Enzootic Pneumonia in Calves*

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Summary

A serologic examination on 24 calves older than 3 months shows that BRS virus seems more closely related to the acute stadium of enzootic pneumonia than IBR, PI-3 and BVD virus. Pneumonic diseases in calves can with great significance be prevented on a short term by giving tylosin, which at the same time gives an averagely higher daily growth.

Introduction

Enzootic pneumonia in calves seems to be an ever increasing problem in both beef and dairy cattle. Long before it became a problem in Denmark, we had reports of the American feedlots on enzootic pneumonia cases, which are known as virus pneumonia, "shipping fever" and the like. In Denmark the disease is often described as influenza or contagious cough. In Holland and West-Germany the disease complex is called respectively "Pinkengriep" and "rindergrippe."

Danish agriculture suffers serious loss as a result of diseases in the respiratory tract in young cattle. About 170,000 calves still die every year and this even though much has been done to diminish this loss. An ever increasing part of the mortality in calves is caused by pneumonic diseases contrary to former days when it was mainly diarrhea cases which caused most deaths.

A disease registration during all-year experiments of 1978-79 showed that pneumonia was the most prominent disease in calves of the age of 0-4 months, as 81% of all the cases were pneumonia (Ostergärd 1980). Blom 1981 showed that in 8 herds with 71 dead calves 6.8% (variation 0.7%-15.2%) were caused by pneumonia, which was also the most prominent death cause. It is generally acknowledged that enzootic pneumonia is a multifactorial disease. Thus an unfortunate correlation between agent, environment and the calf is necessary to cause a clinically recognizable disease. A reproduction of the disease complex has often been difficult, in any case with a limited number of agents (Frank and Marshall 1973, Jacobs and Edinton 1975, Manhanty et al. 1975). Stressing factors such as trade and transport are very straining and often decisive on the start of the disease. Contrary to the size of Denmark, Danish calves are often exposed to long journeys (Hojbjerg 1973).

**Main project in order to obtain a licence as a veterinarian specialized in cattle.*

The present research has on a serologic basis its goal to get an indication of the primary role of four different viruses in cases of enzootic pneumonia. I wanted to get results from calves that had survived, and to come one step into the course of the disease before Bitsch *et al.* 1976, who had a microbial account of 50 autopsied pairs of lungs.

Clinical Symptoms of the Disease Complex

Enzootic pneumonia especially attacks calves of the age of 1-5 months. Stott *et al.* 1978 considered that 66% of the diseases in the respiratory tract occur before the animals are 4 months old and that only 2.5% are observed in calves older than 9 months. Calves younger than two weeks are seldom attacked by the disease, which must be due to protection from maternal antibodies. If calves older than 6-7 months are attacked, the disease often passes without complications, which may be explained by the fact that these calves have had a possibility to build up immunity against secondary bacterial infections. It is typical that even older calves that are attacked by enzootic pneumonia have difficulty in withstanding the infection when on an earlier stage they have been attacked by diseases of the respiratory tract.

The disease can characteristically be observed in the housing period and particularly during December-January-February when 50% of the losses occur (Wizigmann *et al.* 1976). The calf gets fever, is dull and has anorexia. The breathrate is strongly increased and abdominal dyspnea, combined with short unproductive coughs, is common. The calf is observed standing with outstretched, lowered head, spread forelegs and in severe cases it breathes open-mouthed. A seromucous nasal discharge is seen, which later can become purulent-mucopurulent. On auscultation of the lungs, rigid bronchial, raw sounds can be heard that may be compared with the sound of sawing dry wood.

Morbidity is often high. It is often seen to be 90-100% in a certain age group. Mortality of 20-25% can be seen, where secondary infections gain access. A mortality of 5-6% is most common (Wizigmann *et al.* 1976, Stott *et al.* 1978).

Part of the calves that have gone through an outbreak of enzootic pneumonia end up with chronic changes in the respiratory system. It is therefore often observed that the calves still have a significantly exaggerated breathrate a long time after the acute phase, even though the infection is over and orexia is present. It is presumed that secondary

infections have damaged parts of the lungs and reduced the lung capacity, as pure virus infections pass with catarrhal changes only. Recidives are often observed.

Personal Investigations

Materials, methods and results. Serologic investigations of enzootic pneumonia in calves.

To obtain an antibody titer determination for PI-3 (para-influenza-3 virus), IBR (infectious bovine rhinotracheitis virus), BVD (bovine virus-diarrhoea virus) as well as BRS (bovine respiratory syncytial virus) blood samples of 24 calves from 15 outbreaks of enzootic pneumonia from just as many herds were taken, one sample in the absolute acute state as well as one sample three weeks later. It has been an absolute rule that only peracute to acute cases have been included in the investigation, that the clinical symptoms should be as described and that it should take a maximum of 24 hours before the disease was discovered by the owner. This last guideline has limited the number of usable calves a great deal. Only calves older than 3 months are included to avoid disturbing maternal antibodies. All titer measure are shown completely in *table 1.* No numbers of IBR virus are shown as all measurements were negative in both blood samples. Only one blood sample was taken of calves No. 10 and 15, as they both died before the second blood sample was to be taken 3 weeks later. The minimum demand in this investigation for indicating a titer-rise as significant is that the rise has to be at least 3 steps. In this way a significant rise of BRS show in 8 cases (PI-3 in 1 case, BVD in 2 cases). One calf has a significant rise of both BRS and BVD, as noted in *table 2.* Significant rises are stated in % of 22 calves in *table 3.* All calves with a significant rise of one or more viruses came from closed dairy herds. Of the 12 calves without a significant rise of one of the three viruses, four came from beef herds (3 with purchase).

In two cases of herd stock outbreaks only one out of two doubletests reacted for one of the four viruses. At the time of the outbreak of the disease, none of the calves with a significant rise lived in specially closed calf quarters, but in or near the cowstables.

Prophylactic medical treatment of calves at the time of moving in/out.

Materials - Methods - Results

The purpose of this part of the investigation was to illustrate the possibilities and the consequence of a prophylactic medical treatment of calves in a transition period. In this connection the experiment was carried out in two sections F1 and F2 with 10 calves in section F1 and 34 calves in section F2.

Section F1

10 calves (DRB and SDM) were divided into group A and B with 5 calves each. The average age on moving in was

TABLE 1. Paired serologic determinations for 3 different viruses.

	BVD virus	P1-3 virus	BRS virus
1	22.0	5.6	5.6
1a	5.6	2.8	5.6
2	5.6	2.8	11.0
2a	2.8	2.8	5.6
3	1440.0	2.8	11.0
3a	720.0	5.6	5.6
4	1440.0	2.8	5.6
4a	1440.0	11.0	5.6
5	5.6	11.0	2.8
5a	5.6	11.0	11.0
6	2.0	22.0	2.8
6a	2.0	22.0	5.6
7	5.6	2.0	2.8
7a	2.8	2.0	360.0
8	45.0	2.0	2.8
8a	45.0	11.0	90.0
9	2.0	11.0	1.4
9a	2.0	2.8	90.0
10	5.6	2.8	5.6
11	2.0	2.8	2.8
11a	2.0	1.4	90.0
12	45.0	1.4	5.6
12a	45.0	5.6	5.6
13	5.6	2.8	5.6
13a	1.4	11.0	2.0
14	5.6	5.6	11.0
14a	2.8	11.0	5.6
15	11.0	11.0	2.8
16	2.0	5.6	1.4
16a	2.0	5.6	45.0
17	2.8	2.0	2.8
17a	720.0	2.0	45.0
18	5.6	2.0	5.6
18a	90.0	2.0	11.0
19	720.0	1.4	2.8
19a	360.0	11.0	2.8
20	45.0	5.6	90.0
20a	22.0	5.6	180.0
21	90.0	2.8	1.0
21a	90.0	11.0	22.0
22	45.0	1.4	2.8
22a	180.0	5.6	2.8
23	2.0	22.0	11.0
23a	2.0	11.0	11.0
24	2.0	5.6	1.0
24a	2.0	5.6	11.0

TABLE 2. Significant titer rises.

P1-3 virus:	calf	nr. 19
BVD virus:	—	nr. 17-18
BRS virus:	—	nr. 7-8-9-11-16-17-21-24
BRS BVD Virus:	—	nr. 17

TABLE 3. Significant percent titer rises.

Udbrud	dry	BRS	P1-3	BVD	IBE
15	22	8	1	2	0
		36.4%	4.6%	9.1⅔	0

about 14 days. The calves in group B were treated with about 10 mg Tylan®[a](tylosin) per kg. per day for 4 weeks. Nose swabs were taken on day 0 and once a week, 5 times in all.

The investigation was partly carried out as a blind experiment. The bacteriological tests, as well as the resistance determinations are included in *table 4.* Calf no. B-6 had bronchopneumonia entering the calfquarters and was treated with tylosin injectable on day 0 and received at the same time *per os* the next four weeks. Five treatments in all were carried out in the control group (4 treatments according to the diagnosis: respiratory disease and 1 according to the diagnosis of diarrhoea) and one treatment in the experimental group according to the diagnosis respiratory disease. *Table 4* shows that there is no significant difference in the elimination of pathogene bacteria of the airtracts between the control group and the experimental group, and that in 4 weeks' time no resistance to tylosin or other antibiotics included in the investigation had developed.

To the herdsman it was remarkable that group B (the experimental group) was eating more, and earlier, straw and concentrates.

Section F2

This experiment included 34 calves, i.e. 22 calves in the experimental group and 12 controls. The calves were weighed at the start and at the end of the experiment. The experimental group was given 7-10 mg Tylan®[a] soluble powder per kg *per os* daily during 3 weeks. A disease registration showed that the only treatment was on airtract diseases. Fourteen veterinary treatments were carried out in the control group and two in the experimental group, which is a statistically certain difference at an X^2-test ($p<0, 01$). The results of growth are listed in *table 5.*

The average age and weight in the experimental group was 21½ days and 44.3 kilos at the beginning of the experiment. Corresponding figures of the control group were 14½ days and 45.3 kilos. Both section F1 and F2 were carried out in the same stable, a rather old, heated stable with an old ventilating system. Temperature and air humidity were measured in a period of 8 days all 24 hours. The relative air humidity ranged from 72%-76% and the temperature ranged from 12½°C to 11°C, but moderately decreasing in the course of the eight days.

Discussion

Enzootic pneumonia - epidemiology.

The present investigation has focused on four viruses: BRS, PI-3, BVD and IBR. As shown in *table 3,* BRS virus differs from the others by significant serologic titer increase of the investigated calves, PI-3 and BVD by respectively 4.6% and 9.1%. The size of the percentage is not to be compared with other major investigations, but Dutch and Belgian investigations also showed that BRS virus on a serologic basis seems to have the closest connection to outbreaks of enzootic pneumonia (Wellemans *et al.* 1978) (van Nieewstadt *et al* 1978). Bryson *et al.* 1979 followed four outbreaks of pneumonia in calves at four farms in Northern Ireland. The calves ranged in age from 3 weeks to nine months with the greater part 3 weeks to 4 months. Serologic investigations showed high titres of BRS virus. In none of the cases was BRS virus isolated from calves' lungs available for autopsy.

Bitsch *et al* 1976 found in 50 selected pairs of lungs 9 cases of known virus. Of these, 4 cases constituted infections with BRS virus. All cases ranged from acute to subacute. PI-3 and BVD virus seem not to have played an important part in the present material (respectively one and two cases with significant rise). Formerly great importance was attached to PI-3 and BVD virus for enzootic pneumonia in calves. Bitsch (1976) found high titers for PI-3 virus in 2-2½ year old heifers. As early as 1963 Borgen discovered that the greater part of the Danish cattle population at a certain time came in contact with PI-3 and BVD virus. No measurable serologic titres were found in IBR virus. In fact IBR prevails only little in Denmark in contrast to many other countries (Bitsch 1975) Nieuswtadt *et al.* 1978 discovered a significant spread of IBR virus in Holland.

Prophylactic medical treatment.

The F1 and F2 experiments were carried out from January-April in which period there often have been great problems with respiratory diseases when calves were introduced to calfquarters. In the experimental section F1 no resistance developed towards the used antibiotic or any other of the measured antibiotics during a four week period (see *table 4).*

It has to be noted that pathogene bacteria were not eliminated although assumed therapeutic doses were applied daily for four weeks, and in spite of a good sensitivity for the applied antibiotic. In an experiment planned on generous lines Matsuoka *et al.* 1980 discovered a limited reduction of *Pasteurella haemolytica,* but a significant ($p<0.01$) reduction of *Pasteurella multocida* and *Salmonella* with tylosin tatrate treatment. Also a significant reduction of mycoplasms isolated from lung tissue was seen. The above mentioned investigation used different doses in different experiments but generally high doses were applied. Experimental section F2 showed an average daily growth of 171 grams in the experimental group over the control group. ($p<0.01$)

In the experimental group (24 calves) only 2 medical treatments were made contrary to the the 14 medical treatments in the control group (12 calves).

In the experimental sections F1 and F2 none died. There are no precise observations of the calves after the termination of the experimental period.

[a]*Tylosin for this study was made available by Elanco/Lilly, Denmark*

TABLE 4. Bacteriological tries and resistance determinations.

Antibiotic \ Calf No.	I A1 Ph	I A4 Pm	I B6 Pm	I B6 S	I B7 S	I B8 S	I B9 Pm	I Blo Pm	I Blo S	II A1 Pm	II A2 Pm	II A4 Ph	II B6 Pm	II Bol Pm	III A5 Pm	III B6 Pm	IV B6 Pm	IV B7 Pm	V A2 Ph	V A5 Ph	V B8 Ph
Penicillin	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+	3+
Streptomycin				2+		2+										3+				2+	
Tetracyclin				3+		3+														3+	
Neomycin																					
Polymycin				0	0	0			0												
Sulfa			2+								2+										
Sulfa + TMP			3+								3+										
Ampicillin				3+	3+	3+			3+												
Spiramycin											2+	2+	2+			2+			2+	2+	
Tylosin																					
Tylosin mm	28	30	30	29	28	30	33	29	28	28	27	25	26	30	30	25	34	29	26	25	35

3+ = fully sensitive for Tylosin: 3+: >28mm
2+ = moderate — 2+:27-24 mm
0 = resistant

Calf No. \ Week	I	1. II	2. III	3. IV	4. V
A 1	Ph	Pm			
A 2		Pm			Ph
A 3					
A 4	Pm	Ph			
A 5			Pm		Ph
B 6	Pm + S	Pm	Pm	Pm	
B 7	S			Pm	
B 8	S				Pm
B 9	Pm				
B10	Pm + S	Pm			

Ph: Pasteurella haemolytica
Pm. Pasteurella multocida
S: Staphylococcus aureus

TABLE 5. Growth promotion

	kg	kg	kg	kg
				average daily
(22)	975	1.493	23.55	0.693 growth
(12)	544	.757	17.75	0.522 promotion

T-test p 0.01

Weight at start — weight at termination — average growth promotion per calf

In the above mentioned investigation of Matsuoka *et al.* (1980) the same good results were found using prophylactic treatment with tylosin tartrate, because a significant reduction of the mortality was observed using doses of more than 1 gr. tylosin per calf per day.

It has to be stressed that the results of the present investigation can only with certainty be valid for the experimental period and therefore further investigations on a larger material during a longer period will be required.

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