Avian influenza (subtype H5N1) transmission mechanisms

A.S. Safatov1, I.E. Agranovski2, V.N. Mikhailov3, S.A. Kiselev1, O.V. Pyankov1,2, M.O. Skarnovich1, V.A. Petrischenko1, G.A. Buryak1, L.N. Shishkina1, A.N. Sergeev1, I.G. Drozdov1

1Federal State Research Institute State Research Center of Virology and Biotechnology “Vector”, Novosibirsk Region, 630559, Koltsovo, Russia
2School of Environmental Engineering at Griffith University, Nathan Campus, Qld 4111, Brisbane, Australia
3Administration of Rospotrebnadzor in Novosibirsk region, Bd. 7A, Cheluskintsev street, 630132, Novosibirsk, Russia

Keywords: bioaerosols, health aspects of aerosols, avian influenza virus, virus aerosol transmission, aerosol infectivity

The epidemic of avian influenza A subtype H5N1 caused a great economic damage in Asian and European countries. More than 150 million infected birds were slaughtered. According to the WHO data for the beginning of 2007, this subtype of influenza virus killed more than 150 humans. However, in spite of the fact that influenza viruses are respiratory ones, there are no literature data on aerosol way of transmission of infection caused by influenza A subtype H5N1. Moreover, there is evidence that aerosol way of infection transmission is not the main one for this subtype of influenza virus.

The study of the infection development in hens after intranasal infection with avian influenza virus at the dose of 3-5 LD50 allowed us to reveal the following dynamics of the virus accumulation in different organs of birds. The site of initial virus replication is nasal cavity of birds, in which the virus is detected at a considerable concentration already 24 hours post infection in hens and disappears from it within 36 - 60 hours. The virus from nasal cavity obviously penetrates into lungs where the virus concentration reaches 5.8 log10 TCPD50/ml 60 hours post infection and stomach and, at the same time, might spreads throughout the organism through blood and lymph causing infection with maximal accumulation of the virus in gastroenteric tract and excrements (up to 6.5 log10 TCPD50/ml).

Aerosol transmission of infection from diseased birds to healthy ones can occur both through aerosol excreted from respiratory tract of infected birds and aerosol generated from birds’ excrements. Experiments allowing the evaluation of each of the ways separately demonstrated the possibility of both ways of infection transmission.

Thus, there are two main ways of infection transmission: by aerosol (site of entry - upper and lower sections of respiratory tract) when infection occurs through them and fecal-oral route (site of entry - upper sections of respiratory tract) when infection occurs through nasal cavity. It should be noted that from our point of view the second way has higher probability than the first one.

This work was partially supported by RF Government grant #820-R.