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Review Article

Selected viral zoonoses in medical practice

Anna Kossakowska-Krajewska^{a,b,*}

^aDepartment of Nursing, Faculty of Medical Sciences, University of Warmia and Mazury in Olsztyn, Poland

^bDepartment of Neonatal Pathology and Congenital Defects, Provincial Specialist Children's Hospital in Olsztyn, Poland

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ABSTRACT

Introduction: Viral zoonoses develop only in living organisms, are characterized by a great variability that stems from an adaptation to their hosts and can be a serious problem with respect to medical pathology. This group also embraces prion disease or bovine spongiform encephalopathy (BSE), whose etiological factor is modified prion protein (infectious protein particle) deposited in the nerve cells.

Aim: This work was aimed at presenting basic data concerning zoonoses occurring in Poland, including their etiology and epidemiology, along with the methods applied to break the epidemiological chain.

Materials and methods: The material used in this work consisted of available medical literature, including the latest reports concerning this subject.

Results and discussion: Zoonotic infections are caused by infected, asymptomatic or cured animals. Infections may be transmitted via animal products or slaughter products (animal-derived foods), as well as various elements of that environment contaminated by excrement from sick animals. From an epidemiological perspective, diseases such as anthrax or tick-borne encephalitis which have been prevalent for a long time are still significant. Diseases which have appeared more recently, such as bovine spongiform encephalopathy (BSE), avian influenza (H5N1) and swine influenza (H1N1), have also been discussed. Medical procedures in the event of recognizing such a disease are presented, including the official rules of veterinary actions with respect to infected animals and the food derived from such animals.

Conclusions:

1. Viral zoonoses can be a serious threat to human health due to the significant pace of pathogen proliferation. Despite medical advances, these diseases remain a serious problem for both medical and veterinarian services.
2. Due to globalization, "new zoonoses" constitute a worldwide rather than a local problem. This is clearly testified to by the European Union (EU) Zoonoses Directive issued in 1994 by the Council of the European Union.
3. The application of vaccines does not prevent the development of all zoonoses. Knowledge concerning the transmission modes of these diseases is especially important, as is the cooperation of epidemiologists and specialists in epizootology.

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*Correspondence to: Jarocka 78c/30, 10-699 Olsztyn, Poland. Tel.: +48 606 983 935.

E-mail address: akosskraj@gmail.com (A. Kossakowska-Krajewska).

1. Introduction

Zoonoses are defined as diseases or infections transmitted naturally between animals and humans, whereas zoonotic agents include bacteria, viruses, fungi, and parasites that trigger zoonoses.⁵ These diseases develop in specific social and economic conditions favorable to infectious mechanisms, especially in rural environments. The number of pet animals that develop latent zoonoses is increasing. In recent years, new zoonoses have been identified, since new forms develop every year.²³ One of the reasons for this situation is the ever closer contact of humans with an environment which serves as a reservoir for zoonoses and contains their agents and vectors. On the basis of their etiology, zoonoses are divided into infectious and parasitic diseases. Infectious zoonoses are caused by pathogenic agents which have adapted to human beings and to specific animal species. Viruses that develop only in living organisms pose a significant problem for medical pathology. Viruses survive in a natural environment due to their replication in host organisms and are characterized by their great variability stemming from their ability to adapt to their hosts. This is evidenced by such zoonoses as avian influenza (H5N1) and swine influenza (H1N1) both of which have recently become important sources for the worldwide outbreak of diseases. This group also embraces prion diseases or transmissible spongiform encephalopathies (TSE), whose etiological factor is modified prion protein (infectious protein particle). Prion proteins are deposited in the nerve cells as amyloid concretions and lead to spongiform changes. Nearly 90% of prion proteins are found in the brain and spinal cord. They are also found in a distal part of the intestine, retina, bone marrow, the sensory nerve cell bodies of dorsal root and trigeminal ganglia.²⁴ This disease has caused the slaughter of hundreds of thousands of cattle in Europe, as a result of which the economy was also affected.¹⁴

2. Aim

This work presents basic data concerning selected viral zoonoses occurring in Poland, including their etiology and epidemiology, along with the methods applied to break the epidemiological chain.

3. Materials and methods

The material used in this work consisted of available medical literature, including the latest reports concerning this subject which can further serve to initiate additional scientific reports.

4. Results and discussion

Important viral zoonoses occurring in Europe include rabies, tick-borne encephalitis, avian influenza, swine influenza, as well as the prion disease – bovine spongiform encephalopathy (BSE).

4.1. Rabies

Rabies is an acute viral disease that develops in homeothermic animals and humans. It is caused by a neurotropic virus belonging to the family *Rhabdoviridae*. The reservoirs for this virus are host animals, mainly foxes, badgers and bats. They transmit this disease to domestic animals: dogs, cats and cattle. Rodents, such as squirrels, rats, mice, and hamsters can also be rabies carriers; however, people have not been reported to have been infected by these animals. In Poland, approximately 2000 cases of rabies in animals are reported annually.¹⁶ The highest incidence of rabies is detected in cats – 6.8% and dogs – 4.8%, and among wild animals in red foxes – 67.4%, raccoons – 6.5%, roe deer – 3.0%, martens – 2.4%, and badgers – 0.8%. According to the World Health Organization (WHO), 86–90% of rabies cases concerning humans are caused by virus transmission via dogs.²⁷

In the natural environment, infection is nearly always caused by a bite, followed by the close contact of skin, muscles and mucous membrane with infected saliva. During the incubation period lasting from several weeks to months the virus replicates in myocytes, and then spreads 50–100 mm daily transferring to the spinal cord and brain. There it replicates, forming the so-called Negri bodies in the neurons, and then it penetrates into the salivary glands, taste buds, cornea, skin, and other organs via peripheral nerves. The virus is released from nerve endings 2–5 days prior to the appearance of clinical symptoms; however, it has been detected in the saliva of infected animals 14 days before the onset of the disease.^{5,14,27} Factors such as young age, immune deficiency, corticosteroid treatment, bite severity, approximation of the wound with respect to the central nervous system (CNS), and high infectious dosage contribute to the shortened incubation period.¹⁹

In humans, the rabies incubation period ranges from 5 days to more than a year (2 months on average). Following the incubation period, hyperesthesia and pain at the wound site appear. Later, all other symptoms develop, such as psychomotor agitation, auditory and visual hallucinations, dysphagia with hydrophobia and sialosis. The last stage of the disease involves coma and paralysis, and death occurs after 1–10 days.¹⁷ In liquid saliva the virus survives for up to 24 h, and in dry saliva for up to 14 h. It is resistant to putrefaction – its virulence in the medulla of a buried corpse was detected even after 14–20 days. At a temperature of 52°C the rabies virus dies within 30 min, and at a temperature of 80°C within 2 min. It is very susceptible to pH changes: in pH 3.0–3.5 environment it dies within 30 min, and in a pH 6.0 condition it loses approximately 90% of its virulence within 2 h.¹⁷

The last case of rabies in Poland was reported in 2002.⁹ Individuals infected with the rabies virus are administered with a vaccine or serum. Infected animals are not treated because rabies is a disease controlled *ex officio*. It is compulsory to slaughter animals with symptoms of rabies. Carcasses and any other parts of such animals are considered unfit for consumption.^{18,20} In Poland, the vaccination of dogs and cats against rabies is imposed by law. Foxes are vaccinated in selected regions by means of bait.

4.2. Tick-borne encephalitis

Tick-borne encephalitis is an enzootic infection triggered by a neurotropic virus of a large family of arboviruses.

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