

Keratitis

The virulence, transmissibility and course of bovine "pinkeye"

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KERATITIS or "pinkeye" in cattle is an infectious disease which infects cattle of all ages and breeds. It has a wide distribution and has been reported in Holland, South Africa, India, England and in parts of Canada. This disease has been recognized as a serious cattle disease in almost every part of the United States. Keratitis is not a new disease. It was recognized in Nebraska more than 70 years ago. Although the mortality is relatively low, the economic factor is great. Veterinarians and livestock owners readily recognize the importance of keratitis to the cattle industry.

The disease is more prevalent among cattle in the Middle West. Although cattle of all ages and breeds are affected, it is primarily a disease of young cattle. It has been found in field and laboratory studies at this station that adult cattle show a greater resistance to keratitis than do young calves. The period of incubation in this disease following artificial exposure under laboratory conditions has varied from three days to three weeks. Keratitis is more prevalent during summer and early fall. However, it has been observed among cattle during winter months when the infection became more extensive and involved a large number of feeder calves. In these cases the animals were crowded into sheds and barns.

Keratitis of cattle is apparently specific for the species since sheep, swine, rabbits and guinea pigs could not be infected under laboratory conditions. This disease usually makes its appearance among

calves in Kansas during April or May, and continues to be prevalent among cattle of feeder and dairy class until freezing weather. This fact has caused those interested in the disease to suspect flies or other insects as possible vectors in the transmission of the infection. Avitaminosis is probably not a primary factor in the production of keratitis as observed in these studies.

Symptoms

Marked lacrimation, photophobia, clouding of the cornea and congestion of blood vessels of the cornea and conjunctiva are observed in all cases with the onset of the disease. During the first three or four days the eye secretions are of a watery consistency, but later develop into the mucous type and continue in this manner throughout the course of the disease.

Course

Field and laboratory studies conducted at this station have shown that the disease appears in three forms—the mild, acute and chronic types.

Mild type. Affected animals show a slight cloudiness of the cornea with congestion of blood vessels of the cornea and conjunctiva. Watery secretions flow continuously from one or both eyes, depending upon whether the infection is unilateral or bilateral.

Acute type. Apparently this is the most common type of infection observed in cattle. Photophobia, marked lacrimation, extensive clouding of the cornea and conjunctivitis which occurs synonymously

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with clouding the cornea. The circumcorneal blood vessels and those of the conjunctiva are congested in every case. Clouding of the cornea is due to the accumulation of leucocytes. A yellowish discoloration of the cornea may be observed and a slight protrusion of the cornea may be noticed at a point just below the center of the eye. If the cornea ulcerates it usually occurs at this area and the infection becomes more extensive.

Chronic type. The chronic type of infection may develop when the cornea ulcerates and pyogenic infection becomes a secondary factor, causing extensive involvement of the cornea, iris, membrana nictitans and the anterior eye chamber. In these cases the animal becomes permanently blind. A thick pus may accumulate in the anterior eye chamber and continue to escape through the break in the cornea. Enucleation of the eye is sometimes resorted to in these cases. This type of infection is often observed among cattle that are continually exposed to sunlight, wind, dust, flies, etc. It has been found that if calves affected with the mild or acute type of "pinkeye" or keratitis are removed from the herds and placed in darkened flyproof stalls the disease may be prevented from developing into the chronic type.

Transmission

It is difficult to determine the mode of transmission in natural outbreaks of keratitis because the causative factor has not been determined. The incubation period of infection following artificial exposure with virulent eye secretions has varied from three days to three weeks. In a natural outbreak it might be that a number of calves were exposed at the same time, but a difference in the period of incubation would indicate that the infection was spreading rapidly through the herd. Apparently there is no correlation between the severity of the disease and the incubation period as observed in these studies. With few exceptions the type of disease produced under laboratory conditions has been the acute type. This can probably be attributed to the use of semi-darkened, flyproof stalls in housing these animals.

Exposures were made by dropping the virulent eye secretions on the cornea of susceptible calves. It has not been necessary to scarify the cornea or conjunctiva in order to cause transmission in these cases. Occasionally animals were found to be resistant to infection induced in this manner even though composite eye secretions collected from numerous animals were used in the attempt. Calves recovered from mild infection can be reinfected by artificial exposure. Those animals recovered from acute or chronic types of the infection cannot be reinfected under laboratory conditions. Calves recovered from acute infections have not retained the infection in eye secretions longer than three months. On the other hand, a calf infected with the chronic type of infection during early fall was proven a source of keratitis infection in the spring when another calf developed acute keratitis after ten exposures with eye secretions from the first animal. *Escherichia coli*, *Corynebacterium pyogenes*, *Streptococci*, *Staphylococci* and *Pasteurella bovisseptica*, were isolated from eye secretions in one calf affected with the chronic type of keratitis. This is an indication that pyogenic infection as observed in chronic types of the disease cannot be depended upon to destroy the causative infection by bacteriolysis. It is not known to what extent calves recovered from chronic infection would be a source of infection in herds of cattle, but it is a factor. *Escherichia coli*, *Corynebacterium pyogenes*, *Streptococci* and *Staphylococci* have been isolated from calves actively infected with the disease in the field and in the laboratory. *Pasteurella bovisseptica* was isolated from eye secretions of one calf affected with chronic keratitis. The above organisms have not reproduced the disease in calves held under laboratory conditions.

Virulent eye secretions were obtained from numerous cattle in ten herds during three years of study and filtrates of this material were used to expose susceptible calves. The filtration studies have been repeated in thirty-eight calves and four cows since the experiment was commenced without reproduction of the disease. Approximately 70 percent of these

animals were proven susceptible when exposed with known virulent secretions.

Three attempts have been made to prove flies (*Musca domestica* and *Stomoxys calcitrans*) transmitters of keratitis. Diseased and susceptible calves were placed in an outdoor screened stall and subjected to outdoor conditions. A solid partition was placed between the diseased and susceptible animals to prevent them from rubbing heads and possibly transmitting the infection in this manner. Although flies were noticed feeding upon secretions around the margins of the eyes of the diseased and normal calves, the infection was not transmitted to the susceptible animals.

Numerous attempts have been made to transmit keratitis from sheep to cattle and from cattle to sheep, but in all cases the infection proved specific for the species of animal and could not be transmitted.

Treatment

Anti-serum was prepared from three calves that had recovered from acute keratitis. Two calves were given three injections of this serum at seven day intervals. Two weeks after the third injection both calves were exposed with virulent eye secretions. Both calves developed keratitis within ten days.

Symptomatic treatment is usually resorted to in handling outbreaks of keratitis in herds of cattle. Argyrol, boric acid solution, silver nitrate solution, and calomel, are some of the drugs used in treating diseased cattle. If the diseased animals are detected during the early stages of the disease and are placed in a dark stall for several days, the progress of the disease can be checked in some cases.

Summary

1. Infectious bovine keratitis has a wide distribution. It has been diagnosed among cattle of all ages and breeds in practically every part of the United States. It was first reported upon scientifically more than 70 years ago.

2. Keratitis spreads rapidly through herds of cattle under barnlot and pasture conditions.

3. The disease is more prevalent dur-

ing summer and early fall, but it has been observed among cattle during winter months.

4. Keratitis is principally a disease of young cattle but is found in adult cattle of the feeder class during every month of the year.

5. The disease can be transmitted with fair consistency provided virulent eye secretions are dropped on the surface of the cornea. It has not been necessary to scarify the eye tissues in order to assure transmission in these studies.

6. The incubation period of infection following artificial exposure has varied from three days to three weeks.

7. Some calves are naturally resistant to infection and cannot be caused to contract the disease, even though they are exposed repeatedly over a long period.

8. It is difficult to cause transmission of infection from diseased to healthy cattle even though they are compelled to eat and drink from the same receptacles.

9. Three types of the disease have been demonstrated in calves studied under laboratory conditions—the mild, acute and chronic types.

10. It has been impossible to re-infect those calves that have recovered from acute or chronic keratitis.

11. Keratitis is probably a localized infection.

12. Anti-serum prepared from calves recovered from acute infection failed to protect calves from the disease as produced under laboratory conditions.

13. Calves recovered from chronic keratitis may prove a source of the infection for seven months or longer.

14. Filtrates of virulent eye secretions failed to reproduce the disease.



All wild animals suffer from disease and sickness. These diseases are intensified when the animals are used in captivity because they have not built up the immunity common in domestic stock. For instance, silver foxes raised in captivity are susceptible not only to canine distemper, but to paratyphoid and many other ailments.