INFLAMMATORY DISEASE
Bacterial keratitis is a serious corneal infection with large numbers requiring hospital treatment

by Dermot McGrath in Vienna

The imaging capabilities of anterior segment optical coherence tomography (AS-OCT, Visante, Carl Zeiss Meditec Inc) allows for objective, in-vivo assessment of microbial keratitis and effective monitoring of the disease course, according to a presentation at the 2nd EuCornea Congress.

"AS-OCT can be used for in-vivo quantification of bacterial keratitis and provides us with an objective assessment of corneal inflammation and treatment response with serial examinations," said Aris Konstantopoulos MSc, MRCophth.

Dr Konstantopoulos, an ophthalmologist at Southampton University Hospitals NHS Trust, UK, noted that corneal inflammatory disease is a major cause of blindness, as the infection and inflammation can lead to scarring, melting and perforation.

"Bacterial keratitis is a serious corneal infection with at least 4,000 cases of contact lens wearers requiring hospital treatment every year in the UK alone," he said.

The typical pathologic features of bacterial keratitis include epithelial ulceration followed by stromal inflammatory infiltration and the development of corneal oedema as the disease progresses. With slit-lamp examination, it is possible to measure epithelial defect dimensions including infiltrate dimensions and hypopyon height, said Dr Konstantopoulos. Nevertheless, assessment of the depth and extent of pathologic features is subjective and depends significantly on the experience of the examiner. "It is difficult using this approach to form a quantitative assessment of the corneal oedema, and while we can partially assess the conjunctival/episcleral injection, we can't actually grade it," he said.

Given the drawbacks of slit-lamp analysis, Dr Konstantopoulos and Dr Parwez Hossain, consultant ophthalmologist and senior lecturer at the University of Southampton, set out to determine if anterior segment OCT, which has been successfully used to analyse the architecture of clear corneal incisions after cataract surgery and to assess the depth of intrastromal corneal rings in keratoconic eyes, might provide a more objective assessment of corneal inflammation.

"This relatively new imaging modality provides us with non-contact cross-sectional scans of the cornea and the anterior segment and has very good penetration through opaque structures that develop in the cornea. It also incorporates software for the measurement of pathology or structure of the anterior segment," he said.

Because of its non-contact examination, it may be an ideal method for evaluating and monitoring corneal ulcers that are suspected to be microbial in origin, he added.

Dr Konstantopoulos’s study set out to compare corneal inflammation between Gram-positive and Gram-negative pathogens in 18 bacterial keratitis patients. After clinical diagnosis of keratitis was confirmed using corneal scrapes, all patients were treated with intensive cefuroxime and ofloxacin drops. Clinical examination and AS-OCT scans were conducted on presentation and days three, seven and 14 of treatment. 11 patients were found to have Gram-negative pathogens and seven had Gram-positive pathogens.

Cross-sectional AS OCT scans were carried out at all visits through the same area of the corneal infiltration, with the scanning beam running through the meridian that crossed the centre of the infiltration, he said.

"In using AS OCT to assess corneal inflammation, the three key parameters that we looked at in this study were corneal thickness, infiltrate thickness, and infiltrate width," he said.

Overall, the results showed that Gram-negative pathogens induced more corneal inflammation than Gram-positive bacteria. The corneal inflammation decreased rapidly within three days of treatment and differences in infiltrate thickness and corneal thickness between pathogen groups became non-significant after the three-day treatment mark, said Dr Konstantopoulos.

While the small patient numbers limited the significance of the study, he said that data from a larger series also supported the conclusion that gram-negative pathogens induce a larger inflammatory reaction.

"The intense inflammatory reaction observed with AS-OCT is consistent with the clinical picture of the more destructive disease of pseudomonas. We also have the findings from animal studies of bacterial keratitis that show that it is predominantly polymorphonuclear neutrophil infiltration that characterises these infiltrates and that corneal oedema is proportional to corneal ingress of these neutrophils," he said.

Summing up, Dr Konstantopoulos said that AS-OCT examination could be used for objective in-vivo quantification of bacterial keratitis, that Gram-negative pathogens induce more corneal inflammation than Gram-positive bacteria and that corneal inflammation decreases rapidly within three days of treatment. Responding to a question from John Kanellopoulos MD on whether the study might justify the use of corticosteroids in the management of infectious keratitis, Dr Konstantopoulos said further study was needed before making any such recommendation.