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Eye and Eyelid Infections: Treatment and Prevention

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The scope of ocular and lid infections is too wide to permit a discussion of all existing entities. This article places emphasis on the common ocular problems and their treatment in the geographic area and experience of the author. It will not discuss some rare as well as widespread and important causes of blindness, such as onchocerciasis (river blindness), trachoma and leprosy.

1. Inflammation of the Lids (Blepharitis)

Inflammation of the eyelids is known as blepharitis, which may have a variety of causes. The most common forms are: seborrhoeic, staphylococcal and angular. Acute, tender, localised swellings are generally the result of either chalazions or sties. Uncommonly, parasitic infestations by lice or *demodex folliculorum* may be encountered.

1.1 Common Forms of Blepharitis

Seborrhoeic blepharitis is characterised by large, greasy scales at the base of the cilia and represents a dysfunction of meibomian secretion. The condition is frequently associated with seborrhoeic dermatitis of the scalp and often, but not always, treatment of the scalp with antiseborrhoeic shampoos (e.g. selenium sulphide or other keratolytics) will ameliorate the eyelid inflammation. Treatment for the lids themselves can be accomplished by the use of a mild shampoo, such as Johnson's baby shampoo, once daily, depending on severity. Copious warm soaks are also helpful. Staphylococcal contamination is common.

Staphylococcal blepharitis presents with lid hyperaemia and frequent ulcerations of the lid margin from staphylococcal toxins. The lids are matted together on awakening and symptoms of burning, watering and photophobia are common. Underlying seborrhoea is usually an associated finding and corneal complications include marginal infiltrates or ulcers. Treatment with 15% sodium sulphacetamide drops 4 times daily or chloramphenicol 0.5% solution instilled 4 or 5 times daily is helpful. Local corticosteroids such as dexamethasone or prednisolone, 2 to 4 times daily, may be added if corneal complications due to hypersensitivity are present.

Angular blepharitis is characterised by inflammation of the outer angles, redness, oedema and fissures. The agent often responsible is the Morax-Axenfeld Gram-negative rod which responds to sulphonamides, zinc sulphate, or gentamicin, topically applied several times daily.

1.2 Other Types of Blepharitis

Viral blepharitis is caused by herpes simplex, herpes zoster, vaccinia and molluscum contagiosum. Herpes simplex produces a vesicular eruption which breaks down and forms yellow crusts. Herpes zoster presents a similar picture but follows the distribution of the first and second division of the trigeminal nerve. Molluscum contagiosum forms a small skin nodule with an umbilicated centre and secondarily produces a follicular conjunctivitis.

Treatment of herpes simplex blepharitis is generally supportive as it tends to heal within 10 days and is apt to recur. Herpes zoster has no specific therapy except that concentrated gamma globulin may be helpful if keratitis and uveitis are also present. Molluscum skin nodules may be expressed mechanically or treated with light application of electric cautery.

Vaccinia involvement of the lids is usually due to auto-innoculation following vaccination, generally within the first week. If the cornea is involved, treatment should consist of hyperimmune gamma globulin administered systemically. Prevention of local secondary infection with a topical antibiotic is also indicated.

Hordeolum is an infection due to *Staphylococcus aureus* of the lid margin involving the glands of Moll or Zeiss. It presents as an acute swelling, markedly tender with a point of suppuration. Treatment should be aimed at promoting drainage. Hordeola or sties should be incised and drained if treatment with hot water applications fails to promote drainage. Local antibiotics are probably of little value. Systemic antibiotics such as ampicillin (500mg 4 times daily) or erythromycin (500mg every 8 hours) are warranted when multiple, large hordeola or sties are recurrent or they have not responded to local measures to promote drainage. Staphylococci harboured in the nose may be a source of reinfection. Underlying diabetes should be ruled out.

Chalazion is an annoying, chronic, granulomatous inflammation of meibomian glands. It may be present for many weeks or several months. Usually, it is located deeper and away from the lid margins. Chalazions generally do not respond to antibiotic therapy. They should be incised and curetted under local anaesthesia with 1% lignocaine.

Parasitic infestation by the pubic louse *Phthirus pubis* is characterised by itching, redness and excoriations of lid margins. Usually nits and adult lice are visible with slit lamp magnification. It is associated with infestation of the skin or pubic area. Infection is often by sexual contact or finger transmissions. Parasitic infections respond to the application of gamma benzene hexachloride cream to the lid margins. Repeat in 5 to 7 days. The shampoo of the same drug should be used for the pubic and abdominal skin areas. Application of 1% physostigmine or 3% amoniated mercury to the lid margins 2 or 3 times daily is also effective, but the former will produce uncomfortable side-effects due to ciliary spasm and miosis. Cryoapplication has also been recommended.

Demodex folliculorum also produces itching, primarily at night. The organisms can be expressed from meibomian glands where they reside. They can be seen under microscopic examination. Treatment is as for pubic louse infection.

2. Conjunctivitis

2.1 General Considerations

Conjunctivitis has a myriad of causes. Aetiological and epidemiological patterns of conjunctivitis vary in different parts of the world. For example, adenovirus type 8 is endemic in infants and children in Japan, while in North America the virus causes epidemic keratoconjunctivitis, primarily in adults. The causes of conjunctival inflammation are mechanical, bacterial, viral, rarely fungal, and uncommonly, self-induced in neurotic individuals. Anatomical predisposition includes eyes with pronounced vasculature, prominent globes, and vasomotor disorders, which cause a hyperaemic response of the conjunctiva to minimal stimuli, environmental dust or pollution, lack of sleep and fatigue. These eyes are often subjected to anti-

biotics and/or vasoconstrictors without permanent benefit from either medication, as the condition is neither infectious nor an expression of disease. These patients require simple reassurance and the advice that topical medications will not cure the 'bloodshot appearance'.

2.2 Neonatal Conjunctivitis

Smears and conjunctival cultures are mandatory in cases of neonatal conjunctivitis.

Gonococcal infection: This is a hyperacute conjunctivitis with marked lid hyperaemia and purulent discharge, which usually occurs within the first 24 to 72 hours postpartum. A Gram stain of conjunctival tissue scraping will reveal Gram-negative intracellular diplococci, even before the discharge is positive. Numerous pus cells are found in the exudate. Corneal ulceration and perforation are dangerous complications.

Treatment should include penicillin drops (10,000 units/ml) every 1 to 2 hours, or tetracycline ointment instilled every 2 hours combined with systemic penicillin G given intramuscularly. Ampicillin or amoxycillin may be used as an alternative to penicillin G. Gonorrhoeal ophthalmia is prevented by the use of 1% silver nitrate in the eyes of the newborn immediately after birth.

Inclusion conjunctivitis is now known to be due to chlamydia oculogenitalis (TRIC) agent but is difficult to isolate on culture. There is purulent discharge with less severe inflammatory signs. Onset is usually 5 to 12 days postpartum. Smears show cytoplasmatic inclusion bodies in cells stained with Giemsa; no bacteria are seen. Topical sulphonamides or tetracycline ointment, 4 or 5 times daily, is usually sufficient treatment.

Staphylococcal and Pseudomonas organisms are causes of conjunctivitis in newborn and prematures which may result in pneumonia and death. Diagnosis is established by eye cultures. *Pseudomonas* may produce an orbital cellulitis, panophthalmitis, septicaemia and death.

Chemical conjunctivitis may result from reaction to silver nitrate instillation for prevention of gonorrhoeal ophthalmia. Smears and cultures of the conjunctiva are negative. The condition is mild and self-limited.

2.3 Conjunctivitis in Children and Adults

Bacterial conjunctivitis: In children and adults, bacterial causes are usually due to staphylococci, streptococci, and pneumococci, uncommonly Koch-Weeks bacillus (*Haemophilus aegyptius*), and rarely *Corynebacterium* (diphtheria), *Mycobacterium* and *Neisseria* species. Aetiological diagnoses are made by smears and cultures. Most cases of bacterial conjunctivitis usually respond to topical treatment by one or more of the following: sulphafurazole (sulfisoxazole); 15% sodium sulphacetamide; 0.5% chloramphenicol; or combinations of bacitracin or gramicidin and polymyxin and neomycin. Usually, the resistant or persistent cases of inflammation are then subjected to laboratory investigation by smears and cultures. Bacterial conjunctivitis is usually purulent and in the case of infection due to β-haemolytic streptococci and *Corynebacterium* organisms, produces a membranous and pseudomembranous conjunctivitis.

Viral causes of conjunctivitis are usually those associated with the common cold viruses, which produce a watery or catarrhal mucoid discharge. These are self-limited and may be treated with a topical sulphonamide to prevent secondary infection. Influenza and Newcastle viruses may produce associated conjunctivitis with negative cultures and a self-limited course.

Adenoviruses produce a follicular conjunctivitis. Associated corneal involvement occurs with type 8 EKC (epidemic keratoconjunctivitis). Infection may be unilateral with preauricular adenopathy, corneal infiltrates and a purulent sterile discharge. Rising serum antibody titres assist in the laboratory diagnosis. The eye discharge from adenoviral infections are highly contagious and spread by fingers and toxometers contaminated by contact with the infected pa-

tient. Medical personnel tend to transmit the disease. Thus, disposable cotton applicators to examine the eyes followed by thorough washing of the examiner's hands, with sterilisation of instruments making contact with the eye, are important measures in prevention and spread of this disabling disease. There is no specific cure. Topical antibiotics prevent secondary infection and low dose corticosteroids tend to control the subepithelial corneal infiltrates. For example: 10% sulphacetamide, 0.2% prednisolone, 0.12% phenylephrine (Blephamide) or 4% sulphafurazole combined with 0.125% prednisolone, either used 4 times daily, may be helpful but should be tapered off as the disease abates.

Viral follicular conjunctivitis must be differentiated from other TRIC agents. Trachoma involves follicular changes of the upper lid, primarily with involvement of the superior cornea which contains infiltrates and micropanus. Smears of the expressed follicle material show characteristic cellular inclusion bodies. Adult inclusion conjunctivitis is spread by contact of contaminated genital secretion with the eye. The disease is less severe and corneal complications less frequent. Treatment consists in topical and systemic sulphonamides and tetracycline antibiotics. The ointment forms may be applied 4 times daily to the eyes and 1 to 1.5g systemic tetracycline daily for periods of 3 to 6 weeks or longer in the case of trachoma.

Chronic conjunctivitis is often the aftermath of associated chronic staphylococcal blepharitis and frequently the result of over-medication in an attempt to relieve 'bloodshot eyes', which are not the result of infection (section 1.1). Many chronically inflamed eyes are due to toxic or rebound effects of the tissues in response to preservatives, vasoconstrictors or vehicles contained in eye medications, if not the antibiotic itself. Chief offenders are the aminoglycosides, neomycin and gentamicin; benzalkonium chloride; adrenaline (epinephrine) derivatives; and dispersing agents such as methylcellulose and polyvinyl alcohol. It is best to stop all medication for several days when progress is lacking and symptoms persist. Efforts should then be directed to established aetiological diagnosis by laboratory methods; stains, scrapings, and smears of conjunctiva and cultures.

3. Corneal Infections

3.1 Treatment of Corneal Infection

Keratitis and corneal ulcer may arise from trauma to the eye following fingernail scratches, abrasions, foreign bodies, contact lenses, and so on.

Bacterial keratitis: The most virulent bacteria producing corneal ulcer and leading to perforation are: *Pseudomonas aeruginosa,* β-haemolytic streptococci, gonococci, pneumococci and *Staph. aureus.* There is an associated purulent exudate (hypopym) in the anterior chamber. Scrapings of the ulcer margin should be obtained for smears and cultures on appropriate media (blood agar, thioglycolate and beef heart infusion broth and Sobauraud's).

Immediate treatment necessitates use of a combination of drugs aimed at the most frequent causative organisms mentioned above. The highest antibacterial ocular tissue levels are obtained by subconjunctival or subtenon injection administered daily. A 27 gauge needle on a tuberculin syringe is used to draw up 0.5ml of the antibiotic and the conjunctiva anaesthetised with a local anaesthetic such as 8 or 10 drops of amethocaine (tetracaine), piperocaine or proxymetacaine (proparacaine). While the patient looks up, the needle point is engaged just beneath the bulbar conjunctiva near the cul-de-sac where it is loosely bound. The injection is made slowly, as rapid distension of the tissues causes marked pain. The doses for this route (table I) are administered daily over a period of 7 to 10 days.

Topical antibiotic drops are also given, such as chloramphenicol 0.5%; gramicidin, polymyxin, neomycin; sodium sulphacetamide, etc. One or more of these may be given 2 drops every hour or two. Cycloplegics such as 1% atropine or 0.25% hyoscine are given 1 drop 4 times daily to control uveitis and prevent iris adhesions (synechia). 10% acetyl cysteine or 0.5% calcium or sodium edetate may also be used to

Table I. Dosage of antibiotics in corneal infections

Antibiotic	Subconjunctival	Intravitreal	Parenteral
Ampicillin	100mg	—	2-4g q 4h (150-200mg/kg/day)
Bacitracin	10,000u (1mg)	500-1000u	25,000u q 6h
Carbenicillin	100mg	2mg	2-6g q 4h (400-500mg/kg/day)
Cephaloridine	100mg	0.25mg	0.5-1g q 6h
Chloramphenicol	1mg	1-2mg	0.25-0.75g q 6h (50mg/kg/day)
Colistin	25mg	0.1mg	1.5-5.0mg/kg/day
Gentamicin	20-40mg	0.4mg	3-5mg/kg/day
Methicillin	100mg	1-2mg	1-2g q 4h
Neomycin	250-500mg	2.5g	—
Penicillin G	0.5-1mega u	1000-4000u	Usual dose-600,000u to 1.2mega u/day Large dose — 10-12mega u
Polymyxin B	5-10mg	0.1mg	1.5-2.5mg/kg/day
Tobramycin	20-40mg	0.5mg	3-5mg/kg/day
Vancomycin	15-25mg	—	0.5-1g/12h

inhibit collagenase enzymes which destroy corneal collagen and lead to perforation.

While treatment seems drastic, the corneal pathology is rapidly destructive, often leading to perforation and loss of sight, despite intensive therapy. Systemic antibiotic therapy requires maximum dosage and when instituted, it is necessary to watch for toxic side-effects. The destructive tissue damage by toxins elaborated during the inflammatory course may be prevented by systemic or oral steroids (e.g. 60mg of prednisone in 4 divided doses daily, tapering off rapidly as improvement is noted).

Syphilitic keratitis is generally congenital and occurs in acquired syphilis only in about 3% of cases or less. The clinical picture is that of a deep inflammation involving the major part of the corneal parenchyma. Uveitis is invariably associated. There are other stigma of congenital syphilis (Hutchinson's teeth, deafness, depressed saddle-shaped bridge of the nose) that help differentiate it from other types of interstitial keratitis (viral, lymphopathia venereum, tuberculosis, etc.). Treatment requires intramuscular penicillin G 1 mega u daily over a week to 10 days. Topical corticosteroids every hour or by daily subconjunctival injection must be given in addition to cycloplegics to control the severe keratitis and associated uveitis. Ocular therapy may extend for many weeks or months.

Fungus keratitis is usually a chronic, indolent, corneal infection generally following trauma to the eye by plant or vegetable matter. Characteristically, the ulcer appears dry with irregular borders, elevated margins, and satellite lesions. Diabetics and patients who have had immunosuppression are likely candidates for fungus infection. It may also arise from pretreatment of an ocular infection with prolonged use of antibiotic-corticosteroid combinations which allow opportunistic organisms to become invasive. Species of fungi encountered vary but include *Asperigillus, Candida, Furarium, Penicillium, Volutella,* and others.

The generally available systemic antifungal agents such as amphotericin B are highly toxic, and topical application to the eye is generally poorly penetrating. The topical agents available are natamycin (pimaricin), 1% clotrimazole, and amphotericin B and are usually given every 2 hours. Recent reports show that rifampicin and amphotericin B act synergistically against *Candida* infection. At present, therapy of fungus keratitis is disappointing due to the limited availability of effective systemic agents which are fungicidal and non-toxic.

Viral keratitis: Treatment is aimed at the offending virus agent. *Herpes simplex keratitis* will respond to

idoxuridine (IDU) given as drops every 2 to 3 hours over a period of 1 week. If there is no improvement, vidarabine (adenine arabinoside, ARA A, Vira A) can be used 5 times daily and gradually tapered off after 2 weeks or more, depending on clinical improvement. Triflorothymidine 4 or 5 times daily may be substituted if previous treatment fails. If drug therapy is unavailable, one may instil topical piperocaine or amethocaine anaesthetic drops, and mechanically swab the affected area with half strength tincture of iodine which is then neutralised with 4% cocaine.

Topical corticosteroids should be avoided when treating dendritic keratitis due to herpes simplex. They act to spread the disease and allow stromal invasion. Only in chronic recurrent cases of deep herpetic keratitis, when severe iritis and inflammation cannot be controlled, should low dose steroids be used and then only a drop or two daily of 0.125% prednisolone or 0.05% dexamethasone. The steroid should be employed in addition to antiviral agents such as idoxuridine or vidarabine.

Herpes zoster keratitis has no known specific treatment. Control of inflammation with 0.125% prednisolone 3 or 4 times daily may be combined with cycloplegics to control uveitis. A topical sulphonamide helps reduce secondary infection.

Corneal infection by *measles or varicella viruses* have no specific antiviral therapy. Treatment is supportive. Relief of photophobia and prevention of secondary bacterial infection depend on severity and degree of ocular involvement.

Endophthalmitis may be endogenous or exogenous. The latter frequently follows accidental trauma or intraocular surgery, such as cataract extraction. *Staph. aureus* is the predominant cause followed by *Pseudomonas, Proteus,* and *Escherichia coli* as less frequent offenders. Treatment is similar to that of the management of bacterial corneal ulcers, omitting collagenase inhibitors. Fungal endophthalmitis usually occurs as a metastatic spread in patients who have been immunosuppressed or in individuals previously treated with antibiotic and corticosteroid therapy.

Table II. Summary of the prevention and treatment of lid inflammation

Prevention of lid inflammation
1. Improve general hygiene.
2. Mechanical removal of oily scales from lid margin in cases of chronic seborrhoeic blepharitis.
3. Avoid rubbing lids with dirty fingers.
4. Shampoo scalp and lid margins.
5. Correct refractive errors in chronic recurring chalazions.
6. Treat sexual contacts in cases of pubic lice infestations.

Treatment of lid inflammation
1. *Seborrhoeic blepharitis:* Selenium sulphide shampoo to scalp and lid margins daily or bi-weekly depending on severity.
2. *Angular and staphylococcal blepharitis:* Bacitracin, chloramphenicol or erythromycin ointment applied 4 times a day and warm water compresses twice daily.

Early diagnosis is important. Aqueous and vitreous tap is mandatory for smear and culture in most, if not all, cases of suspected endophthalmitis. Direct intravitreal injection of antiobiotic (as well as subconjunctival in desperate cases) may be made immediately following vitreous tap. Dosage is listed in table I. Daily periocular injections produce higher drug levels than the systemic route of administration. Overwhelming intraocular infection may benefit from removal of the infected fluid by vitrectomy, where such facilities as a vitrector are available. Systemic corticosteroids are warranted early (within the first 48 hours of therapy) to counteract inflammatory damage to the retina and other tissues.

Prevention of endophthalmitis is better than cure. Strict asepsis should be attained in the operating room with meticulous attention to surgical procedure, solution and instrument sterility. A subconjunctival injection of antibiotic at the end of the surgical procedure, followed by daily topical antibiotic medication, will reduce the chance of developing endophthalmitis. Sterile cotton and solutions should be used, and the hands washed prior to redressings in the immediate postoperative period.

3.2 Prevention of Corneal Ulcers

Corneal ulcers may be prevented by prophylactic use of antibacterial agents in cases of minor trauma to the eye. Strict attention to aseptic technique is important. Use disposable cotton applicators to examine eyes suspected of infection, washing the hands thoroughly before and after examination. Use sterile solutions to irrigate foreign bodies or remove debris. Do *not* use topical corticosteroids in suspected viral or fungal infections and avoid prolonged topical antibiotic-steroid combinations.

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