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Epidemiology of enzootic rabies in Lithuania

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Summary

A descriptive epidemiology and time series data analysis was used for the investigation of the development of the epidemiological situation related to enzootic rabies in Lithuania during the period of 1994-2004. A significant correlation between sample submissions and recorded rabies cases were detected (P<0.05). Since 1998, cases of wildlife rabies have been prevalent in all regions of Lithuania. Foxes and raccoon dogs were the main resource of this disease. Two seasonal peaks of wild animal rabies in spring and autumn were observed. Domestic animal rabies had only one seasonal peak in autumn. On the average, the prevalence of rabies increased from 23.5% in 1994 to 35.4% in 2004 in foxes and from 11.8% in 1994 to 28.9% in 2004 in raccoon dogs. The prevalence of rabies in cattle decreased from 25% in 1994 to 11.8% in 2004, in dogs from 19.1% in 1994 to 7.2% in 2004 and in cats from 17.6% in 1994 to 6.3% in 2004. 90.7% of all diagnosed rabies cases were diagnosed in foxes, raccoon dogs, cattle, dogs and cats. In 2004 the prevalence of rabies tended to decrease significantly in wild and domestic animals. A significant correlation was discovered between the prevalence of fox and raccoon dog rabies and the prevalence of wild animal rabies and dog rabies (P<0.05).

Keywords: rabies, Lithuania

Rabies has been widespread zoonotic disease in Lithuania for many years (3). Wildlife rabies has enzootic pattern of the disease while urban rabies has been eradicated. The State Food and Veterinary Service have carried out a survey and risk assessment considering the epidemiological situation of rabies and have developed and implemented preventive and control measures against this disease. More than 70% of dogs, 10% of cats and less than 3% of cattle have been vaccinated against rabies annually. Only inactivated vaccines of the highly immunogenic strains of the rabies virus have been used for vaccination of animals. Emergency vaccination of pets and farmed animals was carried out in the areas where the positive case of rabies was detected (1). Municipalities and local administrative authorities have taken care of all stray or homeless dogs and cats. An oral vaccination of wildlife was pursued according to the Lithuanian National Rabies Prevention program during the period of 1995-2000. Baits with SAG-1, Lysvulpen and Rabifox tetracycline marked vaccines were distributed in wildlife living areas (14). The oral vaccination was carried out twice per year in March-April and October-November. Nevertheless, an application of preventive and control measures against rabies has not reduced prevalence of rabies among domestic and wild animals. This situation created a serious risk of the virus transmission to people. From 8 to 11 thousand of people had contacts with suspected animals and about 4-8 thousand of people had post-exposure treatment annually. Since 1960 11 people have died of rabies (5).

The objective of this study was to analyze the development of epidemiological situation of enzootic rabies in Lithuania during eleven years period: dating back to 1994 and 2004.

Material and methods

Rabies has been compulsory notifiable disease in Lithuania for many years. Suspected cases were notified to the local State Food and Veterinary Services and relevant samples were collected and submitted to the veterinary laboratories for the investigation by a direct immunofluorescence test and a biological test. Mouse inoculation has been used to confirm or rule out rabies on negative samples tested by immunofluorescence method (8).

Information about prevention of rabies and control measures and rabies cases in domestic and wild animals were collected respectively from the records of the Animal Health Department of the State Food and Veterinary Service (1). Descriptive epidemiology and time series data analysis were performed to detect sample submissions and reported cases, prevalence and incidence, regional and seasonal variations of rabies. Statistical analysis was performed using Prism 2.01 program. Correlation coefficient (r) and its 95% confidence interval and P value were calculated.

Results and discussion

The number of animal submissions increased more than 7 times from 298 in 1994 to 2123 in 2004, with the greatest annual increases which have been detected during the last 5 years (fig. 1). 42.4% of samples of domestic animals and 57.6% of samples of wild animals were submitted for examination. 33.7% of submitted samples of domestic animals

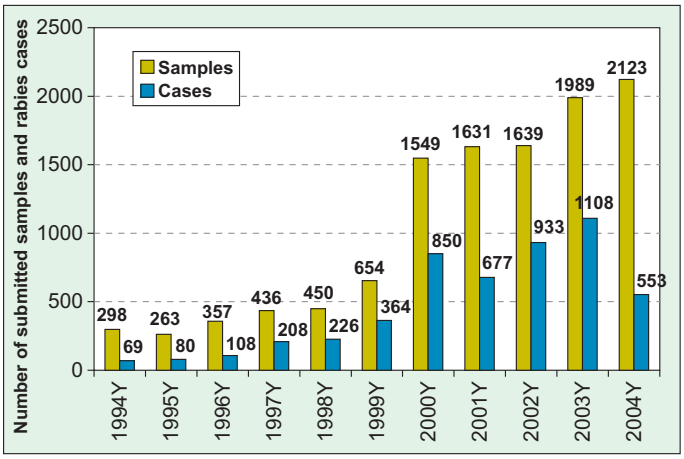

Fig. 1. Number of submitted samples and recorded rabies cases in 1994-2004

and 51.3% of submitted samples of wild animals were found to be positive. Positive significant correlation between the number of submissions and the number of positive cases has been stated ($p < 0.05$).

The prevalence of rabies in domestic animals was 31.7% and in wild animals was 68.3% (fig. 2). The number of rabies cases has increased by 16 times from 69 cases in 1994 to 1108 reported cases in 2003. The number of rabies cases in domestic animals has increased nearly 7 times from 44 cases in 1994 to 301 case in 2003 and in wildlife it has increased by 32 times from 25 cases in 1994 to 807 cases in 2003. The number of animal rabies cases has highly increased during 2000-2003. 850 rabies cases were stated in 2000, 677 cases – in 2001, 933 cases – in 2002 and 1108 cases – in 2003. In 2004 the prevalence of rabies has decreased significantly in domestic and wild animals. 145 rabies cases in domestic animals and 408 rabies cases in wild animals have been fixed (fig. 3).

In 1994-1997 more rabies cases were obtained in domestic animals than in wildlife. Since 1998 wildlife rabies have been prevailing. The prevalence of wildlife rabies was 58.9% in 1998, 75.3% – in 1999, 66.5% – in 2000, 71.6% – in 2001, 73.1% – in 2002, 72.8% – in 2003 and 73.8% – in 2004.

In 1994 most rabies cases were registered in the regions located in the Northern part of Lithuania, with prevailing fox and raccoon dog rabies. It seems necessary to mention that sporadic rabies cases were diagnosed in other geographical parts of the country. In 1999 and 2004 domestic and wildlife rabies was prevailing in all regions of Lithuania.

Two seasonal peaks of wild animal rabies in spring and autumn were stated. The first moderate peak appeared in March-May and the second high peak was found in September-November. 9.1% of cases in March, 8.2% – in April, 8.3% – in May, 9.6% – in September, 11.6% – in October and 10.2% – in November were observed. Domestic animal rabies had only one seasonal peak in autumn (fig. 4). 12.5% rabies cases were recorded in September, 16.2% – in October and 17.2% – in November.

The prevalence of rabies in foxes increased nearly as many as 1.5 times from 23.5% in 1994 to 35.4% in 2004. Comparatively slight decrease of rabies prevalence in foxes occurred from 2000 to 2002. 31.3% prevalence of fox rabies was diagnosed in 2000, 29.1% – in 2001, 29.3% – in 2002. The prevalence of raccoon dog rabies has increased nearly as many as 2.5 times from 11.8% in 1994 to 28.9% in 2004 with the rise of prevalence up to 35% in 2001 and the slight decrease of prevalence to 27% in 2003. The prevalence of cattle rabies decreased more than twice from 25% in 1994 to 11.8% in 2004, with the increased prevalence to 42.6% in 1996 and 43.8% in 1997. The prevalence of dog rabies decreased more than 2.6 times from 19.1% in 1994 to 7.2 in 2004 and the prevalence of cat rabies decreased as many as 2.8 times from 17.6% in 1994 to 6.3% in 2004 (fig. 5).

On the average, 29.4% of rabid foxes, 22.0% of rabid raccoon dogs, 21.9% of rabid cattle, 9.9% of rabid cats and 7.5% of rabid dogs composed 90.7% of all diagnosed cases of rabies (fig. 6).

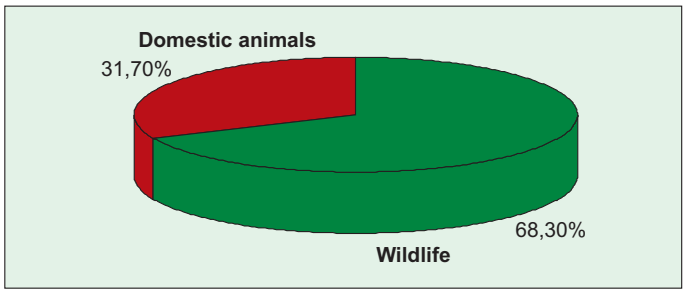

Fig. 2. Prevalence of rabies in domestic and wild animals during 1994-2004

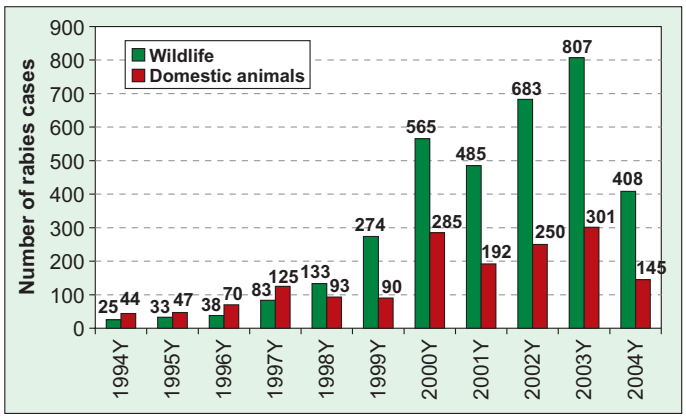

Fig. 3. Number of rabies cases in domestic and wild animals in 1994-2004

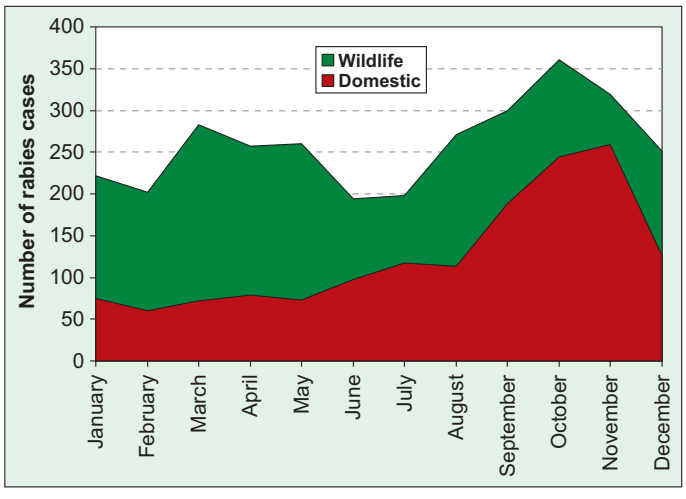

Fig. 4. Incidence rate of rabies in domestic and wild animals in 1994-2004

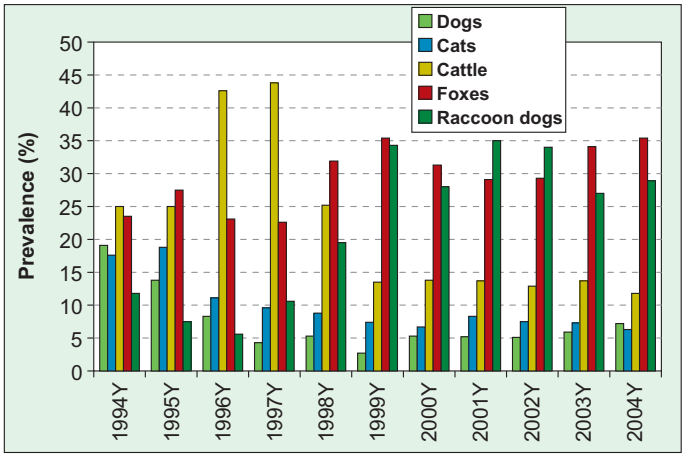

Fig. 5. Prevalence of rabies of the certain species of domestic and wild animals in 1994-2004

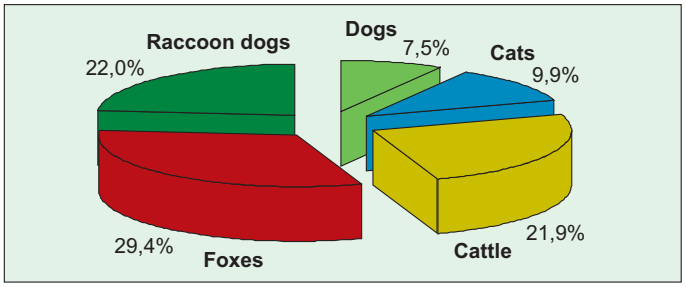

Fig. 6. Prevalence of rabies cases in certain species of animals in 1994-2004

On the average, cases of rabies in foxes made 52.4%, raccoon dog rabies – 34.5%, marten rabies – 8.4% and other wild animal rabies – 4.7% of all wildlife rabies cases (fig. 7). Rabies was diagnosed in polecats, badgers, hamsters, muskrats, rats, roe-deers, otters, wolves, hedgehogs, beavers, minks, elks and lynxes.

On the average, dog rabies made 18.1%, cat rabies – 24.7%, cattle rabies – 53.3% and other domestic animal rabies – 3.9% of all domestic animal cases of rabies (fig. 8). Rabies was also diagnosed in sheep and goats.

Significant correlation was found between the prevalence of fox and raccoon dog rabies and between the prevalence of wild animal rabies and dog rabies ($p < 0.05$). Non-significant correlation was observed between the prevalence of wild animal rabies and cat and cattle rabies, and also between number of rabies cases and the number of vaccinated domestic animals, and the oral vaccination of wildlife and forested areas ($p > 0.05$). The significant correlation was detected between the number of rabies cases and the size of fox and raccoon dog populations and the number of hunted foxes and raccoon dogs ($p < 0.05$).

The investigations have shown quite significant correlation between sample submissions and recorded cases of rabies. This has been related to the increased number of rabies suspected animals, increased public awareness and danger to animals and humans. Geographical distance did not have the influence on the number of sample submissions. This is due to availability of diagnostic capacities of rabies in each country veterinary laboratory. Nevertheless, the passive nature of rabies surveillance and lack of estimates of animal population sizes dictate that prevalence or incidence of rabies cannot be determined for most animal species. Many rabid animals are never observed and live untested and undetected (4).

The highest number of rabies cases has been registered in wild animals, especially in foxes and raccoon dogs, during the last four years. Probably, similar epidemiological situation of rabies is observed in Europe. Since 1994 the number of reported cases in Europe has increased by nearly 1.3 times. In 1997 was stated the reduction of rabies cases and the number of cases has again doubled in 2003 (9). Foxes and raccoon dogs represented most of the wild animal hosts for classical rabies in Europe (2). The available data cannot explain whether these developments were due to the changing rabies incidence or changing case reporting situation in Europe. The economical developments in Lithuania during this period might have contributed to the changes in both the epidemiological situation of rabies and disease surveillance.

Intensive rabies control measures are implemented and urban rabies is eradicated in Lithuania. However, cattle, dogs and cats were commonly affected domestic animals. Other domestic animals accounted on average less than 4% of all rabies cases in domestic animals. More rabies cases occurred in domestic animals than in wildlife during the year 1994-1997. This could indicate a main focus of rabies surveillance on domestic animals. In Europe dogs and cats ranked highest as host to rabies virus of the domestic animals (2). Foxes and raccoon dogs were the main resource of this disease. Wild predators moved into areas of human settlements and animal holdings and close contacts

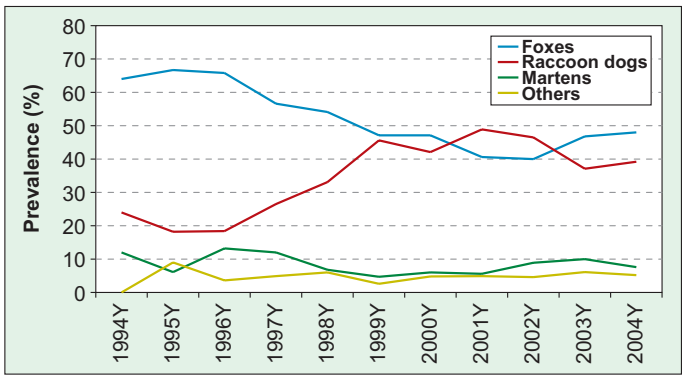

Fig. 7. Prevalence of rabies in the certain species of wild animals in 1994-2004

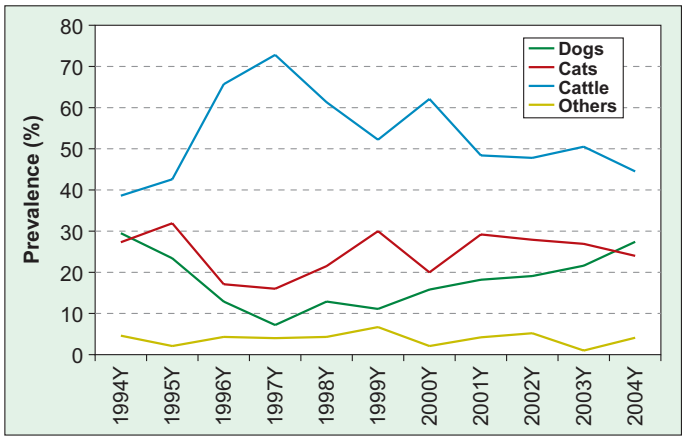

Fig. 8. Prevalence of rabies in certain species of domestic animals in 1994-2004

between wildlife and susceptible domestic animals have increased prevalence of rabies in domestic animals.

Foxes are considered to be the species of animals mainly responsible for the maintaining an epizootiological cycle of the disease in a particular geographical region at a particular time (6). In Lithuania foxes have been wildlife rabies reservoir for many years. Recently raccoon dogs have become the most important wildlife species infected with rabies. In 2001 and 2002 were found more rabies cases in raccoon dogs than in foxes in Lithuania. Most rabies cases in raccoon dogs were also reported from other Baltic States and Poland in 1994-2003 (9). This probably reflects the distribution and densities of raccoon dog population in the parts of Europe. It is evident, that, during their winter hibernation, raccoon dogs can incubate rabies virus and so cause the disease to persist from one season to the next in geographical areas where fox densities are so low that rabies might otherwise die out (2). Martens have a local importance in rabies epidemiology. They made between 4.7% and 13.2% of all rabies cases in wildlife during 1994--2004 in Lithuania. Other wildlife species on average accounted less than 5% of all wildlife rabies cases.

Rabies is has remained an endemic disease in Lithuania. Records showed that in 1994 most sporadic rabies cases were registered in the Northern part of Lithuania and later it became widespread in the whole territory of the country. Probably, several factors could have changed the prevalence of the disease in some regions of the country. In 1995--2000 a short-term wildlife oral vaccination campaign against rabies was carried out in small areas of Lithuania. More rabies cases were registered in the regions where oral vaccination took place. It could be considered that it had a reversed rather than positive effect on prevalence of rabies in fox and raccoon dog population after short time when vaccination was completed. This probably could be illustrated by significant correlation between the prevalence of rabies in foxes and raccoon dogs and their population size and the number of hunted animals. A wild animal population growth could be due to the effects of the oral immunization of wild animals against rabies (10). Occurrence of rabies in forested and less forested areas could be explained by the extensive farming and uncultivated large territories that ensure extended feeding and living areas for wild animals and increase of susceptible animal population.

Rather significant correlation between wild animal rabies and dog rabies showed that most rabid wild animals move in animal holdings and commonly bite chained dogs. Rabid animals on the pasture usually attack cattle. Cattle are the major domesticated species of economic importance affected by rabies. Rabies transmission often involves a carnivore bovine link (13). Occurrence of the disease in cattle kept in the cowshed shows quite long incubation period. Cats probably are infected by accident having contacts with infected small animals.

Cases of rabies in wild and domestic animals tend to demonstrate seasonal variations. A peak of wildlife rabies is observed in March-April, followed by a slight decrease in June, after which the number of rabies cases starts to increase rapidly till December. Wildlife rabies is strongly seasonal due to the biology of the wild animals (7). The number of wild animal rabies cases increased during the spring, when foxes and raccoon dogs breed and during autumn, when they migrate to their new habitats (12). The transmission of rabies virus increases during these seasonal contacts and sightings among animals. In summer an increase in the young fox population is also observed. The number of domestic animal rabies cases increased in autumn, when a maximal number of infected animals move to the animal holdings and attack animals. All the facts mentioned above reflects on the case incidence (7). The correlation between the infected wild predators and the other affected species is observed depending on the population density of the predators (11).

Conclusions

Rabies is a public health concern as well as a problem of wildlife and domestic animals in Lithuania. Rabies virus infected foxes and raccoon dogs are the main reservoir of the disease and they course sporadic cases of rabies in domestic animals. Cattle are the major farmed animal species of economic importance affected by rabies.

Changes in agriculture has enhanced carrying capacity of wild animal habitats and resulted in increase of their population density. The close contact between human settlements and wild animals is a major factor in transmission of the disease to domestic animals.

Currently applied control measures against rabies are not adequate to eradicate wildlife rabies in Lithuania. A long term wildlife oral vaccination program, coordinated with neighboring countries, and appropriate control of population size of foxes and raccoon dogs, might considerably reduce the incidence rate of rabies and capacitate eradication of this disease in Lithuania.

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