Protect and Vaccinate

Prevent pinkeye in two easy steps.

by ***Lowell T. Midla, VMD, MS***

We have all been frustrated with infectious bovine keratoconjunctivitis (IBK, also known as pinkeye) at least once.

We may have turned to our veterinarian for help. Given our vet's dedication to their clients and their commitment to evidence-based medicine, they consulted textbooks, the published literature, etc. to try to find the answers. Unfortunately, while IBK has been studied for more than a century, there is still much to be learned, so there are few definitive answers.

Discouraged by both lack of answers and sometimes conflicting answers, we turn to our experience. However, in our experience we have seen huge problems with IBK in a given year, and little to no problem the next year. Unfortunately, it is not at all clear what was different or what we did or did not do to lead to the difference.

If you have been discouraged by the lack of answers and conflicting answers, keep reading.

What we are pretty sure we know

- The disease triangle (host – pathogen – environment) is particularly applicable to pinkeye. All three are equally important and must be considered in any prevention plan (see Figure 1).
- Damage to the cornea is almost certainly a first step in the pathogenesis of pinkeye. The importance of this cannot be overstated.
- Female face flies *(Musca autumnalis)* feed on ocular secretions and have microscopic sharp mouthparts that damage ocular tissues to stimulate production of these secretions.
- *Moraxella bovis, Moraxella bovoculi* and *Mycoplasma bovoculi* are commensals of the bovine eye. All three are pretty much always there.
- There is abundant, though interestingly inconclusive, evidence to support the generally accepted view that *Moraxella bovis* causes IBK. Abrading or otherwise damaging (e.g., using ultraviolet radiation) the bovine cornea followed by instillation of a pathogenic strain of *M. bovis* consistently leads to IBK.
- The pathogenesis of *M. bovis*-associated IBK is a three-step process: No. 1 corneal damage; No. 2 microbial adhesion facilitated by attachment pili; No. 3 release of cytotoxins by *M. bovis* that rapidly "melt" the cornea in as little as 48 hours.
- Some *M. bovis* vaccines are directed against the attachment pili. Unfortunately, *M. bovis* is adept at switching surface pili and antibody pressure can induce pilus switching, leading to apparent vaccine failure. An obvious solution would be to build a vaccine containing many different pilus epitopes. However, the inclusion of too many different pili leads to antigenic competition. That

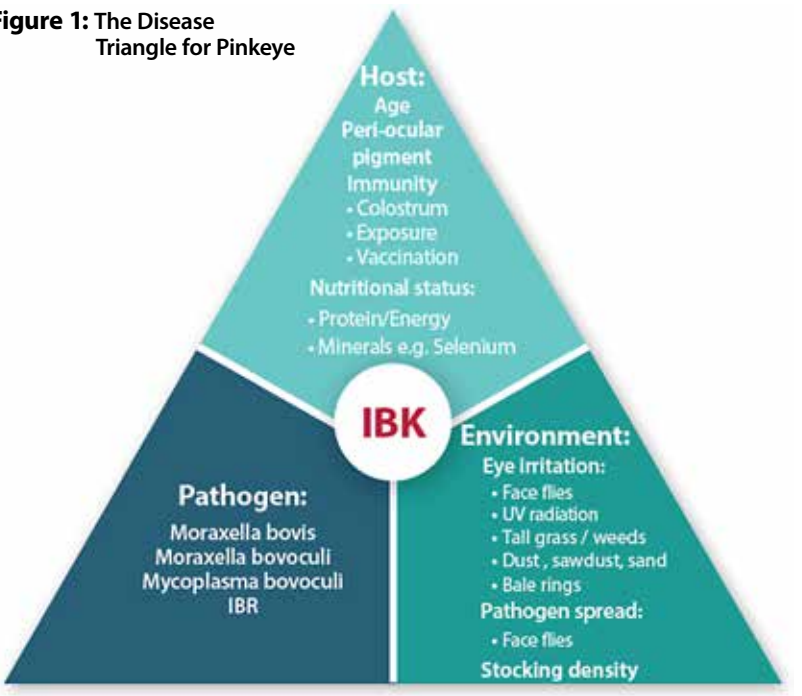

Figure 1: The Disease Triangle for Pinkeye

is, the immune system would "see" so many antigens that it would only respond to some. How many is too many is not yet well-defined.

- O'Connor et al (JVIM 2011) reviewed nine trials of autogenous IBK vaccines and concluded that, "autogenous *M. bovis* vaccines … are ineffective in controlling naturally occurring IBK."
- *M. bovoculi* is commonly cultured from the eyes of affected cattle and has been associated with IBK. It is important to remember that association does not prove causation.
- The standard disease model (damaging the cornea followed by instillation of bacteria) does not lead to IBK when *Moraxella bovoculi* is used. Indeed, there is not a disease model for IBK caused by *M. bovoculi*. That is not to say that *Moraxella bovoculi* is not involved in the pathogenesis of some cases of IBK, but that the pathogenesis of IBK potentially caused by *M. bovoculi* is not fully understood.
- Infectious bovine rhinotracheitis (IBR, BHV-1) is associated with a pinkeye-like syndrome. There is some evidence that vaccination with modified-live IBR vaccine may be a risk factor for IBK.
- Elimination of ocular *M. bovis* infection depends more on reaching therapeutic drug concentrations in the infected ocular tissues than in tears. Oxytetracycline is selectively concentrated in ocular tissues, including the epithelium of the conjunctiva and lacrimal gland ductules, reaching concentrations in these tissues that exceed those in serum.

What we speculate may be true

- Electron microscopy studies suggest that *Moraxella bovoculi* may attach poorly to the corneal surface but attach well to *M. bovis*. Furthermore, *M. bovoculi* growth may outpace that of *M. bovis*. This suggests a hypothetical scenario wherein *M. bovis* attachment to damaged cornea (via pili) is necessary to "get things started" followed by *Moraxella bovoculi* "taking over." If true, then this implies both that timing of ocular culture is critically important vis-à-vis interpretation of culture results, and that vaccination against *M. bovis* should be sufficient to prevent disease.
- Pilus switching by *M. bovis* may occur between the time of isolate submission for development of an autogenous vaccine and the time of vaccination.

What we'd like to know

- Given that *Moraxella bovis*, *Moraxella bovoculi* and *Mycoplasma bovoculi* are commensals of the bovine eye, why do we have apparent outbreaks of IBK? That is, why does the disease seem to be contagious? Is it simply that environmental conditions led to corneal damage in many individuals, or is a more pathogenic variant being spread from animal to animal, or both?
- What is more important toward immunity to IBK, IgG or IgA? That is, might intranasal or intraocular vaccination be more effective?
- Is *Moraxella bovoculi* important, and if so, how and under what circumstances does it fit in to the IBK picture?
- Considering that the typical IBK season begins when maternal antibodies may interfere with vaccination for spring-born calves in the northern United States, when should we vaccinate? Similarly, should extensively managed calves that are only handled once prior to weaning be vaccinated at branding?

Prevent pinkeye in two easy steps

1. **Decrease corneal damage.** While easy to say but less easy to do, remember that difficult is not the same as impossible. A story may help to illustrate. During a visit to a large heifer development facility in the southwest U.S., the herdsman was complaining of an ongoing IBK problem. At the time, manure was being scraped and hauled from nearly a half-mile away. A dirt road along the western edge of the facility carried trucks by every two or three minutes. As I visited with the herdsman my eyes were stinging from the dust. The herdsman stated that even when pens were not being scraped, the road was heavily traveled. This operation did not need a different or better vaccine, it needed a water truck to water the road. There is a reason that "clip pastures and control flies" appears in every IBK article. Evaluate each operation individually to identify and stratify sources of corneal damage and then work to minimize them.
2. **Ensure that animals are prepared for the challenge.** Minimize stressors, including parasitism. Provide adequate protein, energy, vitamins and minerals. If possible, prepare the host with two doses of commercially available *Moraxella bovis* and *Moraxella bovoculi* vaccine. HW

Editor's note: Lowell Midla, VMD, MS, is a technical services veterinarian for Merck Animal Health. Prior to joining Merck Animal Health, he served 24 years as a practicing veterinarian and 15 years teaching at Ohio State University Veterinary School.