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Diseases of the respiratory tract of birds a threat to human health

Choroby układu oddechowego ptaków zagrożeniem dla zdrowia człowieka

SUMMARY

Diseases and infections, which are naturally transmitted between vertebrate animals and man, appear worldwide. Birds play a valid role in zoonotic infections caused by *Mycobacterium avium, M. avium-intracelulare complex, Chlamydia psittaci* and *Aspergillus sp.* Transmission to man occurs by the respiratory route from health and sick birds, throughout fecal droppings and conjunctival/nasal secretions. Preventive strategies in poultry plants include the use of masks, installation of good ventilation to reduce spread by inhalation. The most effective measures are identifying and treating infected poultry flocks. Preventing domestic birds acquiring infections is difficult because wild birds are important in transmission to commercial poultry.

Key words: zoonoses, birds, aspergillosis, chlamydiosis, influenza, tuberculosis

INTRODUCTION

The close association of people with animals in large areas of the world and often in unsatisfactory sanitary conditions continues to promote the opportunity for zoonotic infections. Most of them are well known from the beginning of human civilization. They bloomed and high risk of their spread increased when political and social instability occurred and normal sanitary arrangements were disrupted, disease programmes discontinued and medical service ceased to function. Epidemic diseases such as malaria, plague, yellow fever, variola de-

stroyed civilizations. Some diseases of antiquity had persisted to modern times. Epidemic bubonic plague was vividly described in biblical and medieval times and now in XXI century plague is still a great threat for human health. Tuberculosis from ancient times up to now still attacks millions of individuals every year.

TUBERCULOSIS

Tuberculosis is an ancient disease with evidence of this affliction, in the form of classical spinal lesions was dated back to about 3000 BC. Most probably it attacked animals before the appearing of a primitive human population. With the progress of the eradication schemes and the introduction of pasteurization of milk and tuberculostatics, infection of man and other species of animals was gradually reduced. But still *Mycobacterium avium*, *M. tuberculosis* and *M. bovis* attack most species of birds. Transmission of tuberculosis from poultry and companion birds, exotic birds in zoo gardens is now an extremely event in well developed countries. Bird infections have been recorded due to both *M. avium* and *M. tuberculosis* and *M. bovis* bacilli. The risk of *M. avium* infection is great because (i) this bacterium is one of the most drug resistant acid-fast bacilli, (ii) because birds infected by *M. bovis* and *M. tuberculosis* can transmit infection to man [Calnek *et al.* 1991]. Moreover, *M. avium* is the cause of tuberculosis in a wide range of bird species and has also been isolated from other animals including pigs, cattle, and deer. In humans it causes pulmonary disease in adults, cervical lymphadenopathy in children, and disseminated disease in immunosupressed individuals. The atypical acid-fast bacilli from the *Mycobacterium avium-intracellulare* complex infecting birds create a potential threat both for humans and animals. The AIDS has a significant effect on the incidence of *M. avium* infections. This species occurs as the late complication of AIDS and may be localized or disseminated. Tuberculosis still produces a considerable toll of disease and death in man. Bad social and economical situation, infections with suppressive viruses, environment pollution, and enormous use of pesticides promote the development of tuberculosis in man and animals.

INFLUENZA

Another threat, differing from bacterial diseases both by ethiopathogenesis and sources of infection, antigenic variation, great possibilities of adaptation to different orders of animals is influenza caused by the influenza viruses of type

A. This high contagious acute respiratory illness appears to have afflicted human beings since ancient times. Influenza A viruses infect a large variety of animal species, including humans, pigs, horses, sea mammals and birds [Collier 1996]. It is worthy to note that influenza A viruses produced devastating pandemics in humans [Kańtoch 1997, Samorek-Salmonowicz *et al.* 1998]. In the XX century antigenic shift has occurred resulting in pandemics and frequent epidemics have occurred between pandemics as a result of a gradual antigenic change in the prevalent virus (antigenic drift). Some pandemic strains are thought to have emerged by reassortment of avian and human influenza A viruses infecting the same host. One of the main threat in influenza create interspecies transmission of the virus and hence the appearance of new highly pathogenic subtypes [Kańtoch 1997, Samorek-Salmonowicz *et al.* 1998]. Recent phylogenetic studies of influenza A viruses have revealed species-specific lineages of viral genes and have demonstrated that the prevalence of interspecies transmission depends on the animal species.

Three groups of animals appear to be far more important in terms of numbers and the epidemic/endemic nature of influenza than other animals: these are birds, pigs and horses [Samorek-Salmonowicz *et al.* 1998]. The global studies on the influenza viruses of mammals and birds showed that the vast number of viruses have been isolated from a wide variety of birds. The most devastating influenza pandemic recorded occurred in 1918. It has been estimated that during this pandemic between 20 and 40 million deaths occurred throughout the world [Kańtoch 1997, Samorek-Salmonowicz *et al.* 1998, Stephenson 1999]. Close correlation between human and animal influenza was made during this pandemic. Influenza virus A H1N1 [Samorek-Salmonowicz *et al.* 1998] endemic in pig population started to attack human beings in 1918. Several viruses that have been isolated from domestic poultry were shown to be influenza A viruses. The Asian flu pandemics in 1957 H21N2 replaced the H1N1 subtype and 1968 H3N2 virus has appeared [Kańtoch 1997]. The 1968 Hong Kong H3N2 stain contained HA and PB1 genes from and avian donor and the NA and other five genes from the Asian H2N2 strain. Viruses antigenically identical to human variants of H3N2, H2N2, and H1N1 subtypes have been isolated from wild birds and domestic poultry, some have been reported to cause disease outbreaks in chickens that have shown a temporal relationship to influenza epidemics in humans.

The best example is epidemics of human influenza in march 1997. Influenza virus A subtype H5N1 was isolated from the tracheal samples of a boy with a fatal influenza (in USA, Holland and England) [Cohen 1997, Stephenson 1999]. This highly pathogenic strain originated from birds in which 100% mortali-

was noted in experimental studies. It was noted, for the first time that HA protein, which is an integral membrane protein and the major surface antigen of the influenza virus, can form links with haemagluttinin receptors of the cell membrane of human cells. Since that time the coordinated work on the role of H5N1, reservoirs of influenza viruses that exist in animals, particularly birds, and on the epidemiology of animal viruses, particularly in relation to human influenza, is thoroughly studied.

CHLAMYDIOSIS

Chlamydiosis is a systemic, bacterial zoonotic disease associated with significant mortality if untreated. Human chlamydiosis occurs worldwide, mainly affecting persons exposed to infected psittacine, and other birds, and less commonly to animals. Birds are a natural host of *Chlamydia psittaci*. Many wild game and garden birds are known to be infected and remain an important source of infection to humans and other birds. The avian strains are extremely virulent and complications in infected patients are very often. Infection is transmitted through inhalation of infected aerosols contaminated with avian droppings, nasal discharges, and wounds. Person to person transmission is rare [Boroń 1983, Anusz 1995]. In birds, exposure of nestlings to infection is the major mode of transmission. Wild birds are important in transmission to commercial poultry. Carrier state and asymptomatic infections are noted up to 90% of birds in a herd. In birds *Ch. psittaci* is spread with saliva, feces, oral and nasal discharge [Gerlach 1993, Choroby zakaźne 1998]. Non-productive and persistent infections are common in chlamydial diseases but the mechanism is unknown. Chlamydiae may survive in cells for long periods in a non-replicative form or, alternatively, multiply at a low level. Chlamydiosis gives only short-lived, modest protection against disease [Boroń 1983, Anusz 1995, Centers for Diseases Control... 1998].

In humans the onset of disease may be insidious or rapid with fever, headache and generalized malaise with an incubation period 4-15 days [Choroby zakaźne 1998]. Epistaxis and mucocutaneous manifestations frequently occur. Complications include hepatosplenomegaly, meningitis or meningoencephalitis, myocarditis or pericarditis [Vanrompay *et al.* 1995]. A silent form of chlamydiosis is also noted. Since the introduction of intensive poultry rearing several major outbreaks of chlamydiosis affecting man have been reported, mainly associated with duck and turkeys. In West Germany in 1980-1986 1312 cases of human chlamydiosis and 2893 cases of chlamydiosis in poultry were diagnosed [Gerbermann 1989]. In USA in 1987-1996 619 cases of chlamydiosis were

noted by the CDCP [Centers for Diseases Control... 1998]. The caged birds were sources of infection for 70% of patients.

Control strategies have met with variable success depending on the degree of compliance or enforcement of legislation. Improved standards of husbandry, transport conditions and chemoprophylaxis are useful for controlling chlamydial infections [Shewan 1980].

Prevention and control of chlamydiosis is based on control of bird's movement, identification of infected birds quarantine and chemotherapy. Psittacines must have appropriate health certification and birds must originate from countries free of chlamydiosis. Quarantine periods vary in different countries [Tully 1993, Vanrompay *et al.* 1995, Centers for Diseases Control... 1998]. The most effective measures are identification and treatment of infected flocks remembering that apparently healthy birds may be infectious. Identification of chlamydiosis in birds based on isolation of the agent from blood, feces, nasopharyngeal swabs and internal organs [Tessler 1984, Vanrompay *et al.* 1992, Ritchie *et al.* 1994, Anusz 1995, Moroney *et al.* 1998], electron microscope examination and by serological tests: IF, ELISA, Blocking-ELISA [Haven *et al.* 1992, Vanrompay *et al.* 1992, 1995, Moroney *et al.* 1998, Everett and Anderson 1999]. Genom detection by PCR technique appeared to be both reliable and rapid test. There are also recommended latex agglutination test and CF [Haven *et al.* 1992, Fudge 1993, Grimes 1993]. The plate agglutination test, tube agglutination, passive hemagglutination and immunodiffusion are rarely used for diagnosis of the disease [Calnek *et al.* 1991, Moore *et al.* 1991, Gerlach 1993, Ritchie *et al.* 1994]. Treatment with tetracyclines and enrofloxacine is recommended [Vanrompay *et al.* 1995, Centers for Diseases Control... 1998].

ASPERGILLOSIS

Opportunistic infections caused by *Aspergillus fumigatus* create now a valid problem especially in immunosuppressed patients causing invasive pulmonary aspergillosis or disseminated aspergillosis [Choroby zakaźne... 1996]. It is found worldwide and in almost all domestic animals. In chickens, turkeys, less frequently in ducklings, pigeons, canaries and geese, *A. fumigatus* attacks usually the respiratory system. In chickens and turkeys the disease may be endemic on some farms. Humans may become infected by inhaling a large numbers of spores in heavily contaminated hatching machines or from contaminated litter or by inhalation of spore-laden dust from contaminated litter. Major risk factors include long-term high dose corticosteroid therapy, organ transplantation, hereditary disorders of neutrophils function [Choroby zakaźne... 1996].

Invasive pulmonary aspergillosis usually extends rapidly, causing progressive, ultimately fatal respiratory failure unless treated promptly and aggressively. Extra pulmonary disseminated aspergillosis may involve the liver, spleen, kidney, brain or other tissues and is usually fatal. Necrosing cutaneous lesions may also develop.

CONCLUDING REMARKS

A new dimension of zoonotic diseases manifests by the growing numbers of immunosuppressed people. Infections, which in the normal individual are unapparent, may become life threatening during immunosuppression. Apart the respiratory tract infections birds are reservoir and vector of the infections of the alimentary tract. Humans become infected by contact with infected birds or contamined bird products (eggs, meat). For example, the bird- adapted serovars of Salmonellae ma cause serious illness in human beings. Human salmonellosis now is a major international problem both in terms of morbidity and economic costs. Prevention and control of food poisonings is time and money consuming.

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STRESZCZENIE

Choroby i infekcje przenoszone w sposób naturalny z kręgowców na człowieka występują na całym świecie. Ptaki odgrywają ważną rolę w infekcjach odzwierzęcych wywołanych przez *Mycobacterium avium, M. avium-intracelulare complex, Chlamydia psittaci* i *Aspergillus sp.* Człowiek zakaża się przez układ oddechowy od chorych i zdrowych ptaków, przez kał i wydzieliny worka spojówkowego i jamy nosowej. Strategie obrony przed zakażeniem polegają na stosowaniu masek w kurnikach, instalowaniu odpowiedniej wentylacji. Najodpowiedniejszym sposobem jest identyfikacja i leczenie zakażonych stad drobiu. Zapobieganie zakażeniu ptaków domowych jest trudne, ponieważ zakażają się one od wolno żyjących ptaków.

Słowa kluczowe: zoonozy, ptaki, aspergilloza, chlamydioza, influenza, gruźlica