Identifying anterior segment crystals

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Abstract

A series of 22 patients with crystals in the anterior segment of the eye was examined by specular microscopy. Of 10 patients with hypermature cataract and hyperrefractive bodies in the anterior chamber cholesterol crystals were identified in four patients and in six of the 10 in whom aspirate was obtained cholesterol crystals were demonstrated in three, two of these having shown crystals on specular microscopy. In 10 patients with intra-corneal crystalline deposits, cholesterol crystals were found on specular microscopy, including one case of Schnyder's crystalline corneal dystrophy. Of two patients with multiple myeloma, corneal crystals were demonstrated in one. Crystals of the anterior segment of the eye are most likely to be cholesterol, and identification is important for future treatment.

Diagnosis of the nature of crystalline deposits seen in the anterior segment of the eye may form the basis of treatment. Though uncommon, crystalline deposits may occur in a wide variety of conditions^{1,2} and it is important to differentiate those associated with a variety of general medical conditions from those occurring in local corneal disease, such as old corneal scarring, or those associated with the recently described infectious crystalline keratopathy.³⁻⁶

We have studied a series of patients who presented with crystalline deposits in the cornea and in the anterior chamber of the eye, identifying these crystals by specular microscopy and also by light microscopy when an aspirate from the anterior chamber could be obtained. The value of these findings in the diagnosis of the underlying condition is discussed.

Materials and methods

A series of 22 patients were studied with various types of crystal in the anterior segment. Ten patients, six males and four females, mean age 71 (SEM 5) years, range 44 to 84 years, had crystals in the anterior chamber associated with a hypermature cataract. Another 12 patients, three males and nine females, aged 64 (SEM 4) years, range 42 to 83 years, were examined for crystalline deposits in the cornea, including two patients with multiple myeloma.

Specular microscopy was performed with the wide-field Pocklington contact specular microscope (Konan Camera Research Inc, Hyogo, Japan) after the instillation of topical oxybuprocaine hydrochloride 0.4% (Benoxinate), without a contact lens. Conventional and relief mode specular microscopy pictures were obtained by our previously described technique.^{7,8} The relief mode^{9,10} enables the observer to view the

changes taking place on the posterior surface of the corneal endothelium. Photographs were taken of the central cornea and also above, below, and to either side in an extensive pattern. A Minolta XD-5 camera with data back was attached to the specular microscope. Kodak Tri-X 135 film was used and developed in D 76 developer for 13 minutes at 23°C. Corneal deposits were examined by coming forward to focus on these deposits at various levels in the corneal stroma. Crystals in the anterior chamber could be demonstrated by focusing back into the anterior chamber, which allowed visualisation of deposits on the posterior surface of the cornea as well as material circulating in the anterior chamber of the eye.

Fresh anterior chamber aspirate was obtained in six patients with hypermature cataract and phacolytic glaucoma and was examined by direct microscopy, without the use of xylol or alcohol in order to avoid dissolving the crystals.

Patients were derived from the authors' practices or hospital outpatients seen from 1985 to 1990. Ethical approval was provided by the Research and Ethics Advisory Committee of the hospital and informed consent was obtained from all subjects.

Results

Of the 22 patients there were 10 with hypermature cataract and refractile bodies in the anterior chamber, 10 with hyperrefractive granules in the cornea, and two with multiple myeloma, one having superficial fine particulate corneal opacities. Ten patients with a hypermature cataract showed hyperrefractive granules in the anterior chamber on slit-lamp biomicroscopy (Fig 1). On specular microscopy crystals were demonstrated on the posterior corneal surface or in the anterior chamber in four of these 10 patients. These crystals had a typical rectangular appearance consistent with cholesterol crystals (Fig 2), though the notched corner typical of cholesterol could not always be

Figure 1 Slit-lamp biomicroscopy of the left eye of a 55-year-old male with a hypermature cataract shows dense exudate with hyperrefractive bodies in the anterior chamber.

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Figure 2 Specular microscopy of the same eye as Figure 1 shows numerous rectangular light crystalline structures consistent with cholesterol crystals. (Bar=100 μm .)

identified. The presence of these crystals was subsequently confirmed in anterior chamber aspirate in two of these patients who were among the six patients on whom anterior chamber aspiration was performed. Of the six patients in whom crystals were not demonstrated on specular microscopy it was not possible to obtain any detail on specular microscopy owing to corneal oedema in three patients, while in the other three it was possible to obtain detail but not to see crystals. Fresh anterior chamber aspirate was obtained in six of the 10 patients with hypermature cataract, and in three of these typical crystals were demonstrated, including two patients in whom crystals were seen on specular microscopy. These crystals were birefringent to polarised light (Fig 3).

There were 10 patients with various local corneal conditions in whom possible corneal crystals were seen clinically on slit-lamp biomicroscopy. These included five patients with old quiescent vascularised corneal scars, two with old seronegative interstitial keratitis, one with Schnyder's crystalline corneal dystrophy, one with an old corneal graft, and one with marginal degeneration of the cornea. Specular microscopy in all these patients showed light rectangular crystalline structures (Figure 4) con-

Figure 4 Specular microscopy of the right eye of a 70-year-old female with deposits of crystals in an old area of vascularised scarring shows rectangular crystals in the corneal stroma consistent with cholesterol crystals. Arrow indicates a notched corner. (Bar=100 μm .)

Figure 3 Anterior chamber aspirate from the same eye as in Figures 1 and 2. Under polarised light birefringent flat rectangular notched crystals of cholesterol are seen. (Original magnification, $\times 2500$.)

sistent with cholesterol, though a notched corner could not always be demonstrated.

In one of the two patients with multiple myeloma numerous fine superficial corneal opacities were seen on slit-lamp biomicroscopy. Specular microscopy showed numerous light stick-like structures of uniform thickness with rounded ends arranged irregularly at angles to each other. They ranged from 1 to 4 endothelial cell diameters in length (Fig 5) and were consistent with myeloma crystals.

Discussion

Establishing the exact nature of crystalline structures in the anterior segment of the eye presents a clinical problem, as biopsy is usually not possible. Although it is possible to examine an anterior chamber aspirate, this is an invasive procedure, and identification of the crystals may be required before operation is undertaken. It may be very difficult to obtain material which can be usefully examined by corneal biopsy, especially if the deposits are deep, while specular microscopy is a simple non-invasive means of identification.

In the present cases most of the crystals were cholesterol, and these could be identified because of their regular geometric form, though a notched corner was not always apparent as the crystals could overlap each other or be seen edge on. However, some discrete crystals were usually seen, and their morphology differed from that described for the deposits of infectious crystalline keratopathy, whose exact nature is still not clearly established¹¹ and whose differentiation has important treatment implications. The cholesterol crystalline deposits seen in our cases were static or only very slowly progressive and most were associated with old quiescent vascularised keratopathy of various causes, including one patient who had a corneal graft, two others with old interstitial keratitis, and one with marginal corneal degeneration with little vascularisation.

The morphology of deposits seen in our case with multiple myeloma was distinctive and different from the cholesterol deposits seen in the other cases. One report of deposits in multiple myeloma described crystalline deposits within the endoplasmic reticulum of plasma cells,¹² another crystals in the cytoplasm of keratocytes,¹³ while another report¹⁴ described needle-like elec-

Figure 5 Specular microscopy of the left eye of a 61-year-old female with multiple myeloma showing numerous small stick-like crystalline structures lying at different angles to each other, consistent with myeloma crystals. (Bar=100 μ m.)

tron-dense extracellular particles in the cornea at all levels. In our patient the numerous light stick-like structures seen on specular microscopy were up to 4 endothelial cell diameters in length, which strongly supports an extracellular location for these crystals.

Although other crystalline deposits have been described in the cornea, our experience suggests that corneal crystalline deposits are most likely to be cholesterol, as are the hyperrefractive granules in the anterior chamber of patients with hypermature cataract. Specular microscopy may

be used to identify these crystals, thus providing a basis for clinical diagnosis and subsequent management without the need for invasive biopsy.

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