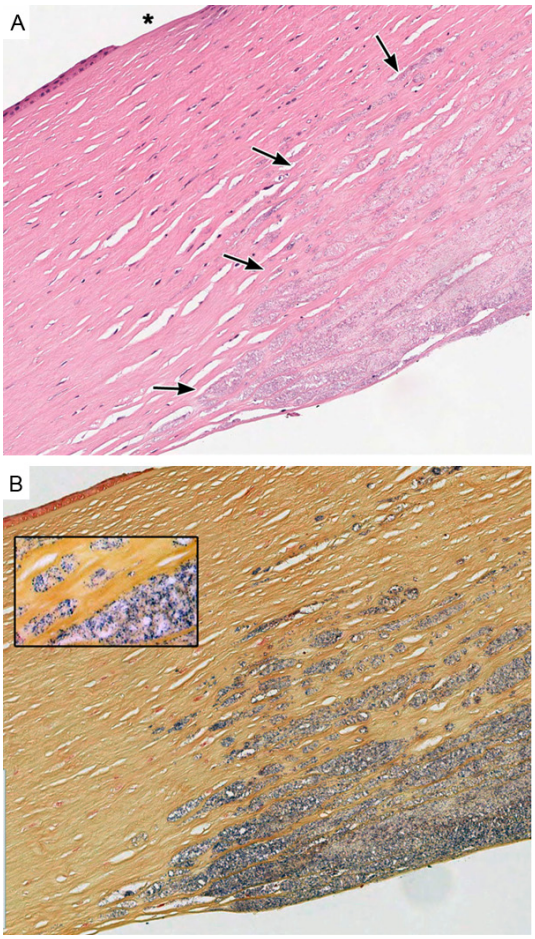

Figure 3. Pathology slides of corneal tissue. A. H&E stained section of the cornea reveal a region of de-epithelialization (asterisk) associated with deep, underlying infiltrates of pale granular-flocculant material (arrows). Note the absence of a neutrophilic inflammatory response. B. Gram stain reveals numerous large colonies of gram positive (blue) bacteria, shown at higher magnification in the inset. Original magnification 100×; inset 400×.

description of the first documented case of ICK, it was noted that Descemet's membrane was intact except at the graft-host junction, and the endothelial cells were normal in morphology except for being slightly reduced in number [1]. In our case report, the histology slides demonstrate a region of endothelial attenuation associated with retrocorneal fibrosis on one side and dense colonies of bacteria in the posterior third of the stroma. One cannot tell for certain if the posterior pathology was secondary to a possible precursor of graft failure or from ICK, but given the bacteria noted deep in the stroma, it seems likely to be from ICK. In addition, there was disruption of the

stromal-Descemet interface that may have been weakened by the infectious nature of this disease process which has not been described in previous reports.

Treatment options for posterior involvement of ICK may be more limited and topical antibiotics may not penetrate the cornea to clear deposits. Given the above reports and our case report of posterior stromal involvement, the deeper involvement of the cornea may be a predilection for ultimately requiring penetrating keratoplasty. Other novel treatments such as Nd: YAG laser treatment to the biofilm has been reported with success, however Daneshvar et al even suggests that this is likely related to the superficial location of the corneal crystalline infiltrate [7]. In fact, corneal endothelial damage has been reported with Nd: YAG laser corneal photocoagulation and therefore would not suffice as a suitable option if the very deep stroma or endothelium is involved, as was the case in our patient [8].

In conclusion, for ICK cases involving the deep stroma, it may require total penetrating keratoplasty as a first-line treatment given antibiotic penetration may be difficult. It may be difficult to examine the extent of deep involvement on slit-lamp examination, although an excisional biopsy may guide treatment.

Disclosure of conflict of interest

None.

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