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Post-exposure anti-rabies prophylaxis in humans exposed to animals in Lublin province (Eastern Poland) in 2006-2011

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Abstract

The aim of our study was to analyze medical records from years 2006-2011 of all patients exposed to animals and consulted at the Dispensary of Rabies Prophylaxis in the Department of Infectious Diseases at the Medical University of Lublin in Eastern Poland. During the studied 6-year period, 1,504 persons exposed to animals were consulted, and prophylactic procedure consisted of active immunization applied in 19.21% of the total consulted. Dogs and cats were the most common animal species suspected as the source of rabies exposure. Anti-rabies prophylaxis was applied to 51.56% of all vaccinated patients exposed to dogs and to 20.06% exposed to cats. Rabies was confirmed mainly in domestic animals (2 cats, 1 dog). Among wild animals, only 1 case of rabies was confirmed in a single bat.

Key words

rabies, post-exposure anti-rabies prophylaxis, epizootic situation in Poland, incidence of animal rabies, human exposure

INTRODUCTION

Rabies is a lethal encephalitis caused by negative strand RNA-viruses belonging to the genus *Lyssavirus*, family *Rhabdoviridae* of the order *Mononegavirales*. The Lyssavirus genus is categorized into seven major genotypes numbered 1-7. The major genotypes include Rabiesvirus (RABV), Lagos bat virus (LBV), Makola virus (MOKV), Duvenhage virus (DUVV), European bat lyssaviruses 1 and 2 (EBLV-1, EBLV-2), and Australian bat lyssavirus (ABLV). In Poland, two genotypes of rabies viruses have been isolated – genotype 1 (classic RABV) from terrestrial animals, and genotype 5 (EBLV-1) from bats [1]. Rabies and rabies-related viruses constitute one of the most important viral zoonoses and pose a significant threat to public health across the globe [2]. RABV, the prototype lyssavirus, is the causative agent of the classical rabies and is responsible for the vast majority of all human rabies cases. However, it can be assumed that all lyssaviruses can cause indistinguishable fatal encephalitis both in humans and other mammals. Interestingly, bats are primary or sole reservoir hosts for all lyssaviruses except MOKV. Rabies is transmitted from animals to humans with saliva via a bite wound, scratch wound, or licking of mucous membrane. Although human-to-human transmission has not been proved, some cases of rabies transmission through corneal transplant from an infected donor have been described [3, 4]. Rabies is essentially a fatal viral disease with only six cases of documented human survival [5]. According to the WHO data, more than 55,000 people die of rabies each year, and about 95% of these deaths occur in Asia and Africa. Most human deaths are caused by bites from infected dogs and between 30%-60% of the victims of dogs are children under the age of five. Over 3 billion people are thought to be at risk of rabies virus infection in over 100 countries in the 21st century. Children are considered to be at a higher risk than adults [6, 7].

Rabies is present on the European continent and still remains an important public health problem, although some countries have a rabies-free status. The risk of contracting rabies in developed countries is generally low but cases of rabid animals imported from enzootic areas are reported every year [8]. Animal reservoirs for rabies exist in all continental areas worldwide. The red fox (*Vulpes vulpes*) is the main terrestrial wildlife rabies vector in Europe, while the raccoon dog (*Nyctereutes procyonoides*) is another significant vector, mainly in the Baltic countries. The main indigenous animal reservoirs are dogs in eastern European countries and on the borders with the Middle East, foxes in central and eastern Europe, raccoon dogs in north-eastern Europe, and insectivorous bats throughout the entire territory [9, 10].

In Poland, terrestrial rabies posed a serious problem in the 20th century, but within the past decade the epidemiological situation has started to change. The introduction of mass vaccination of dogs in 1950, introduction of safe and immunogenic cell culture based vaccine in 1984, and the introduction of mass oral immunization of foxes in 1993 were the key factors in the successful strategy for the elimination of rabies [11]. Recommendations to improve rabies control in animals and prevention of human transmission have recently been published in the WHO Expert Consultation on Rabies. The post-exposure prophylaxis (PEP) in humans

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to prevent rabies includes cleaning and disinfecting the wound or point of contact, and administering anti-rabies immunization as soon as possible. Rabies vaccine is given for contacts of category II (minor scratches or abrasions without bleeding, or licks on broken skin and nibbling of uncovered skin) and category III (single or multiple transdermal bites, scratches, or contamination of mucous membrane with saliva and suspected contact with bats) exposures. Anti-rabies immunoglobulin should be given for category III contact, or to people with a weaker immune system. The most common vaccination schedule is the Essen schedule, with five intramuscular doses in five visits, on days 0, 3, 7, 14, and 28. The WHO recommends observation of a suspected animal source for 10 days, as the early symptoms of the disease in dogs or cats are not very specific [12].

In clinical practice, the most important and also difficult question is whether or not to initiate specific immunoprophylaxis in exposed people. The decision requires an accurate epidemiological history, considering the type of exposure, animal species and behaviour of the animal, and current epizootic situation.

In Poland, only two deaths in humans with rabies were reported in past decade (1 in 2000 and 1 in 2002). This low rate of human rabies in Poland reflects the success of the vaccination programme, and also domestic animal control [13, 14].

PATIENTS AND METHODS

We have retrospectively analyzed the data and medical documentation from the years 2006-2011 of all patients more than 14 years of age consulted at the Dispensary for Rabies Prophylaxis in the Department of Infectious Diseases at the Medical University in Lublin, Poland. Patients with post-exposure anti-rabies prophylaxis (PEP) were selected for future study. The demographic data of patients and animal species were also analyzed.

RESULTS

During the studied six-year period (2006 to 2011), 1,504 persons were consulted at the Dispensary for Rabies Prophylaxis in the Department of Infectious Diseases at the Medical University in Lublin. In 2006, 353 were consulted, in 2007 – 361, in 2008 – 323, 2009 – 248, 2010 – 108, and in 2011 – 111. Prophylactic procedures were applied in 289 persons (19.21% of the total consulted) and consisted of active immunization (vaccination). In 2006, 46 persons were vaccinated (15.91% of all vaccinated cases), in 2007 – 39 (13.49%), 2008 – 53 (18.33%), 2009 – 49 (16.95%), 2010 – 48 (16.64%), and in 2011 – 54 (18.68%) (Tab. 1). The vaccinated patients were 163 males (56.4%) and 126 females (43.6%). In the group of vaccine recipients, 147 persons (50.86%) resided in cities and 142 (49.14%) lived in villages.

Dogs were the most common animal species suspected as a source of rabies exposure. Anti-rabies prophylaxis was applied to 149 people exposed to dogs between 2006-2011 (51.56%), 21 in 2006, 22 in 2007, 24 in 2008, 26 in 2009, 22 in 2010 and 34 in 2011. PEP was also applied in 58 people exposed to cats (20.06% of all vaccinated). Twenty-six people were exposed to bats (8.99%), 21 exposed to rats (7.27%), 9 exposed to foxes (3.11%), 8 exposed to martens (2.77%), 4 exposed to squirrels (1.38%), 2 exposed to house mice (0.69%), 7 exposed to ferrets (2.42%), 1 exposed to roe deer (0.35%), 1 exposed to a chimpanzee (0.35%), 1 exposed to a mole (0.35%), 1 to a badger (0.35%), and 1 exposed to a weasel (0.35%). Rabies was confirmed in 1 dog in 2011, in 2 cats (1 in 2007 and 1 in 2011), and in 1 bat in 2009 (Tab. 2).

Table 1. Total number of consulted and vaccinated persons from 2006-2011 at the Dispensary for Rabies Prophylaxis in the Department of Infectious Diseases, Medical University, Lublin, Poland

Year	Total number of consulted persons	Vaccinated n	%
2006	353	46	15.91
2007	361	39	13.49
2008	323	53	18.33
2009	248	49	16.95
2010	108	48	16.64
2011	111	54	18.68
Total	1,504	289	100%

Table 2. Vaccinated persons after exposure to particular species

Year	2006	2007	2008	2009	2010	2011	Total	%
Animal species suspected of being a source of exposure								
Dog (*Canis familiaris)*	21	22	24	26	22	34	149	51.56
Cat (*Felis catus)*	8	9	8	12	10	11	58	20.06
Bat *(Myotis myotis)*	8	1	1	4	10	2	26	8.99
Rat (*Rattus norvegicus)*	4	3	3	4	5	2	21	7.27
Red fox (*Vulpes vulpes)*	2	1	2	2	1	1	9	3.11
Marten *(Martes martes)*	1	-	1	1	3	2	8	2.77
Ferret *(Mustela putorius furo)*	3	-	3	-	-	1	7	2.42
Squirrel (*Sciurus vulgaris*)	-	-	-	1	1	2	4	1.38
House mice *(Mus musculus)*	1	-	-	-	1	-	2	0.69
Roe deer *(Capreolus capreolus)*	1	-	-	-	-	-	1	0.35
Chimpanzee *(Pan paniscus)*	1	-	-	-	-	-	1	0.35
Weasel *(Mustelanivalis)*	-	-	-	-	-	1	1	0.35
Mole (*Talpa europaea)*	-	1	-	-	-	-	1	0.35
Badger *(Meles meles)*	-	-	1	-	-	-	1	0.35

DISCUSSION

Rabies has been a part of the history of civilization for several millennia, rooted in its enzootic environment and representing a severe threat to public health across continents. Compared to any other human or animal pathogen-induced disease, it is the most severe of all infectious diseases, being invariably fatal. Vaccination is the most effective method

of pre- or post-exposure medical intervention against this viral disease [7]. During six years (2006-2012), active post-exposure immunization was administered in 289 patients after exposure to animals. This data indicates a decrease in the number of vaccinated persons at the Dispensary of Rabies Prophylaxis in the Department of Infectious Diseases at the Medical University in Lublin consulted in Lublin province. In previously reported data from 2004 and 2005, the PEP was administered in 120 persons within a two-year period, which is almost a half of the total vaccinations from the last six years [15].

In Poland within the past decade, the epidemiological picture of rabies has started to change. In 2006, 81 cases of animal rabies were reported in Poland which was almost a 40-fold decrease in the number of animal rabies cases compared with the year 2001. 79% of rabies cases were noted in wild animals (53% in foxes and 17% in raccoon dogs) [16]. In the following year (2007), only 70 cases of animal rabies were detected. Most cases were observed in Eastern Poland (9 cases in Lublin province). As in the past years, most cases of rabies were noted in wild animals (60% in foxes and 10% in raccoon dogs) [17]. In 2008, 28 cases of rabies in animals were recorded. 21% of all the cases were noted in Lublin province. Rabies in wild animals was observed in 82% of all cases with almost all the cases mainly in foxes (64%) [18]. In 2009, the total number of rabies in animals decreased dramatically and was the lowest since this disease was registered in our country. Only 8 cases of animal rabies were reported in 2009, mainly in western Poland [19]. In 2010, the number of animal rabies was 151 (mainly in wild animals) and in the following year (2011) 160 cases were noted. In 2010 and 2011, most cases of rabies were noted in foxes (117 in 2010 and 103 in 2011). Among domestic animals in 2010 and in 2011, more cases of rabies were confirmed in cats (10 in 2010, and 8 in 2011) than in dogs (9 in 2010, and 5 in 2011) [20]. The total numbers of rabies in animals in Poland from 2006-2011 are presented in Table 3. Among the people exposed to animals

Table 3. Animal rabies in Poland in studied period (2006-2011)

Year	Total number of rabies cases in Poland
2006	81
2007	70
2008	28
2009	8
2010	151
2011	160

and consulted at the Dispensary for Rabies Prophylaxis in Lublin, in only four cases were they exposed to animals with confirmed rabies (Tab. 4). There were two rabid cats (1 in 2007 and 1 in 2011), 1 rabid dog (2011) and 1 rabid bat (in 2009).

The number of reported cases of rabies in domestic dogs has decreased substantially, primarily because of improved canine vaccination and stray animal control programmes [11]. Recent data presented by Kołłątaj et al. indicate that

Table 4. Animals with confirmed rabies in our material

Animal species with confirmed rabies	2006	2007	2008	2009	2010	2011	Total
Dogs	-	-	-	-	-	1	1
Cats	-	1	-	-	-	1	2
Bats	-	-	-	1	-	-	1

in rural areas in Lublin province preventive vaccination of dogs against rabies has actually been carried out by only 64.8 ± 7% of dog owners (below the level recommended by the WHO) and by only 19.8 ± 9.1% of cats owners [21]. According to the WHO, in order to prevent rabies epidemics at least 80% of the total dog population should be vaccinated [22]. Canine rabies can be eliminated, as has been demonstrated in North America, Western Europe, Japan, and many areas in South America. However, canine rabies is still widespread, occurring in over 80 countries and territories, which are predominantly in the developing world. In more than 99% of all human rabies cases, the virus is transmitted from dogs, and half of the global human population lives in canine rabies-endemic areas and is at risk of contracting rabies [9]. The large number of rabid cats compared with other domestic animals might be attributed to a lower vaccination rate among cats because of less stringent cat vaccination laws [21]. In Poland, there were more cases of rabies in cats than in dogs [11].

In countries where domestic animals are vaccinated and the population of foxes is tightly controlled, bats are the main source of infection. Bats are increasingly implicated as an important wildlife reservoir for variants of rabies virus transmitted to humans. Transmission of rabies virus can occur from minor, seemingly underappreciated or unrecognized bites from bats [2]. In our study material, rabies was confirmed in only one bat in 2009.

We also studied human exposures to rodents which, however, are not reservoirs of rabies virus. Small rodents (e.g. squirrels, rats, mice) and lagomorphs (including rabbits) are rarely infected with rabies and have not been known to transmit rabies to humans [23].

Although the main reservoir of rabies in Poland are foxes, in our study material contact with foxes was the reason for vaccination in only 9 people (3.11% of all vaccinated) between 2006-2011, and there were no confirmed cases of rabies in this group of animals. Most cases of animal rabies in Poland are recognized in wild animals. In our material, however, the main source of rabies were domestic animals (3 out of 4).

In Poland, post-exposure treatment is administered to approximately 7,000 people annually, and in most cases immunization followed exposure to animals in which rabies could neither be ruled out nor confirmed [11]. Among our 289 vaccinated patients from 2006-2011, only in four cases (1.38%) the vaccination was administered after exposure to animals definitively confirmed to be rabid. Most people in our dispensary were vaccinated after a dog bite (51.56% of all vaccinated), and after being bitten by cats (20.06%). We observed an almost three-fold decrease in people exposed and consulted in our dispensary after contact with animals in 2010 and in 2011, but the total number of vaccinated individuals was similar to that in 2006-2009 (48 in 2010 and 54 in 2011).

Routine surveillance data confirm a decreasing trend in animal rabies, which is a consequence of the implementation of the fox immunization programme. At the same time in Poland, an increase in rabies reservoirs other than the fox host species, e.g. raccoon dogs, has been observed [11]. In our study material, most people were exposed to domestic animals and no one had a contact with raccoon dog. In our previous data from 2004, one person exposed to a cat with confirmed rabies received passive immunization (RIG, anti-rabies immunoglobulin) [15]. In the present study, all four

patients exposed to rabid animals were successfully protected by vaccination. The use of immunoglobulin in PEP in Poland is low and not systematically integrated in the management of suspected cases [12]. We have not observed any case of rabies in our exposed patients.

It is estimated that more than 15 million people undergo rabies post-exposure prophylaxis (PEP) worldwide every year [7]. It should be pointed out that rabies is 100% fatal, and prevention of this viral disease is the best and only option for cure [24]. Currently available rabies vaccines have well-established safety and efficacy profiles and can be administered either before or after an exposure occurs. In our study material, we did not observe any side-effects during vaccination, and the vaccine was well tolerated in all immunized persons.

CONCLUSIONS

1. In Lublin province, the inhabitants are still exposed to rabid animals, both domestic and wild.
2. Among rabid animals which served as a source of humans exposure, 75% were domestic animals (2 cats, and 1 dog), and only 25% among wild animals (1 bat).
3. Epidemiological analysis and evaluation of post-exposure prophylaxis revealed that the number of vaccinated patients during last six years was similar. A decrease was observed in the number of people exposed to animals in 2010 and in 2011, but the total number of vaccinated people in the years mentioned was not lower than before.
4. Since 2006, a decrease has been observed in the number of annually vaccinated patients compared to the number of active immunized patients in 2004 and 2005.

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