**Infectious Keratoconjunctivitis**

**(Pinkeye, Infectious ophthalmia)**

* Infectious keratoconjunctivitis of cattle, sheep, and goats is characterized by blepharospasm, conjunctivitis, lacrimation, and varying degrees of corneal opacity and ulceration.
* Infectious bovine keratoconjunctivitis (IBK) is the most common ocular disease of cattle and is seen worldwide.

**Etiology :**

* The gram-negative rod *Moraxella bovis* is the only organism demonstrated to cause IBK in cattle. Seven different serogroups of *M bovis* are currently recognized.
* Most other ocular infections of cattle are characterized by conjunctivitis with minimal or no keratitis.
* *Moraxella bovoculi* has also been reported in cases of infectious keratoconjunctivitis in reindeer. Plant awns, face flies, ultraviolet radiation from bright sunlight, dry and dusty environmental conditions, and shipping stress are all risk factors associated with IBK in cattle.
* In cattle, additional risk factors that should be considered when making herd management decisions include trace mineral deficiencies such as selenium and copper deficiency. Flies can also serve as vectors for *M bovis*.
* In sheep and goats, naturally occurring conjunctivitis or keratoconjunctivitis can be associated with *Chlamydia pecorum*, *Mycoplasma* spp (notably *M conjunctivae*), *Moraxella ovis*, *Colesiota conjunctivae,Listeria monocytogenes,Acholeplasma oculi,* and *Thelazia* spp.

**Clinical Findings:**

* The disease usually is acute and tends to spread rapidly.
* In all species, young animals are affected most frequently, but animals of any age are susceptible.
* One or both eyes may be affected.
* The earliest clinical signs are photophobia, blepharospasm, and epiphora; later, the ocular discharge may become mucopurulent.
* Conjunctivitis, with or without varying degrees of keratitis, is usually present. In sheep and goats, concurrent polyarthritis may be present in association with *C pecorum* infections.
* Appetite may be depressed because of ocular discomfort or visual disturbance that results in inability to locate food.
* The usual clinical course varies from a few days to several weeks.
* Most corneal ulcers in cattle with IBK heal without loss of vision; however, corneal rupture and permanent blindness can occur in the most severe cases.





**Lesions**

* Lesions vary in severity.
* In cattle, one or more small ulcers typically develop near the center of the cornea.
* Initially, the cornea around the ulcer is clear, but within a few hours a faint haze appears that subsequently increases in opacity.
* Lesions may regress in the early stages or may continue to progress.
* After 48–72 hr in severe cases, the entire cornea may become opaque, blinding the animal in that eye.
* Blood vessels may invade the cornea from the limbus and move toward the ulcer at ~1 mm/day.
* Corneal opacity may result from edema (hazy white to blue corneas), which is a part of the inflammatory process, or leukocyte infiltration (milky white to yellow corneas), which indicates severe infection.
* Continued active ulceration may cause corneal rupture.
* Relapse may occur at any stage of recovery.

**Diagnosis:**

* In all species, presumptive diagnosis is based on ocular signs and concurrent systemic disease.
* It is important to distinguish that the lesions are not due to foreign bodies or parasites
* . In IBR, upper respiratory signs and conjunctivitis predominate, while keratitis accompanied by ulceration is rare.
* In bovine malignant catarrhal fever, respiratory signs are prominent with primary uveitis and associated keratitis.
* Microbial culture may be beneficial in confirming the causative organisms.
* *Chlamydia* and *Mycoplasma* spp require special media; the diagnostic laboratory should be consulted before sample collection.
* Cytologic evaluation of stained slides prepared from conjunctival scrapings of sheep and goats may reveal *Chlamydia* organisms; however, intracytoplasmic inclusion bodies can be difficult to recognize.
* PCR analysis can be used to detect *Chlamydia* and *Mycoplasma* spp.

**Treatment:**

* *M bovis* is susceptible to many antibiotics. Because antibiotic susceptibility may vary in different geographic locations, bacterial culture and susceptibility testing is advised. One common treatment is bulbar conjunctival injection with penicillin.
* In the USA, long-acting oxytetracycline (two injections of 20 mg/kg, IM or SC, at a 48- to 72-hr interval) and tulathromycin (2.5 mg/kg, SC, given once) are currently approved antibiotics to treat IBK in cattle.
* Other effective antibiotics include ceftiofur crystalline free acid (6.6 mg/kg, SC, at the base of the ear) and florfenicol (20 mg/kg, IM, two doses at a 2-day interval). A single injection of long-acting oxytetracycline (20 mg/kg, IM) along with oral oxytetracycline (2 g/calf/day for 10 days) fed in alfalfa pellets has also been shown to be effective at reducing severity of IBK during a herd outbreak.
* Topical applications of ophthalmic preparations should be applied at least three times a day to be effective, and thus are often not cost-effective or practical in herd settings.
* Effective antibiotics for topical ophthalmic use include triple antibiotic, gentamicin, and a combination oxytetracycline/polymyxin B ointment..
* A third-eyelid flap or partial tarsorrhaphy, which will shade the cornea from sunlight, together with subconjunctival injection, may reduce morbidity in severely affected animals.
* A temporary eye patch glued to the hair surrounding the eye is an inexpensive and easily applied treatment. The eye patch provides shade, prevents exposure to flies, and may help to decrease spread of organisms.
* For sheep and goats in which chlamydial and mycoplasmal infections are suspected, respectively, topical tetracycline, oxytetracycline/polymyxin B, or erythromycin ointments are treatments of choice.
* These preparations are all effective against *Chlamydia* or *Mycoplasma* and should be applied 3–4 times daily. If topical therapy is not practical, long-acting oxytetracycline (20 mg/kg, IM) or the addition of oxytetracycline to the feed (80 mg/animal/day) may be beneficial.
* Animals with substantial uveitis secondary to keratoconjunctivitis that is particularly painful may benefit from topical ophthalmic application of 1% atropine ointment 1–3 times daily. This will prevent painful ciliary body spasms and reduce the likelihood of posterior synechia formation that occurs with miosis. Because of mydriasis caused by atropine, treated animals should be provided with shade. Systemic NSAID treatment may be used to provide relief from secondary uveitis.

**Prevention and control**

* Good management practices are of paramount importance to reduce or prevent spread of infection in cattle, sheep, and goats.
* Separation of infected animals is beneficial when possible.
* Gloves and protective clothing should be worn and then disinfected between animals when affected individuals are being handled.
* Temporary isolation and preventive treatment of animals newly introduced to the herd may be helpful, because some of these animals may be asymptomatic carriers.
* Ultraviolet radiation from sunlight may enhance disease (particularly in cattle); therefore, affected animals should be provided with shade.
* Dust bags or insecticide-impregnated ear tags can be used to reduce the number of face flies (*Musca autumnalis*), an important vector for *M bovis*.
* *M bovis* bacterins are available and can be administered before the beginning of fly season.
* Cattle should be started on *M bovis* vaccine series 6–8 wk before the anticipated first cases of IBK to allow time for adequate immune responses to develop.
* The efficacy of current commercially available *M bovis* bacterins is controversial and likely varies because of vaccinal versus outbreak strains of *M bovis* and varying degrees of cross-protection afforded by vaccination.
* Vaccination may reduce the severity and duration of infection in affected animals.
* IBR may predispose cattle to infection with *M bovis*; thus, vaccination of herds against IBR may reduce outbreaks of *M bovis*.
* The use of modified-live IBR vaccines has been associated with outbreaks of IBK in cattle; IBR vaccination must be appropriately timed with cattle shipments so that these events do not coincide.
* Vaccination of cattle with a modified-live IBR vaccine could likely exacerbate an outbreak of IBK associated with *M bovis* and/or *Moraxella bovoculi* because of increased ocular and nasal secretions spreading bacteria between herdmates as well as corneal epithelial damage.
* In recent studies, the efficacy of autogenous *Moraxella* spp bacterins to prevent IBK has not been demonstrated in randomized controlled field trials.
* Nevertheless, anecdotal evidence has suggested that, for some herds, *M bovis* and/or *Moraxella bovoculi* autogenous bacterins have provided benefit in reducing IBK problems. It is unlikely that any *Moraxella* spp vaccine will ever completely control IBK in the face of overwhelming challenge from and exposure to other risk factors such as flies, dust, other infectious agents, and trace mineral deficiencies.
* As such, planning and implementing a successful IBK control program should address multiple issues that may potentially reduce susceptibility of cattle to IBK beyond just vaccines against *Moraxella* spp.