Serosurvey of three virus infections in reindeer in northern Norway and Svalbard

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Abstract: Sera from 326 Norwegian reindeer (NR) and from 40 Svalbard reindeer (SR) were examined for antibodies to reindeer herpesvirus (RHV), bovine viral diarrhoea virus (BVDV) and parainfulenza type 3 virus (PIV-3). No antibodies to any of these three viruses were detected in sera from SR. Sixty-three percent of sera from 101 adult NR (> 12 months old) and 15 % of 225 NR calves (6 months old) had antibodies to RHV; corresponding values for BVDV were 41 % and 6 %, respectively. Twenty-seven percent of adult NR and 1 % of NR calves had antibodies to both viruses. No antibodies to PIV-3 were detected in any NR sera.

Key words: Herpesvirus, BVDV, PIV-3, serology

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Introduction

Bovine virus diarrhoea virus (BVDV), bovine herpesvirus (IBR/IPV) and parainfluenza type 3 virus (PIV-3) have been isolated from several different species of wild ruminants (Karstad 1981; Plowright 1981). Reindeer may also become infected with these viruses, but usually without showing any sign of clinical disease. However, under certain circumstances it is possible that these viruses may contribute to disease in reindeer (Rockborn *et al.* 1990; Rehbinder *et al.* 1992).

In the present investigation sera from Norwegian reindeer (*Rangifer tarandus tarandus*) (NR) and Svalbard reindeer (*Rangifer tarandus platyrhynchus*) (SR) were examined for antibodies to reindeer herpesvirus (RHV), BVDV and PIV-3. In addition, lungs from Norwegian reindeer were examined for the presence of pneumonia.

Material and methods

Blood samples were collected from 326 NR from seven «pasture districts» (see Tyler and Jonasson 1993) in Finnmark county in northern Norway in the autumn of 1991, and from 40 Svalbard reindeer in Reindalen, Svalbard, in December 1990. All sera were heat inactivated for 30 minutes at 56°C before being tested.

Table 1. Proportion (%) of seropositive Norwegian reindeer tested for antibodies to reindeer herpesvirus and bovine virus diarrhoea virus (BVDV) in seven pasture districts in Finnmark, northern Norway.

District	n	Herpes Titer			BVDV Titer			Herpes + BVDV	
		<2	≥2	% pos.	<4	≥4	% pos.	n	% pos.
A	50	32	18	36	39	11	22	7	14
B	48	31	17	35	29	19	40	9	19
C	50	45	5	10	47	3	6	1	2
D	50	28	22	44	42	8	16	7	14
E	50	38	12	24	38	12	24	5	10
F	50	39	11	22	50	0	0	0	0
G	28	15	13	46	27	1	4	1	4
Total	326	228	98	30	272	54	17	30	9

Table 2. Comparison of the proportion (%) of adult and calf Norwegian reindeer from seven pasture districts in Finnmark which tested seropositive for antibodies to reindeer herpesvirus and bovine virus diarrhoea virus (BVDV).

District	Herpes				BVDV				Herpes + BVDV			
	Calves		Adults		Calves		Adults		Calves		Adults	
	N	%	N	%	N	%	N	%	N	%	N	%
A	1	5	17	57	2	10	9	30	0	0	7	23
B	1	4	16	70	2	9	17	74	0	0	9	36
C	2	4	3	85	2	4	1	25	0	0	1	25
D	3	15	19	63	0	0	8	27	0	0	7	23
E	3	8	9	69	6	16	6	46	2	5	3	23
F	11	22	0*		0	0	0*		0	0	0*	
G	13	46			1	4			1	4		
Total	34	15	64	63	13	6	41	41	3	1	27	27

N number of seropositive animals
* one adult was tested

Antibodies to herpesvirus were measured in a conventional neutralization test (Rimstad *et al.* 1992) using a herpesvirus isolated from reindeer in Finland (Ek-Kommonen *et al.* 1986). Antibodies to BVDV were also measured in a neutralization test (Løken *et al.* 1982).

Antibodies to PIV-3 were measured in a standard haemagglutination inhibition test (Mayr *et al.* 1977), using cell-culture grown virus (a Norwegian bovine strain, Vet. Inst. V698/76), kaolin-treated sera and guinea pig erythrocytes. Titres below 1:8 were considered negative. Lungs from the NR tested were investigated through a post mortem examination.

Results

No sign of disease was observed during sampling or post morten examination of the lungs of NR and no lung worm (*Dictyocaulus spp.*) was isolated.

All sera tested for antibodies to PIV-3 were negative. Sera from SR, 30 adults (≧ 2 years old) and 10 calves (6 months old), also tested negative for antibodies to RHV and BVDV.

Results of testing for neutralizing antibodies to RHV and BVDV for each of seven grazing areas in Finnmark are presented in Table 1. A small proportion (9 %) of NR had antibodies to both viruses. Detailed results for calves (6 months old) and adults (> 12 months old) are presented in Table 2.

Discussion

Svalbard reindeer is the only species of ungulate naturally present on the high Arctic archipelago of Svalbard. Cattle and pigs are kept indoors at

two of the settlements there. Musk-oxen (*Ovibos moschatus*) were introduced from Greenland in the 1930s but died out 50 years later. Except for a few cases of rabies (Ødegaard and Krogsrud 1981; Presterud *et al.* 1992), there is no evidence of mortality caused by infections diseases in this subspecies of reindeer (Reimers 1983).

No specific antibodies were found in sera from SR in the present study indicating that the animals tested had not been infected with any of the three viruses investigated. We cannot say, however, to what extent the results are representative for the whole population of reindeer on Svalbard. The sera investigated were collected from only one geographical area and SR appear to be sedentary. It seems unlikely that there is much exchange of animals between different parts of Svalbard (Tyler and Øritsland 1989).

Pestivirus has not, to our knowledge, been isolated from reindeer, but reindeer have been experimentally infected with BVDV (Morton *et al.* 1990). Clinical signs included loose stool containing blood and mucus and transient laminitis or coronitis. The symptoms indicate that BVDV is capable of replicating and causing clinical disease in reindeer.

In the present investigation 17 % of 326 NR had antibodies to BVDV. The proportion of seropositive animals varied from 0 % to 40 % between herds (Table 1). This variation is within the range reported for reindeer/caribou in Finland (Neuvonen *et al.* 1983 (58 %)), Sweden (Rehbinder *et al.* 1992 (6 %)), Canada (Elazhary *et al.* 1979 (60 %) and Elazhary *et al.* 1981 (73 %)) and Alaska (Zarnke 1983 (3 %)). BVDV itself was isolated in none of these investigations.

Herpesviruses have been isolated from reindeer in Finland (Ek-Kommonen *et al.* 1986; Nettleton *et al.* 1988) and Sweden (Rockborn *et al.* 1990). Herpesvirus strains isolated from reindeer are different from IBR/IPV-virus and from herpesvirus isolated from goats (Rimstad *et al.* 1992). Antibodies to herpesvirus have been detected in reindeer from Finnmark but the virus itself has not been isolated (Hyllseth *et al.* 1993).

We found antibodies to RHV in 30 % of 326 NR. The frequency of occurrence of antibodies in the different grazing areas varied between 10 % and 46 %. This variation is within the range reported from Finland (Ek-Kommonen *et al.* 1982 (23 %); Neuvonen *et al.* 1983 (49 %) and Nettleton *et al.* 1988 (31 %)), Sweden (Rockborn *et al.* 1990 (11 %) and Rehbinder *et al.* 1992 (28 %)), Canada (Elazhary *et al.* 1979 (14 %) and Elazhary *et al.* 1981 (40 %)) and USA (Dietierich 1981 (39 %)). These results, however, should be interpreted cautiously because the frequency of antibodies may be influenced by the age and condition of the animals investigated, whether homologous reindeer herpesvirus or heterologous bovine virus is used in the neutralization test, and by possible modifications of the neutralization test used in different laboratories.

We have no simple explanation for regional variation in the frequency of seropositive reindeer in Finnmark. It may be due to different management regimes, different conditions for virus transmission or stressing conditions. Reactivation of RHV has been shown experimentally using cortisone (Ek-Kommonen *et al.* 1986; Rockborn 1990) and BVDV infection may cause immunosuppression in cattle (Liess 1990). NR, but not SR, are harassed during summer by biting flies, but it is not known whether these flies can transmit virus. It is, however, known that some viruses, including BVDV, are transmitted between animals by blood feeding insects (Tarry *et al.* 1991).

We found a higher proportion of seropositive animals among adults than among calves. Similar results have been observed in other populations of reindeer (Ek-Kommonen *et al.* 1982; Nettleton *et al.* 1988). In cattle, antibodies to herpesvirus (IBR/IPV) and BVDV virus persist for years after a primary infection (Liess 1990; Straub 1990). In addition, maternal antibodies against IBR/IPV virus and BVDV may last for 3–4 months and 8 months, respectively, in bovine calves (Liess 1990; Straub 1990). To our knowledge, no similar data exist for reindeer and we cannot determine from our results whether the antibodies found in 6 months old calves came from maternal transmission or from acquired immunity.

IBR/PIV-virus infections can occur simultaneously with BVDV and/or PIV-3 infections in cattle. According to two investigations from Germany, bovine herpesvirus (IBR/IPV) and BVDV were isolated simultaneously from 1.2 % and 3.6 % of the cattle, respectively (Straub 1991). There is evidence that mixed infection

with these viruses can cause severe clinical illness in cattle (Grieg *et al.* 1981). In the present study 27 % of adults, but only 1 % of calves had antibodies to both herpesvirus and BVDV, indicating that these animals had been infected with both viruses but no sign of disease was observed. However, only virus isolation trials can elucidate the ocurrence of mixed infections, but this was not attempted.

PIV-3 has never, to our knowledge, been isolated from reindeer, but antibodies to PIV-3 have been detected in sera from reindeer in Sweden (Rehbinder *et al.* 1992) and Alaska (Dieterich 1981). No antibodies to PIV-3 were detected in any of the sera we tested and the significance of PIV-3 infection in reindeer remains unknown.

In conclusion, the present investigation indicates that pestivirus and herpesvirus infections are endemic in reindeer in Finnmark. There was no evidence of clinical disease associated with the two virus infections detected in the present serosurvey. In cattle and sheep the persistent pestivirus infection in immunotolerant animals is by far the most important manifestation of this infection, both as regards disease and spread of infection. To our knowledge, the persistent form of infection has never been reported in reindeer or other cervids. Herpesvirus infection has been reported in connection with outbreak of necrobacillosis in reindeer (Rockborn *et al.* 1990).

Further investigation is necessary to clarify the role of these virus infections in reindeer. Pestivirus from reindeer should preferably be isolated and compared with BVDV isolates to determine their genetic and antigenic relationship. Transmission of pestiviruses between domestic ruminants and cervids sharing common pastures should also be investigated.

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