Avian Influenza (AI)

Disease Profile

AI is caused by infection of birds with avian influenza type A viruses (AIV). These viruses occur naturally among wild aquatic birds worldwide and can infect domestic poultry and other bird and animal species. Wild aquatic birds can be infected with AI A viruses in their intestines and respiratory tract, but usually do not get sick. AI viruses are classified into **low (LPAI) and highly pathogenic (HPAI) phenotypes.** HPAI viruses have been eradicated from domesticated poultry in many countries but eradication of HPAI virus on a global scale is not expected as pockets of endemic infection continue to exist. LPAI virus strains are found worldwide. AI infections are widely distributed in aquatic wild bird populations. The majority of infections are acute and asymptomatic. Faecal-oral transmission chains dominate. The environment (surface water, sediments) probably acts as an important factor of virus perpetuation. Incidence of infection is cyclic in the natural hosts and peak values correlate with autumn migration of aquatic wild birds in the northern hemisphere.

Risk

All viruses in general have considerable **genetic flexibility** through point mutations and through exchange of whole genome segments during co-infection of a single host cell with different AI virus. HPAI viruses arise by mutation *de novo*, from LPAI precursor viruses maintained in the natural host reservoir. Influenza viruses circulating in animals pose potential threats to human health. The primary risk factor is direct or indirect exposure to infected live or dead poultry or contaminated environments. Efficient or sustainable human-to-human transmission of avian origin influenza viruses has not yet been reported. Vaccination is an important method for controlling AI but can stimulate antigenic drift if vaccines are not applied properly and under controls. Likewise, without proper **marker systems** it will be difficult to differentiate infection from vaccine responses. Failure of all available vaccines to induce sterile immunity implies risks of silent spread of virus by apparently healthy but infected vaccinated poultry.

What do we have?

Diagnostics are available worldwide but are limited. Technology for characterisation of strains is quite advanced, but sometimes lagging behind in low income countries. The palette of commercially produced and distributed test kits comprises antibody and antigen detection ELISAs, (real time) PCR, rapid antigen detection assays and antigens for serological purposes.

Vaccines: H5, H7, H9 *vaccines* are available. Vaccination of wild birds is not feasible. There are two types of vaccines commercially available at present: inactivated (whole virus) and recombinant vaccines (subunit). Approaches to differentiate infected from vaccinated birds are the use of a heterologous vaccine (vaccine virus with the same H type as the field strain but a different N type) or the use of recombinant subunit vaccines.

Antivirals are effective in AI virus infected poultry but their use is prohibited due to the risk of resistance and hazard thereof for humans.

What do we need?

- Research to fill gaps in relation to pathogenesis, immunology, vaccinology, epidemiology and control.
- Cheap, stable and sensitive tests which allow high-throughput generic and subtype-specific multiplex serological screening.
- Rapid and sensitive methods of assessing infectious status of flocks.
- Easy to apply, single dose, cheap, marker vaccines that induce clinical broad protection and bring virus shedding to a minimum. Further development of recombinant vaccines is required.

Read the full chapter here.