

**An arctic fox rabies virus strain as the cause
of human rabies in Russian Siberia**

Brief Report

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Summary. A case of human rabies in the arctic zone of Siberia is described. The victim was bitten by a wolf, but characterization of the isolate by monoclonal antibodies showed that it was an arctic fox virus strain. This discovery reaffirmed the value of strain typing rabies virus isolates in regions where this has not been done already: such characterization pertains to the identification of the reservoir host, to the natural history of the virus in the reservoir, and to future surveillance, post-exposure treatment, and public education in the region.

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Human rabies cases are very rare in the Far North, although rabies is seen in wolves, dogs and arctic foxes. Human rabies cases have been reported from the Yamal peninsula, Chukotka, Siberia, and from North America [1]. This rarity of human cases is seen in spite of extensive epizootics of rabies in arctic foxes (*Alopex lagopus*) and transmission from this species to domestic animals. This phenomenon has been regarded by some as evidence of the low virulence for humans of the strain of rabies virus present in arctic foxes. However, this notion is unsubstantiated by any credible epidemiological or laboratory evidence and there are other possible explanations. For example, there are relatively few humans in the region and the temporal and spatial distribution of arctic foxes is such that they come in contact with humans only infrequently. Further, protective outer garments used in the cold climate of the region would protect people from many attempted bites. Finally, in many parts of the Far North there are no facilities that do rabies diagnosis and no surveillance that would depend upon laboratory confirmation of cases. Nevertheless, it is important from a public health perspective to question the notion that arctic foxes carry a rabies virus strain that is less virulent than street virus strains seen in other parts of the world.

Arctic fox rabies virus isolates react uniquely with an anti-nucleocapsid monoclonal antibody designated MAb P-41 (Federal Research Center for Virus Diseases of Animals, Tübingen, Germany). Virus has not been isolated from most human rabies cases from the Far North and where virus isolation has been done, in most cases the isolates have not been characterized using monoclonal antibodies. However, in two cases human isolates have been assessed: these were isolates from cases from the Pskov region of Russia (57 °N latitude, temperate zone). Although the human exposures were from a dog and a wolf, both isolates reacted with MAb P-41 and so were considered to derive indirectly from arctic foxes [2].

The human rabies case described here occurred in the Norilsk district of the Krasnoyarsk region of Russian Siberia (69 °N latitude, arctic zone) at the end of March 1998. The subject was a male, 51 years of age, who was attacked by a wolf. He received multiple wounds on his head, face, shin and hand. Rabies vaccine (Rabivac, Vnukovo-32) was given on days 0, 3 and 7 post-exposure, but then the subject declined further doses. Rabies immune globulin (RIG) was unavailable – the territory had been free of rabies for many years so there had been no demand for it.

The subject felt sick on day 25 post-exposure; he presented with fever, malaise and paresthesia around some of the bite sites. He exhibited periods of hyperactivity and developed tremors and hydrophobia. He died 6 days later with ascending paralysis.

Virus was isolated from the brain and spinal cord of the victim by intracerebral inoculation of mice. Mouse brain impressions were examined by indirect immunofluorescence using anti-nucleocapsid monoclonal antibodies from the set developed for the World Health Organization by the Wistar Institute of Anatomy and Biology, Philadelphia, Pennsylvania, USA [3, 4]. An arctic fox virus strain from Yakutia and a fox strain from Western Siberia were used as controls. Bright fluorescence was obtained when the human isolate was tested with MAb P-41. The human isolate failed to react with MAbs 422–5, 102–27, 701–9, which are strain specific, but did react with 33 other Mabs known to be more broadly reactive. This reactivity pattern of the human isolate matched that obtained when the arctic fox isolate was used, but was different from that obtained with the fox isolate.

No human rabies cases had been recorded in the Krasnoyarsk region since at least 1955 (earlier data are unavailable). Only five animal rabies cases, all in dogs, had been reported in this region during the same period (3 in 1981, 1 in 1990, 1 in 1994). At the same time, the northern part of the region has always had a dense arctic fox population. The human rabies case reported here serves to make several points:

1. There is practical utility in characterizing rabies virus isolates in regions where this has not been done – for example, as in this case, such characterization pointed to the reservoir host for the virus. As in this case, this is not always easy. Since the human victim was bitten by a wolf, it might have been presumed

that there was a local or regional endemic focus in wolves – only an investigation such as that done here provides needed proof.

2. It has always been dangerous to consider a region “rabies-free” without doing extensive surveillance over long periods of time. This is especially important for the purpose of making vaccination decisions.
3. In several parts of the world it has been believed that the local rabies virus is less virulent than usual street viruses. As in the case described here, in most instances where such beliefs have been investigated properly, it has been determined that this is not the case – all street rabies virus strains should be presumed to be virulent.

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