Bovine Malignant Catarrhal Fever in Colorado

Robert E. Pierson, *D.V.M.*
***Marcelo Arango,** *M.V.Z.*
Department of Clinical Sciences
A. E. McChesney, *D.V.M.*
Department of Pathology
College of Veterinary Medicine
Colorado State University
Fort Collins, Colorado

Introduction

Bovine malignant catarrhal fever (MCF) was first recognized in Africa and Europe about 1850 (12,13,14) and in the United States in Pennsylvania in 1920 (1). Today, in certain parts of the world, MCF is recognized as an important disease of cattle (1,9,11,16), deer (3,7), buffalo (10), and bison (15). Sheep (5,14) and some species of wildlife (12,13,17,16) are suspected to be carriers of the disease although they do not develop clinical signs (14).

Within the United States, MCF usually occurs sporadically, but occasionally it reaches epizootic proportions. Since single isolated cases are seldom diagnosed or reported, the accumulation of accurate statistical data has not been possible.

A severe epizootic of MCF resulted in the death of 87 cattle in one feedlot (37%) in northern Colorado, and the severity of this epizootic stimulated studies of MCF by veterinarians. This paper describes the incidence and general characteristics of MCF as it occurs in northern Colorado.

Methods

The statistical data reported herein were obtained from the files of the College of Veterinary Medicine and Biomedical Sciences of Colorado State University. The 364 animals determined to have had MCF were identified by staff members of the Department of Clinical Sciences, or at necropsy by members of the Department of Pathology, Colorado State University. Records of 158 cattle were used to determine incidence according to type of cattle operation, and in 172 animals, the age, sex, and breed of cattle were recorded. In 122 herds, the exposure of cattle to sheep was recorded, and in 59 animals clinical signs were described.

**Graduate student.*

Incidence and Occurrence

Malignant catarrhal fever is an acute, infectious, noncontagious disease of cattle, characterized by low morbidity (1-3%) and high mortality (90-100%) (2,8). A virus, suspected to be the etiologic agent of MCF, was isolated from affected cattle (18) in cell culture systems. The agent was cellassociated, caused cytopathogenic effects in cells and had properties similar to those of herpes viruses.

The disease has been observed in Colorado for at least 30 years, but from January, 1962, to July, 1972, in the area of Fort Collins, Colorado, 364 animals were recognized as having MCF (Table 1). Because of the high mortality associated with MCF and because feedlot owners often destroy diseased animals, this figure probably represented a small percentage of the cases of MCF that occurred in northern Colorado. It is estimated that approxi-

Table 1

MFC in Northern Colorado, Incidence by the Year in the Period 1962-1972

Years	Number of[a] Animals Affected	Percent of Animals Affected
1962 - 63	32	9
1963 - 64	19	5
1964 - 65	68	19
1965 - 66	28*	8
1966 - 67	25	7
1967 - 68	26	7
1968 - 69	15	4
1969 - 70	16	4
1970 - 71	23	6
1971 - 72	13	4
1972 to July	99*	27
Total	364	100

[a]364 – complete and incomplete records.
*Two epidemics: 11% died in one epizootic in 1965; 37% died in one epizootic in 1972.

professional

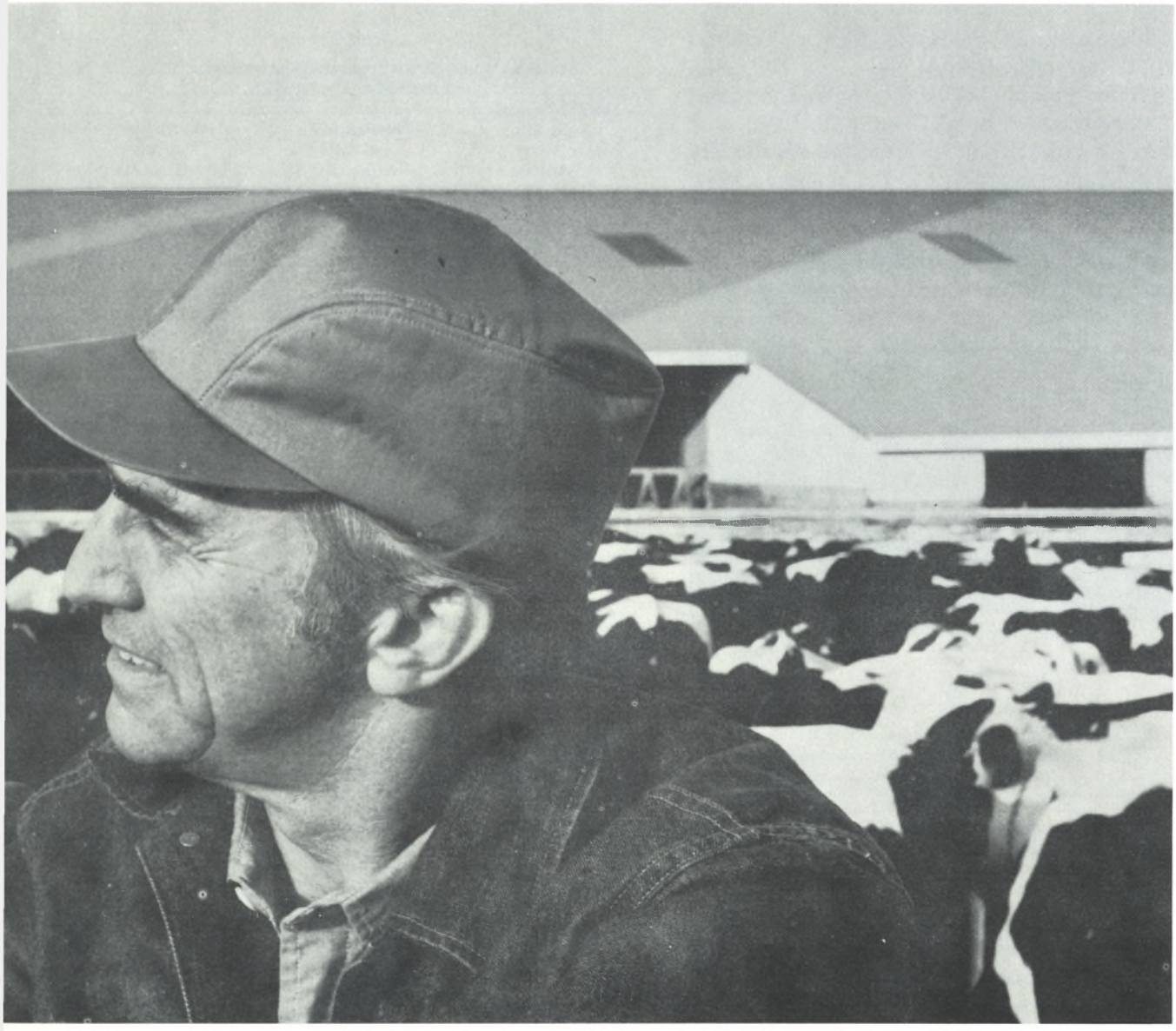
modern mastitis management*

Progressive dairymen have cut mastitis losses as much as 75% and saved up to $60 per cow in 18 months . . . by following the recommendations of their veterinarian. They have made the 4-step Modern Mastitis Management program a regular, routine part of their herd health practices:

These 4 simple steps are:

1. Properly operate and maintain milking equipment.
2. Treat clinical mastitis flare-ups immediately.
3. Dip teats in a recommended disinfectant after each milking.
4. Follow a program of dry cow therapy.

this 4-step modern mastitis management program

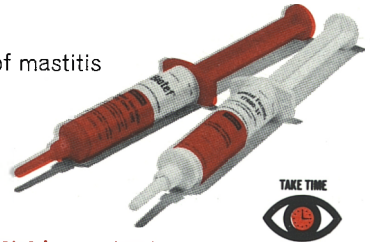


HELPS YOU SERVE YOUR CLIENTS BETTER . . .
BUILDS A MORE SUCCESSFUL DAIRY PRACTICE

Mastitis is still the Number 1 health problem in dairy cattle. Dairymen need your professional knowledge and counsel to solve it. You can help them reduce and control the incidence of mastitis in their herds by helping them establish a program of Modern Mastitis Management.

To assist you in convincing dairymen this program can help them cut mastitis losses, Upjohn has made available a complete package of communication aids: a 30-minute color movie narrated by Chet Huntley; a 28-page booklet; envelope stuffers; counter cards—all on the subject of Modern Mastitis Management. Ask your Upjohn representative how you can make use of these materials and for his cooperation in conducting Modern Mastitis Management meetings with dairymen.

Special Formula 17900-II*. . . a proven name in the treatment of mastitis
Biotef®. . . the gelled-base dry cow product



WARNINGS: Special Formula 17900-II*: Milk taken from treated animals within 96 hours (8 milkings) after latest treatment must not be used for food. Biotef®: For use in dry cows only. Use no later than 4 weeks prior to calving.

TAKE TIME
OBSERVE LABEL DIRECTIONS

from the strong red line of **Upjohn** *Veterinary Products, Kalamazoo, Michigan 49001*

mately 200 cattle in the area of Fort Collins, Colorado, die annually from MCF.

In 1965 an epizootic of MCF occurred in cattle in one feedlot with a loss of 12 animals (11%), and in another feedlot (1972), an epizootic resulted in the loss of 87 animals (37%).

Malignant catarrhal fever occurs throughout the year in northern Colorado with the highest incidence during the winter months (Table 2). The incidence of the disease diminishes in the spring and remains minimal until the following winter. The Fort Collins area is mainly a feedlot area where cattle six months to two years of age are fattened for market. In a survey of 158 cattle affected with MCF, 130 (82%) were feedlot cattle, 24 (15%) were dairy cattle and four (3%) were range cattle (Table 3). Among all types of cattle operations, cattle one to two years of age were more frequently affected with MCF (49%) than were cattle two years of age and older (28%) (Table 4). Both sexes and all breeds are equally affected (Tables 5 and 6).

Table 2

MCF in Northern Colorado, Monthly Incidence for the Period 1962-1972

Month of Occurrence	Number of[a] Animals Affected	Percent of Animals Affected
January	88	24*
February	128	35*
March	53	15*
April	28	8
May	16	4
June	11	3
July	9	3
August	5	1
September	6	2
October	5	1
November	8	2
December	7	2
Total	364	100

[a]364 – complete and incomplete records.
*Note that 74% of the cases were seen during the winter months of January, February and March.

Table 3

MCF in Northern Colorado, Incidence According to Type of Cattle Operation in the Period 1962-1972

Type of Cattle Operation	Number of Animals Affected	Percent of Animals Affected
Feedlot cattle	130	82
Dairy cattle	24	15
Range cattle	4	3
Total	158*	100

*158 cases with incidence data in records.

Table 4

MCF in Northern Colorado, Age Incidence in the Period 1962-1972

Age	Number of[a] Animals Affected	Percent of Animals Affected
Less than one year	39	23
One to two years	85	49
Two years or older	48	28
Total	172	100

[a]172 – cases with incidence data in records.

Table 5

MCF in Northern Colorado, Sex Incidence in the Period 1962-1972

Sex	Number of[a] Animals Affected	Percent of Animals Affected
Female	79	46
Steers*	90	52
Bulls	3	2
Total	172	100

[a]172 – cases with incidence data in records.
*Steers predominate in this area.

Table 6

MCF in Northern Colorado, Breed Incidence in the Period 1962-1972

Breed	Number of[a] Animals Affected	Percent of Animals Affected
Angus*	32	19
Angus x Hereford*	37	22
Charolais	6	3
Guernsey	4	2
Hereford*	52	30
Holstein*	33	19
Jersey	2	1
Shorthorn	6	3
Bison	2	1
Total	172	100

[a]172 – cases with incidence data in records.
*Predominate in this area

Role of Carrier Animals

Little is known about the transmission of MCF as a naturally occurring disease, but in Africa, some species of wild animals probably are carriers. The blue wildebeest (Connoehates Gnu) have been identified as carriers of MCF (3,16), and transplacental transmission of MCF has been reported among them (17). Outbreaks of MCF in cattle have occurred concurrently with the wildebeest calving and sheep lambing season in Kenya and Tanzania (3,4,14).

In northern Colorado, 88% of the herds in which MCF was reported were within one mile of sheep

Table 7

MCF in Northern Colorado, Cattle to Sheep Exposure

Exposure	Herds in which MCF was Recognized	Percent of Herds in Direct or Indirect Contact with Sheep
Sheep near feedlot	67	54.95*
Sheep within 1 mile	40	32.75*
No known contact	15	12.30
Total	122	100

*88% of the cases occurred when sheep were either on the farm or within one mile of the farm.

(Table 7). The part played by sheep in the transmission of MCF is unknown, but during the lambing period in Colorado, which occurs during the winter months, the greatest number of cases of MCF have been recorded. Notably, veterinarians have observed many outbreaks of "sheep-associated" MCF when cattle were in close contact with feeder lambs but not with ewes.

Clinical Findings

Four clinical forms of MCF have been described: peracute, head and eye, intestinal, and mild form (2,6,8). A chronic form of the disease has been described in cattle in Michigan (1). Signs differentiating these forms are seldom clear cut, and two or more forms are often recognized in an individual animal. The "head and eye" form is the most common in Colorado (Figs. 1, 2, and 3); the mild and chronic forms are rarely recognized.

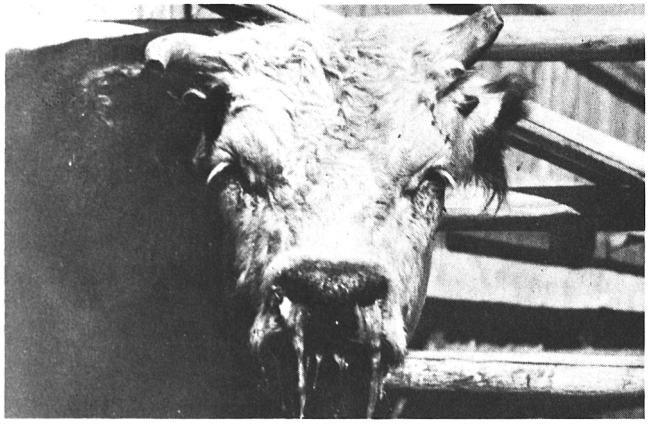


Figure 1. Feedlot steer with head-and-eye form of malignant catarrhal fever.

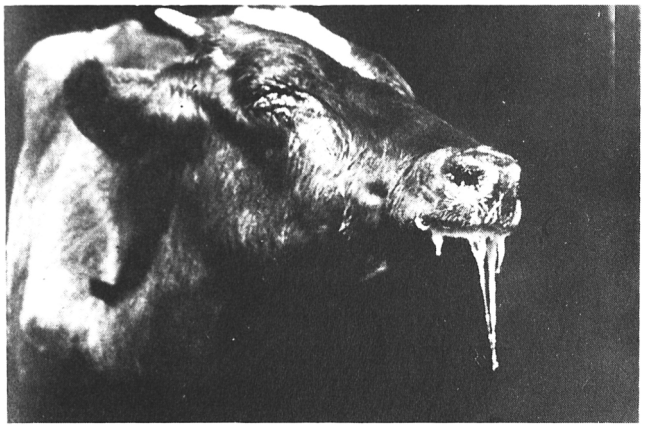


Figure 2. Holstein heifer with head-and-eye form of malignant catarrhal fever.

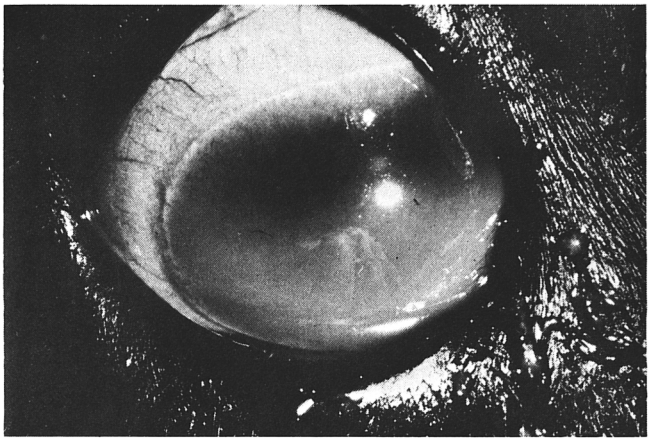


Figure 3. Eye of steer showing corneal opacity due to malignant catarrhal fever.

Table 8

MCF in Northern Colorado, Clinical Signs Observed in 59 Cattle in the Period* 1962-1972

Clinical Signs	MCF	
	No. of Animals in which the Sign Occurred*	Percent of Animals in which the Sign Occurred
Temperature above 104°F	59	83
Photophobia	47	80
Lacrimation	46	78
Scleral Injection	46	78
Corneal Opacity	44	75
Enlarged lymph nodes	40	68
Weakness	38	64
Nasal Exudate	35	59
Diarrhea	35	59
Crusted Muzzle	29	49
Stertorous Breathing	28	47
Oral Cavity		
1. Mucosal Hyperemia	26	44
2. Mucosal Ulcers	23	39
3. Salivation	26	44
Moist & Dry Rales (Auscultation of Lung)	17	29
Abnormal Behavior (Aggressiveness, Ataxia, etc.)	19	32
Cutaneous Lesions		
1. Non-specific Dermatitis	8	14
2. Coronary Necrosis & Ulceration	5	8
3. Treat Ulceration & Necrosis	4	7
Bloody Urine	6	10

*59 cattle with complete records.

In 59 naturally occurring cases of MCF, clinical signs were studied and recorded (Table 8). The disease, acute in onset, was characterized by body temperatures of 104-107°F, depression, anorexia, weakness, and a marked drop in milk production. No constant sequence in which the following signs developed was evident: photophobia, lacrimation, injected sclera, mucopurulent ocular discharge, and corneal opacity. Opacity, which started at the corneal limbus, extended toward the corneal center and became progressively more marked. Somatic and visceral lymph nodes were usually enlarged.

Nasal discharge, at first catarrhal, was followed by mucopurulent exudate which often had an offensive odor. The muzzle was crusted and eroded. Stertorous breathing resulted from narrowing of the nasal passages by swollen hyperemic mucous membranes and mucopurulent exudate.

Dark, bloody, fetid feces were usually observed in the intestinal forms of the disease. Hyperemia, shallow erosions and ulcers of the oral mucosa were often accompanied by excessive salivation. The mouth was sensitive and animals resisted examination of the oral cavity.

Signs less frequently observed included: hyperasthesia, aggressiveness, ataxia, or the inability to stand. The epidermis, especially near the coronary band of the hooves and around the base of the horns, had areas with necrosis or ulcers. Similar changes infrequently were observed on the teats and other areas of the body. Bloody urine was observed in approximately 10% of the cattle with MCF.

Clinical Pathology

Leukopenia occurred consistently in MCF and was first observed at the time of the initial rise in body temperature. Leucocytes were reduced in number to as low as three thousand per cmm. of blood, with a relative increase in mononuclear cells (2).

Necropsy Lesions

Gross and microscopic postmortem lesions were described in records from 59 animals that died with MCF. Observed lesions were usually associated with a necrotizing vasculitis and have been presented in the order of their frequency of occurrence.

Gross and microscopic lesions, observed in the oral cavity, esophagus, abomasum and intestinal tract, consisted of capillary congestion, focal necrosis and ulceration of the mucosa. Encrustation of the muzzle was consistently observed.

Lymph nodes were generally enlarged, firm and contained hemorrhagic or necrotic foci. The spleens were congested, moderately enlarged and contained markedly increased number of lymphocytes.

Small white foci that were slightly elevated were frequently observed in the renal cortex. Histologically, the foci resembled accumulations of lymphocytes. Hemorrhages and ulcers in the mucosa of the urinary bladder usually were associated with vasculitis.

Corneal edema and opacity progressed from the corneoscleral junction toward the corneal centers. Capillaries in the conjunctiva were markedly congested. Fibrin, neutrophils and lymphocytes were present in the anterior chamber of the eye and in the subconjunctival tissue at the fornix of the conjunctiva. Small arteries at the conjunctival fornix, the meninges, brain, liver and adrenals had large numbers of lymphocytes in their adventitia.

Gross and microscopic lesions of the nasal cavity and trachea consisted of necrosis and ulceration of the mucosa, capillary congestion, submucosal edema and diphtheretic membrane formation.

Discussion

The results presented in Table 1 indicate that the number of cases recorded from 1962-1967 exceed those recorded from 1968-1972 even though there was an increase in the cattle population during the last five years. The reduction in cases of MCF may be attributed to shorter periods of time spent by cattle in feedlots and to the improved sanitation maintained in these feedlots.

Table 2 shows that 74% of the reported cases of MCF occurred during the winter months. The stress induced by cold weather, the strict confinement of cattle, and the occurrence of the lambing season during these months may have contributed to the high incidence of the disease.

Tables 3, 4, 5 and 6 present the incidence of the disease according to type of cattle operation, age, sex and breed. In northern Colorado, cattle one and two years of age are most often affected. This age incidence also corresponds with data findings presented by researchers in Africa (13), but since cattle of this age predominate in Colorado, no definite conclusion can be reached as to whether or not age is a valid factor in the incidence of MCF. Older and younger animals are affected also, but in smaller percentages. The relationship of incidence to age could result from natural or acquired resistance, or because older animals are not usually kept in strict confinement or in as large a group as are the one to two year old cattle. All breeds of cattle do not appear to be equally affected by MCF. Most cases are Angus, Angus x Hereford, Hereford and Holstein; however, this may be

because of the disproportionate representation of these breeds in feedlot cattle. When sex as a factor in the incidence is considered, steers show a slight predominance. This increased incidence may be attributed to the fact that there are more steers than heifers or bulls in northern Colorado.

Sheep have long been suspected as being carriers of MCF (14), but this hypothesis lacks supporting proof. The results in Table 7, however, indicate that 88% of the recorded cases of MCF occurred in cattle with close or immediate contact to sheep. More lambs are fattened in the Fort Collins area than any other place in the United States. The high incidence of MCF in feedlot cattle in this area suggests some correlation may exist between cattle to sheep exposure. Since 12% of the herds recorded showed no "sheep-association," the possibility of other animals (rabbits, mice, etc.) acting as carriers cannot be disregarded. The strongest proof supporting the sheep associated hypothesis is that the lambing season is concurrent with the months in which the highest incidence of the disease occurs.

Blood sucking insects such as ticks, flies, and mosquitos have been suspected vectors, but ticks, flies and mosquitos are not commonly encountered during wintertime, which is the period of the highest incidence of MCF. Since the incubation period for naturally occurring MCF has not been determined, the reduced number of insects in the winter may not eliminate their role as carriers.

The "head and eye" form of MCF is the most common type found in Colorado. This may suggest that various strains of the virus exist that will induce certain forms of the disease.

Leukopenia is commonly found in cattle with MCF, as it is in some other viral diseases. Apparently it occurs because the virus causes depression of the formation of leukocytes in the bone marrow.

A differential diagnosis of MCF requires the consideration of: bluetongue, foot-and-mouth disease, vesicular stomatitis and infectious bovine rhinotracheitis. Bluetongue is the only infectious disease of ruminants that histologically resembles MCF. Both diseases have vasculitis as their primary lesion. However, neural and ocular lesions are not seen in bluetongue. Foot-and-mouth disease and vesicular stomatitis have vesicles in the mucose of the oral cavity. No mucos of vesicles are found in the oral cavity of cattle with MCF. Mucosal disease can be differentiated from MCF because panophthalmitis is rarely observed and lymph node enlargement or encephalitis are not present in mucosal disease. Infectious bovine rhinotracheitis is a disease with high morbidity and low mortality and the lesions are restricted to the upper respiratory tract.

Confirmation of the disease may be made by observation of the clinical signs in correlation with histopathologic findings. Generalized fibrinoid necrotizing vasulitis is probably unique to MCF in cattle.

Summary

From 1962 to 1972 veterinarians diagnosed malignant catarrhal fever (MCF) in 364 animals from the vicinity of Fort Collins, Colorado. Eighty-two percent of the cases of MCF occurred in feedlot cattle which were usually one to two years of age. No significant differences in sex or breed incidence were evident. Seventy-four percent of all cases occurred during the winter months.

Two large epizootics occurred in feedlot cattle which were near feeder lambs and brood ewes. Clinical signs were typical of MCF infections and characteristic of the "head and eye" form. The basic histological lesion was necrotizing vasculitis.

References

1. Berkman, R. N., Barner, R. D.: Bovine Malignant Catarrhal Fever. I. It's Occurrence in Michigan. J.A.V.M.A. 132, No. 6, (March 15, 1958): 243-248. – 2. Blood, D. C. and Henderson, J. A.: Veterinary Medicine. Third edition, The Williams and Wilkins Comp., Baltimore, (1968): 479-482. – 3. Clark, K. A., Robinson, R. M., Marburger, R. G., Jones, L. P., Orchard, J. H.: Malignant Catarrhal Fever in Texas Cervix. J. of Wildlife Diseases. Vol. 6, Proceeding Annual Conference, (October, 1970): 376-383. – 4. Daubney, R. and Hudson, J. R.: Transmissions Experiments with Bovine Malignant Catarrhal. J. Comp. Path. 49, (1936): 63-89. – 5. Gotze, R.: Bosartiges Katarrhalfieber. IV. Mitteilunge., Berl., Munch. Tierarztl., Wochnschr., 53, (1932): 848-855. – 6. Gotze, R. and Liess, J.: Untersuchungen uber das Bosartige Katarrhalfieber des Rindes. II. Schafe als Ubertrager. Deutsche. Tierarztl. Wochnscher., (1930): 194-200. – 7. Huck, R., Shand, A., Allsop, P. J. and Paterson, A. B.: Malignant Catarrh of Deer. Vet. Rec. 73, (1961): 456-465. – 8. Hutyra, F., Marek, J., and Manninger, R.: Special Pathology and Therapeutic of the Diseases of Domestic Animals. 5th ed. Alexander Eger, Inc., Chicago, (1949): 485-495. – 9. Machinnon, M. M.: Malignant Catarrhal Fever of Bovines. The New Zealand Vet. J., 4, (1956): 91-96. – 10. Manjoer, M.: Contribution to the Knowledge of the "Penjakit ingusan" of Cattle and Buffaloes in Indonesia, Especially on the Island of Lombok. Vet. Bulletin, English summary of the thesis for the degree of D.V.S.C., University of Indonesia, Bogor. Hemera Zoa, 62 Abstr. in Vet. Bull., 25, (1955): 621. – 11. Marchall, C. J., Munce, T. E., Barnes, M. F., and Boerner, F.: Malignant Catarrh Fever, J.A.V.M.A., 56 (1920): 570-580. – 12. Mettam, R. W. M.: Snotsiekte in Cattle. 9th and 10th Rep. Dir. Vet. Educ. Rec., Union of S. Africa. (1923): 395-432. – 13. Piercy. S. E.: Studies in Bovine Malignant Catarrhar. I. Experimental Infection in Cattle. The British Vet. Journ. 110, (1954): 508-516. – 14. Piercy, S. E.: Studies in Bovine Malignant Catarrhar. V. The Role of Sheep in the Transmission of the Disease. Brit. Vet. J., 110, (1954): 508-516. – 15. Pierson, R. E.: College of Veterinary Medicine, Colorado State University, Fort Collins, Colorado. Personal communication. (1972). – 16. Plowright, W.: Malignant Catarrhar Fever. J.A.V.M.A. 152, No. 6, (March 15, 1968): 795-803. – 17. Plowright, W., Ferris, R. D. and Scott, G. R.: Blue Wildebeest and the Aetiological Agent of Bovine Malignant Catarrhal Fever. Nature. London. 188, (1960): 1167-1169. – 18. Plowright, W., Macadam, R. F., and Armstrong, J. A.: Growth and Characterization of the Virus of Bovine Malignant Catarrhal Fever in East Africa. J. Gen. Microbiol., 39, (1965): 253-266.