

## Answers to Medical Quiz

Nada Sayed Hassan Al-Yousuf. FRCS(Ed)\*

- A1. Infectious crystalline keratopathy.
- A2. Mostly by *Streptococcus viridans*.
- A3. The response to antibiotics is usually poor. Superficial lamellar keratectomy to remove or debride the infected tissue can be curative. Other therapeutic measures are excimer laser ablation and repeat penetrating keratoplasty.
- A4. *Streptococcus viridans* produces a glycocalyx matrix that is thought to contribute to the crystalline shaped deposits seen clinically. This matrix serves to “hide” the bacteria from the immune system. This helps to explain both the absence of ocular inflammation and the white cell infiltrates.

### DISCUSSION

Infectious crystalline keratopathy (ICK) is a slowly progressive unique indolent keratitis. It occurs almost exclusively in patients with corneal grafts who are on topical steroids.

Clinically, it consists of a dense, white, deep, infiltrate from which crystalline deposits are seen to arise in a branching pattern. The epithelium overlying the dense infiltrate may be denuded or intact. Occasionally, the infiltrate may erode through the epithelium and present on the surface.

The infecting organism is usually *Streptococcus viridans*<sup>1-3</sup>. The bacteria colonize the anterior corneal lamellae. Rarely, other organisms, such as *Enterococcus*, *Peptostreptococcus*, *Haemophilus aphrophilus*, *Alternaria*, *Mycobacterium fortuitum*, and *Candida* species, have been implicated<sup>3,4</sup>. *Streptococcus epidermidis* can produce infectious crystalline keratopathy in the posterior stroma<sup>5</sup>.

The presence of biofilm in ICK can be demonstrated with transmission electron microscopy with appropriate fixation techniques that stabilizes the bacterial extracellular matrix. Biofilm stains intensely with Periodic acid Schiff because of the polysaccharide rich extracellular matrix and weakly with Gram stain because of the high proportion of nonviable organisms. Biofilm formation occurs in ICK but probably not in chronic bacterial keratitis without crystalline changes. Secretion of an extracellular matrix by bacteria to form a biofilm is a response to

nutrient-deprived environment where growth and replication is depressed. Electron microscopy of corneas with infectious crystalline keratopathy caused by *Candida albicans* also revealed the organism surrounded by a polysaccharide-rich glycocalyx consisted with a biofilm<sup>6</sup>. The extracellular matrix of the biofilm may mask the microorganism antigens, explaining the relative lack of inflammatory response in these infections and the relative resistance to antibiotic treatment.

A culture proven diagnosis of infectious crystalline keratopathy may be difficult to achieve, especially when the organism is a nutritionally variant strain of *Streptococcus*. Various culture enhancement may be needed, including longer incubation times, pyridoxal hydrochloride supplementation to the media, cross streaking the media with *Staphylococci*, and incubation in 5 to 10 % CO<sub>2</sub><sup>3</sup>. Although in vitro studies show susceptibilities to penicillin G, gentamicin, and cephalothin<sup>1</sup>, *S. viridans* is slowly growing, and the response to antibiotics is usually poor. The inflammatory response may be dampened by topical steroid therapy.

In cases where the keratopathy is very superficial, excimer laser ablation and superficial lamellar keratectomy were found to be successful<sup>7</sup>. Often repeat penetrating keratoplasty is required for definitive therapy. Prognosis is favourable in these cases<sup>1-3</sup>.

## REFERENCES

1. Sutton GL, Miller RC, Robinson LP. Infectious crystalline keratopathy. *Aust N Z J Ophthalmol* 1990;18:151-5.
2. Pararajasegaram P, Mower G, Barras CW, et al. An unusual case of crystalline keratopathy. *Aust N Z J Ophthalmol* 1990;18:155-6.
3. Ormerod LD, Ruoff KL, Miesler DM, et al. Infectious crystalline keratopathy. Role of nutritionally variant *Streptococci* and other bacterial factors. *Ophthalmology* 1991;98:159-63.
4. Lam S, Miesler DM, Krachmer J. Enterococcal infectious crystalline keratopathy. *Cornea* 1993;12:273-7.
5. Lubniewsky AJ, Houchin DR, Holland EJ. Posterior infectious crystalline keratopathy with *Staphylococcus epidermidis*. *Ophthalmology* 1990;97:1454-9.
6. Elder MJ, Matheson M, Stapleton F, et al. Biofilm formation in infectious crystalline keratopathy due to *Candida albicans*. *Cornea*. 1996;15:301-4.
7. Eiferman RA, Forgey DR, Cook YD. Excimer laser ablation of infectious crystalline keratopathy. *Arch Ophthalmol* 1992;110:18-23.