INFECTIOUS BOVINE KERATOCONJUNCTIVITIS IN A DAIRY CATTLE FARM IN TANZANIA

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SUMMARY

The present study was designed with the objective of determining incidence and pattern of occurrence of Infectious Bovine Keratoconjunctivitis (IBK), investigating its causal agents and evaluating treatment methods in a dairy cattle farm in Tanzania. During the period of four years, IBK affected 724 (22.3 %) calves aged <6 months, 594 (17.9 %) weaners aged 7 to 12 months, 361 (14.8 %) young stock aged 13 to 18 months and 963 (4.9 %) adults aged >18 months (Numbers in parentheses refer to incidence rates per age group). Incidence and severity of IBK varied according to age, season, nutritional status, fly activity and type of management. The disease was found to occur all the year around with peak incidence during rainy season and towards the end of dry season. Out of 58 cases in which Bacterial isolations were attempted, *Moraxella bovis* was found in 35 (60.3 %), *Branhamella catarrhalis* in 22 (37.9 %) and *Staph. aureus* in 18 (31.0 %). Often, the infection was mixed. In a treatment trial whereby 64 animals were given topical Penicillin–Streptomycin (Streptopen®, Glaxo) twice a day for seven days, 29 cases were given intravenous injection of Tribrissen® (Coopers) every other day for 3 days and 48 animals were treated with two or three subconjunctival injections of Penicillin–Streptomycin (Penstrep®, C–Vet LTD) spaced 7 days apart, recovery rate was best in the latter treatment group. It was therefore concluded that subconjunctival injections were the treatment of choice for IBK.

INTRODUCTION

Infectious bovine keratoconjunctivitis (IBK) is the most important eye disease of cattle with worldwide occurrence (Marr, 1977; Baptista, 1979). The occurrence of this disease in Tanzania was reported as far back as 1958 (Anon., 1958; 1964). Annual reports from different regions mentioned "a particularly obstinate form of ophthalmia where treatment failed to produce any improvement". The aetiology of the disease was, however, not determined and no detailed studies were conducted.

Studies done elsewhere show that IBK is a disease of multiple aetiologic agents with *Moraxella bovis* being predominant (Mitter, 1915; Pugh and Hughes, 1972; Barber, 1984; Barth *et al.*, 1986). Other organisms associated with IBK include *Branhamella catarrhalis*, Mycoplasma spp., Rickettsia, Chlamydia and viruses (Wilcox, 1970; Plankhotin and Alakhverdiev, 1971; Langford and Leach, 1973; Gourlay *et al.* 1974, Wafulla *et al.*, 1985; Barth *et al.*, 1986). Nematodes of the genus Thelazia have also been reported (Smear, 1968)

In endemic areas in temperate countries 40% of a herd may be affected in an outbreak of IBK over a six to eight week period during summer months (Fleming, 1975). The disease causes severe pain, impairs vision and consequently leads to reduced feed consumption, diminished growth, loss of condition and reduced milk yield (Pedersen, 1973; Thomas *et al.*, 1978; George and Kagonyera, 1986). Death is rare but permanent

bilateral blindness which occurs in untreated cases necessitates destruction of the animal. These effects and the high morbidity rate (40 %) mentioned above make the disease economically important. Furthermore the disease is associated with high treatment costs (George and Kagonyera, 1986).

Various cost effective treatments have been tried in the field. They include topical application of antibiotics twice a day for five days (Wafulla *et al.*, 1985) and subconjunctival injection of streptomycin–penicillin or Kanamycin (Abeynayake and Cooper, 1989). In the latter treatment regimes, injections were done once, twice or thrice, depending on severity and speed of recovery, at intervals of seven days. Other treatment methods include intramuscular injection of long acting tetracycline or intravenous use of cotrimoxazole. Efficacy and applicability of these treatments vary with breed, climate, management (e.g. availability of labour) and other environmental factors. The need for each environment to determine appropriate treatment regime rather than extrapolating from other research findings can, therefore, not be overstated.

The present study was therefore designed with the objective of determining incidence and pattern of occurrence of IBK in relation to environmental, host and managemental factors, determining the causal agents of IBK and evaluating treatment methods used in Tanzania. The overall objective, in addition to clarifying on IBK in Tanzania, was to determine the most appropriate treatment method for the disease.

MATERIALS AND METHODS

Location

The study was conducted at Morogoro among dairy cattle belonging to Sokoine University of Agriculture (SUA). SUA is situated at an altitude of about 520 meters above sea level and has a bimodal rainfall pattern with short and long rainy seasons. The long rains occur between February and May; short rains start in October and end in December. The rest of the year forms the dry period for Morogoro. Temperatures are almost constant throughout the year, ranging from 27°C to 31°C at daytime and not less than 14°C at night during the coolest month.

Animals

Animals comprised mainly of Friesian, Ayrshire, Jersey, Mpwapwa and crosses of these breeds with indigenous cattle (Zebu). The animals were divided into six groups by the farm management: Group 1 (n = 69) comprised of preweaning calves, aged less than 6 months, that were kept in separate rooms, and their house was fly proof. Group 2 (n = 28) comprised of weaner calves, aged 7–12 months, that were kept in separate rooms and had little contact with each other but their house was not fly proof. Group 3 (n = 44) comprised of weaner calves, aged 7–12 months, that were kept in one big room that was not fly proof, with one feeding trough and one water trough. Both troughs were inadequate for the number of animals that were kept. Group 4 (n = 37) comprised of young stock (age 13–18 months) that were kept in a paddock and only occasionally did these animals move out briefly for treatment or spraying. Group 5 (n = 64) comprised of a dry herd (>2 years), also kept in a paddock but far from the farm buildings. Group 6 (n = 128) was a

milking herd. Animals in this group were grazed in the morning and evening periods when the weather was cool, and were kept under shade and zero grazed at mid-day, when temperatures were high. Generally, this group was adequately fed.

Records

Data on the incidence of IBK was obtained from farm records for a period of four years. A total of 2,642 cases of IBK from different age groups, namely calves (<6 months; n = 724), weaners (7–12 months; n = 594), young stock (13–18 months; n = 361) and adults (>18 months; n = 963) were available for analysis. From this data, monthly incidence rates of the disease for each age group were calculated. Records from the meteorological station of the University farm were used in order to obtain data on the weather. These weather data were correlated with incidence rates.

Clinical cases

A total of 370 animals representing different age groups were examined clinically and then followed for six months in order to evaluate incidence–management relationship. Those found with IBK (141 cases) were used for clinical, bacteriological and treatment studies.

Bacteriological investigations

Samples were collected from conjunctival sacs of 60 cattle with IBK by means of sterile cotton wool swabs. A swab was rolled in each eye's conjunctival sac and then placed in a sterile test tube. All swabs were streaked onto sheep blood agar plates within half an hour and incubated at 37°C for 48 hours. Reading of plates was done at 24 and 48 hours of incubation. For identification, Grams staining and other bacteriological tests namely plasma coagulase test, gelatin liquefaction and nitrate reduction test were done on isolates.

Treatment

One hundred and fourty one cattle affected with IBK were treated. Three treatment methods were used depending on severity of the disease. Sixty four animals with mild signs, before development of ulcer, were given topical Penicillin–streptomycin (Streptopen(R), Glaxo) twice a day for seven days. Forty eight severely affected cattle, 23 of which had not responded to topical streptopen, were given subconjunctival (SC) injections of Penicillin–streptomycin (Penstrep(R), C–Vet LTD). The number of injections for each affected animal depended on rate of recovery. Thus injections were given once, twice or three times, at weekly intervals until definite signs of recovery were evident. Twenty nine animals with severe signs of IBK were treated with intravenous injection of Tribrissen(R) (Coopers Animal Health LTD, Berchamstead, U.K) at a dose rate of 30 mg /kg body weight. This was followed by a similar dose, divided into two and given 48 and 72 hours later. In three animals, eye enucleation had to be done because the disease was very severe involving corneal rupture, iris prolapse, exophthalmos and panophthalmitis. Subconjunctival injections were done as follows: A 22 gauge needle attached to a syringe, containing 2 ml of injectable antibiotic (Penstrep(R)) was used. After the animal was sufficiently restrained, pressure was applied on the upper eyelid between the orbit and eyeball. This caused protrusion of loose bulbar conjunctiva into which the antibiotic was injected. Animals seemed to tolerate the procedure and no local anaesthetic or other premedication was required.

Statistical analysis

All data was analyzed according to Snedecor and Cochran (1989). Chi square test was used to assess the significance of differences in management-incidence relationship; simple correlation analysis was used to assess the relationship between incidence rates and age as well as rainfall and seasonality.

Table 1: Average Incidence Rates (%) of IBK According to Age, Month and Rainfall Distribution

		Age Groups				
	Rain-fall(mm)	Calves (< 6mon)	Weaners (7-12)	Young (13-18)	Adults (>18 mon)	Herd aver**
Jan	162.2	26.7	17.5	18.4	1.7	13.7
Feb	110.2	6.3	18.0	14.6	3.4	9.3
Mar.	146.6	30.7	18.2	16.4	8.0	12.2
April	130.1	35.6	22.9	14.5	12.2	15.4
May	77.1	22.1	23.7	10.4	9.5	11.9
June	29.0	16.1	19.8	5.4	9.5	9.5
July	10.9	6.9	7.6	6.5	1.3	4.7
Aug	13.2	6.3	6.7	6.3	1.8	7.0
Sept	16.0	14.5	12.8	17.1	3.1	10.9
Oct	50.3	24.3	23.0	18.4	4.1	15.2
Nov	113.6	32.3	23.5	23.8	5.0	15.3
Dec	162.8	25.4	21.1	25.9	3.2	14.4
Aver*		22.3	17.9	14.8	4.9	11.6

N.B: Incidence rates were calculated for each age group from 2642 cases out of which 724 were calves, 594 weaners, 361 young stock, and 963 adults. Aver* = monthly average for each age group; Herd aver** = average incidence rates for herd.

RESULTS

Incidence and occurrence pattern

Average incidence rates according to age groups together with average monthly rainfall distribution for the period of study are shown in Table 1. There was a very high correlation between incidence rates and age (r = - 0.96) as well as rainfall (r = 0.83in calves and 0.71 for herd average). Incidence of IBK decreased with increasing age. They were higher during the rainy season and towards the end of dry season. Moreover, the pattern of occurrence in relation to season was similar in all age groups. Figure 1 shows pattern of occurrence of IBK in calves (the most susceptible age group) as well as herd average in relation to mean monthly rainfall.

Clinical cases

Results on occurrence of IBK in relation to management groups are shown in Table 2. Differences in incidence of IBK between management groups were statistically significant ($P < 0.05$).

Incidence of IBK in calves kept in fly proof houses was lowest although, because of its age, it was expected to be the highest. Only eight out of 69 animals in this group were affected.

Table 2: Incidence of IBK in relation to different management groups

	Affected	Not affected	Total	% Affected
Separate rooms:				
Group 1				
Flyproof	8	61	69	11.6
Group 2				
Not flyproof	23	5	28	82.1
Common room				
Group 3				
Small space	37	7	44	84.1
Group 4				
Ample space	23	14	37	62.1
Paddocks				
Group 5				
Dry herd	24	30	64	37.1
Group 6				
milking herd	26	85	128	20.3

Its incidence was, however, highest in animals kept in a common room that was not fly proof and had small space for drinking and feeding. Thirty seven out of 44 animals in this group were affected. Furthermore, clinical features in this group were more severe than in other groups.

Regarding clinical signs, ocular discharge of serous fluid was often the first sign to be observed. This was quickly followed by blepharospasm and photophobia within two to three days.

Photophobia was accompanied by inflammation of cornea and conjunctiva. The focus of inflammation started from the center of the cornea rather than from the periphery. The inflammation was followed by a more copious discharge that soon became purulent. The discharge formed a wet streak down the cheek and this streak could be seen from a distance. In the center of the inflamed cornea there appeared an area of opacity whose colour was pinkish. The opacity appeared within two to three days after detection of the first sign. Between the third and fifth day the opaque area developed one or more pimples that soon became erosions. The erosions progressed into ulcers. In untreated animals the cornea became thick and dull with grayish yellow colouration. Pus and fibrinous deposits were often seen around the ulcerated area. Ulcers were found to deepen and frequently the descements membrane prolapsed through them. Affected eyes in some animals developed hypopyon irrespective of treatment while in others, possibly due to increased intraocular pressure, bulged out of their sockets and gave an impression of tumorous masses of about 5 cm long. Commonly, both eyes were affected but not to the same degree.

The disease was noted to cause systemic signs especially in calves,

Table 3: **Isolation of *M. Bovis*, *Br. catarrhalis* and *Staph. aureus* from 58 diseased cattle**

Age Group	Bacterial growth	No. of animals	M	B	S	M+B	M+S	B+S
Calves	Unilateral	10	4	2	2	1	1	–
<6 mon.	Bilateral	3	1	1	–	1	–	–
Weaners	Unilateral	15	8	5	–	–	2	–
7–2 mon.	Bilateral	11	5	1	1	1	1	2
Y/Stock	Unilateral	5	3	1	–	–	1	–
	Bilateral	4	1	1	1	1	–	–
Adults	Unilateral	10	–	1	3	2	2	2
	Bilateral	–	–	–	–	–	–	–
TOTAL		58	22	12	7	6	7	4

N.B: M = *M. bovis*, B = *Br. catarrhalis*. S = *Staph. aureus;* M + B = *M. bovis + Br. catarrhalis*, M + S = *M. bovis + Staph. aureus, B + S = Br. catarrhalis + Staph. aureus*

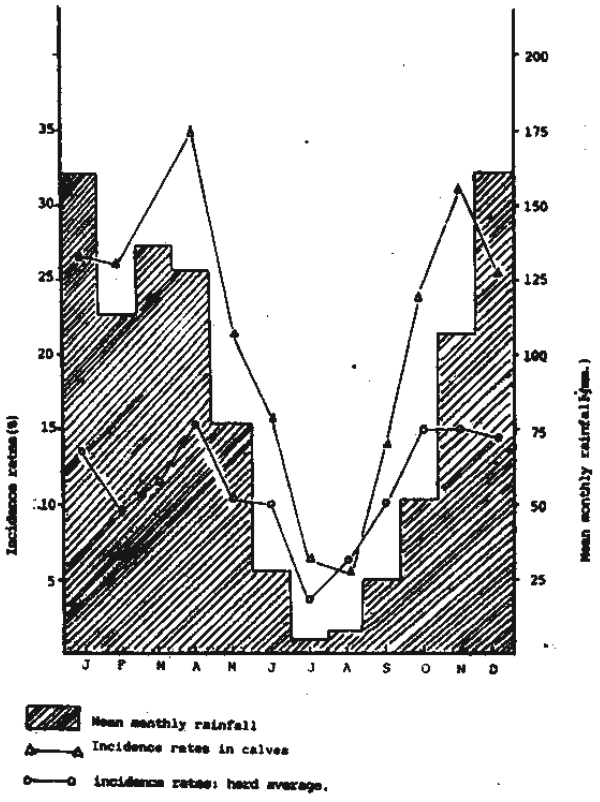

Figure 1: Occurrence pattern of IBK in relation to rainfall.

DISCUSSION

This study has shown that IBK occurs all the year round with peak incidence during the rainy season and towards the end of dry season. This seasonal variation could be attributed to fly activity as well as level of nutrition. During rainy season high disease incidences as fly activity of particularly of *Musca domestica* increased was noted. Furthermore significant differences in infection rates between calves kept and those not kept in fly proof houses were observed. Flies could thus be important in the transmission of IBK. This importance has also been noted by other workers (Hughes and Pugh, 1970; Brown and Adkins, 1972; Kopecky *et al.*, 1986). Other insects namely moths; *Arcyophora longivalvis* have been associated with IBK transmission in Uganda (Guilbride *et al.*, 1959). They were however not observed in this study. In general, insects have been suspected to play dual role: Bringing infectious agents to the eyes and damaging the cornea directly or indirectly by forcing animals to traumatize themselves while attempting to dislodge them. Corneal damage by whatever means predispose animals to IBK.

Higher incidence of IBK in animals with poor nutritional status is a confirmed phenomenon (Wilcox, 1970; Beug *et al.*, 1976). Moreover undernourished animals suffer from severe forms of IBK (Baptista, 1979). As nutritional status is governed by fodder availability which varies according to season, it is to be expected that IBK should show seasonal variation. The high incidence rates of IBK towards the end of dry season, observed in this study, coincides with a period of lowest feed supply.

Decreasing incidence rates as well as severity with increasing age was noted. The reason for this is probably, development of immunity. Immunity to *M. bovis* is reported to be present but is of short duration (Freitas, 1964; Hughes and Pugh, 1972; Hughes and Pugh, 1975). But in the presence of continuous challenge, it could be made to last longer.

Most clinical signs observed in this study are in agreement with Billing's description of 1889 and others after him (Baldwin, 1945; Formston, 1954; Freitas, 1964; Bedford, 1976 Scott, 1977). Our impression, however, was that signs observed in this study were of more severe degree. Protrusion of eyeball (exophthalmos) was only occasionally described in the mentioned reports. Reasons for greater severity were probably due to level of nutrition and prevalence of other intercurrent diseases that lowered resistance of susceptible animals.

Bacteriological investigations indicated that in the animals studied, IBK was caused by *Moraxella bovis*, *Branhamella catarrhalis* or *Staph aureus*, or it was a mixed infection. *M. bovis* was isolated, pure or mixed, in 35 cases (60.3 %), *Br. catarrhalis* in 22 (37.9 %) and *Staph. aureus* in 18

(31.0 %) out of 58 cases. From these results it could be concluded that *M. bovis* was the major cause of IBK. The other two bacteria were less efficient in causing the disease and mostly helped to exacerbate the condition. Thelazia species, although known to be prevalent in Tanzania (Ecimovic, 1973), were not observed in the animals examined.

Results obtained using subconjunctival injection of Penicillin-Streptomycin were superior to those of using either topical streptopen(R) (Glaxo) or IV tribrissen(R) injection in terms of response percentage and speed of recovery, subconjunctival injection had an advantage of requiring, mostly, one or, occasionally, two treatments spaced seven days apart. This made the method less demanding to personnel doing treatments and less stressful to animals as they were handled less frequently. These findings indicate that while further research is required, it can be recommended that subconjunctival injection of antibiotic is a treatment of choice for IBK.

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