British Journal of Ophthalmology, 1984, **68**, 472–474

Corneal ulcer due to *Achromobacter xylosoxidans*

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SUMMARY We report a case of corneal ulcer caused by the opportunistic organism *Achromobacter xylosoxidans* which developed during chronic topical steroid treatment of an eye with neovascular glaucoma. *A. xylosoxidans* has probably been underreported as a cause of ocular infection because of confusion between this organism and other Gram-negative organisms, particularly pseudomonas. *A. xylosoxidans* is resistant to aminoglycosides and some cephalosporins but not carbenicillin. This difference in antibiotic sensitivity patterns between *A. xylosoxidans* and pseudomonas makes an accurate differentiation between the 2 organisms important. This case was successfully treated after substituting topical carbenicillin for topical gentamicin and amikacin.

Achromobacter xylosoxidans is a Gram-negative water-borne bacterium first described and named in 1971 by Yabuuchi and Ohyama,[1] who isolated the organism from the purulent ear discharge of 7 patients. The first report of an ophthalmic infection was in 1977, when the organism was isolated from an infected orbit.[2] It has also been isolated from spinal fluid, blood, urine, and bronchial washings.[3] The organism has been variously classified as a Mimea and later Acinetobacter. It is easily confused with pseudomonas and other Gram-negative pathogens but has a different antibiotic sensitivity profile. We report here a patient with a corneal abscess due to this organism.

Case report

A 34-year-old man was struck in the right eye by an airgun pellet at age 12, the accident resulting in no light perception. The patient remained comfortable until September 1979, when he developed severe pain in the right eye. Examination at that time revealed a normal left eye, a 40 prism dioptre right exotropia, right circumcorneal vascular injection, diffuse epithelial and stromal corneal oedema, iris neovascularisation, a 3 mm hyphaema, a dense cataract, and an intraocular pressure of 54 mmHg. There was no light perception in the eye and a diagnosis of neovascular glaucoma was made. Treatment was instituted with atropine 1% twice daily and dexamethasone 0·1% 4 times daily, with disappearance of pain and inflammation.

Two months later he again developed severe pain in the right eye associated with an infiltrate in the central cornea and loss of 25% of the overlying corneal tissue without hypopyon. Superficial and deep vessels occupied the entire peripheral cornea. The corneal ulcer was cultured with a cotton tipped applicator and later placed on chocolate and blood agar. Samples taken for Gram stain revealed polymorphonuclear leucocytes and slender Gram-negative rods, tentatively diagnosed as pseudomonas. Initial therapy included topical gentamicin 5 mg/ml hourly, subconjunctival injection of gentamicin 20 mg, topical carbenicillin 6 mg/ml hourly, and atropine 1%. The dexamethasone 0·1% which he had used for the previous 2 months was discontinued. A repeat subconjunctival injection of gentamicin 20 mg was given on the second day. The initial culture report identified the organism as a pseudomonas species resistant to gentamicin but sensitive to carbenicillin.

The corneal infiltrate progressed and he was admitted to the Emory University cornea service. The right cornea contained a large superior paracentral, propeller-shaped, yellow-white stromal infiltrate with an overlying epithelial defect and diffuse epithelial and stromal oedema.

Scrapings obtained from the ulcer with a platinum spatula were plated directly on to blood, chocolate, Lowenstein-Jensen, and Sabouraud agars and into thioglycolate broth. Gram stain of the scrapings

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showed numerous polymorphonuclear leucocytes and Gram-negative rods. The patient was continued on topical atropine 1%; carbenicillin 6 mg/ml was increased to every 30 minutes; topical amikacin 25 mg/ml was added every 30 minutes. After 2 days on this therapy the infiltrate and ulcer remained unchanged.

The initial cultures taken by the referring ophthalmologist and those taken at Emory grew *Achromobacter xylosoxidans*. A tube dilution antibiotic sensitivity test of minimum inhibitory concentrations demonstrated resistance to amikacin at 64 µg/ml and resistance to gentamicin at 32 µg/ml but sensitivity to carbenicillin at 8 µg/ml. Since the abscess was clearing clinically, the topical amikacin and carbenicillin were continued for 72 hours, then amikacin was discontinued. By the sixth hospital day the epithelial defect was healed, and minimal corneal infiltrates remained. After discharge on tapered doses of carbenicillin for a one-week period the patient became asymptomatic, and the ocular inflammation disappeared.

Discussion

The paucity of reports of ophthalmic infection caused by *Achromobacter xylosoxidans* may reflect infrequent recognition of the organism caused by confusion in the nomenclature and difficulty in identification. Because pseudomonas species are common ocular pathogens, the misidentification of achromobacter as pseudomonas occurred in this case when the early cultures indicated a Gram-negative rod. Consequently the patient was started immediately on gentamicin. This was an ineffective treatment, since achromobacter isolates are resistant to aminoglycosides and cephalosporins[4] (Table 1).

Since *A. xylosoxidans* is most frequently found accompanying other organisms in clinical infections,[5] its pathogenic role is difficult to assess. It can be considered an opportunistic pathogen. Dworzack *et al.*[6] described a patient with a deficiency of IgM who developed pneumonia due to *A. xylosoxidans*. Holmes *et al.*[2] reported finding *A. xylosoxidans* in the blood of one patient on chemotherapy for breast carcinoma, in another patient with metastatic adenocarcinoma in the liver, and in a third patient on chronic steroid inhalation therapy.

A. xylosoxidans has rarely been isolated from the eye. Holmes *et al.*[2] isolated the organism from the infected orbit of a patient who had lost the globe after a perforating injury from shrapnel. Our case is unusual because the corneal ulcer was due solely to achromobacter. The patient was on chronic topical steroids for therapy of his noevascular glaucoma and corneal oedema. The steroids probably interfered with local immune defense mechanisms, enabling achromobacter to establish itself opportunistically.

A. xylosoxidans is an aerobic, oxidase-positive, Gram-negative rod.[7] The specific growth characteristics of our isolate are listed in Table 2. In 1939 *A. xylosoxidans* was included in the class Mimeae, which were a group of Gram-negative bacilli.[8] Gilardi,[9] while studying the Mimeae, was able to identify 2 new genera biochemically; *Achromobacter anitratus* and *A. lwoffii*. *A. anitratus* was reported as a causative agent of conjunctivitis[10] in 1949 and of corneal ulcers[11] in 1968. The organisms are Gram-negative, oxidase-negative, and now recognised as members of the Acinetobacter group. *Achromobacter* and the *Alcaligenes* genus resemble each other biochemically. However, oxidative production of acid from glucose and xylose excludes *Achromobacter* from the genus *Alcaligenes*, which is assaccharolytic.

Pien and Higa[12] isolated from external ear drainage 9 strains of *A. xylosoxidans* that had previously been reported by their laboratory as *Pseudomonas* species, non-*P. aeruginosa*. The organisms they isolated were peritrichously flagellated, oxidase-positive, Gram-negative, as well as sensitive to carbenicillin, sulphonamide, and trimethaprim/sulphamethaxozole combination. The type and number of flagella and the characteristic antibiotic sensitivity pattern serve to differentiate *Achromobacter* from *Pseudomonas*, which is resistant to sulphonamide/trimethaprim/sulphamethaxozole.[4]

The source of *A. xylosoxidans* and its natural habitat are unknown. Holmes *et al.*[2] suggested the organism is a water pathogen. Two of their strains were isolated from a swimming pool and from chlorhexidine 0·5% solution. Shigeta *et al.*[13]

Table 1 *antimicrobic susceptibilities of* Achromobacter xylosoxidans *from corneal ulcer*

Antibiotic	*Broth minimum inhibitory concentration µg/ml*	*Agar disc diffusion*
Amikacin	>64	R
Ampicillin	16	R
Carbenicillin	8	S
Cefamandole	16	S
Cefoxitin	>64	S
Cephalothin	64	R
Chloroamphenicol	32	I
Gentamycin	>32	R
Kenamycin	>64	R
Penicillin	>16	R
Polymyxin B	8	S
Tetracycline	32	R
Tobramycin	>32	R
Trimethoprim/ sulphamethoxazole	≤1·2/0·06	S

R=resistant. S=sensitive. I=intermediate.

Table 2 *Biochemical characteristics of* Achromobacter xylosoxidans *isolate from corneal ulcer*

Characteristics	*Results*
Gram-negative asporagenous rod	+
Motility, Difco	+
Oxidase	+
Growth on MacConkey agar	+
Growth on salmonella-shigella agar	+
Growth on cetrimide agar	+
Citrate, Simmons	+
Catalase	+
Nitrate reduction to gas	+
TSI (slant/butt)	K/K*
H_2S production, TSI butt	−
H_2S production, lead acetate paper	−
Litmus milk	K
Water soluble pigment production	−
OF glucose open, acid Difco	−
OF glucose sealed, acid Difco	−
OF glucose open, acid CDC, SB46 medium	−
OF glucose sealed, acid, CDC SB46 medium	−
Oxidate production from (CDC SB15 medium):	
glucose	+
xylose	+
mannitol	−
lactose	−
sucrose	−
maltose	−
fructose	−
10% glucose	K
10% lactose	K
L-lysine decarboxylase	−
L-arginine dihydrolase	−
L-ornithine decarboxylase	−
Growth, 5°C	−
Growth, 25°C	+
Growth, 37°C	+
Growth, 42°C	+
Gelatin hydrolysis	−
Indole	−
Urea, Christensen's	−

*Alkaline.

described an outbreak of cerebral ventriculitis and suggested it was due to contaminated chlorhexidine solution. The organism was isolated in 20 containers of the solution and from the wash basins on the surgical wards. Although this organism is infrequently encountered, because of its resistance to gentamicin and its opportunistic nature it is likely to become a more important organism causing nosochomial infections. When Gram-negative infections are encountered, treatment should begin with gentamicin as the drug of first choice, since pseudomonas is more likely than *Achromobacter xylosoxidans*. When a non-*Pseudomonas aeruginosa* species is identified on early culture reports, the addition of a second antibiotic such as carbenicillin should be considered to cover the opportunistic gentamicin, gentamicin-resistant, Gram-negative organisms like *Achromobacter xylosoxidans*.

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