

Avian Influenza Summary

Introduction

1. This note provides a brief summary of an analysis undertaken by a DISCONTTOOLS group of experts on Avian Influenza (AI). They reviewed the current knowledge on the disease, considered the existing disease control tools, identified current gaps in the availability and quality of the control tools and finally determined the research necessary to develop new or improved tools. Full details of the analysis can be downloaded from the web site at <http://www.discontools.eu/> by selecting Disease Database, then the specific disease and highlighting the variables of interest. This is completed by selecting “create a report” which can then be downloaded as either a PDF or Excel spread sheet.

Disease profile

2. Sporadic outbreaks of Highly Pathogenic Avian Influenza Virus (HPAIV) viruses have been eradicated from domesticated poultry in most developed countries but eradication of HPAIV H5N1 on a global scale is not expected in the short term as pockets of endemic infection, especially in domestic waterfowl, continue to exist in several countries. Low Pathogenic Avian Influenza Virus (LPAIV) strains are found worldwide as a sequel of sporadic spill-over infection from wild bird populations but also as entrenched endemic infections of poultry.

3. 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 of up to 30% correlate with autumn migration of aquatic wild birds in the Northern hemisphere.

4. In poultry, infections by “low pathogenic” AIV may go undetected and usually cause only mild symptoms. However, the highly pathogenic form may cause disease with extensively high mortality rates within 48 hours.

Risk

5. Avian Influenza Viruses in general have considerable genetic flexibility through point mutations which accumulate due to an intrinsically high mutation rate of these viruses and through exchange of whole genome segments during co-infection of a single host cell with AIV of different sub- and genotypes. HPAIV arise by mutation de novo, probably in gallinaceous poultry, from LPAIV precursor viruses maintained in the natural host reservoir. To date, all naturally occurring HPAIV come from subtypes H5 and H7. However, the majority of H5/H7 in circulation is of the LP phenotype.

6. Influenza viruses circulating in animals pose threats to human health. The primary risk factor for human infection appears to be direct or indirect exposure to infected live or dead poultry or contaminated environments. Efficient or sustainable human-to-human transmission of avian origin AIV has not yet been reported and exposure to high doses of virus is probably required to initiate “dead-end” infection of humans.

7. Eradication of LPAIV is impossible due to the reservoir function of aquatic wild bird populations. Numerous deaths due to HPAIV H5N1 and its recent descendants have been reported in migratory wild birds including highly endangered species, which usually carry avian influenza viruses asymptotically.

Diagnostics

8. Diagnostics are available worldwide but are limited. Technology for characterisation of strains is quite advanced, but sometimes lagging behind in developing countries. The palettes of commercially produced and distributed test kits is growing and comprises antibody and antigen detection ELISAs, PCR (including real time-PCR), rapid antigen detection assays and antigens for serological purposes. Approaches, in Europe, that can be applied 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 vaccine. The validity of DIVA tests for HPAI, however, remains to be assessed under field conditions;

9. Cheap, stable and sensitive tests fit for purpose are needed which will allow high-throughput generic and subtype-specific multiplex serological testing tools. The development of pen side antibody test in order to detect the optimal age at vaccination (birds could be vaccinated at an age when maternally derived immunity is still present and might have a negative impact on the uptake of the vaccine). In addition, rapid and sensitive methods of assessing infectious status of flocks such as testing of routine mortalities needs to be developed

Vaccines

10. 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 subunit) and recombinant vaccines (e.g., fowl pox, NDV, HVT). Recombinant vaccines have been licensed in a number of countries

11. There is a need for easy to apply, single dose, cheap, marker vaccines that induce clinical broad protection and bring virus shedding to a minimum. Information from field studies on the most effective method of application is required with the long term aim of using mass application routes (e.g., spraying or drinking water application) if possible in combination with other vaccines (e.g., NDV).

12. Further development of recombinant vaccines is required. a) using backbones which favour induction of protection in ducks (e.g. duck herpes viruses etc.) b) investigating whether such vaccines are capable of circumventing the potentially negative effect on immune response in birds still having maternally derived antibodies and c) undertaking field studies to evaluate the DIVA principle using new recombinant vaccines in practise and with larger flocks.

Pharmaceuticals

13. Antivirals (Tamiflu & Relenza) are effective in AIV infected poultry but their use is prohibited due to the risk of resistance and hazard thereof for humans.

Knowledge

14. Avian influenza has been studied for many years, but despite this there are still significant areas of uncertainty in the understanding and knowledge about the disease especially in relation to pathogenesis, immunology, vaccinology, epidemiology and control. Research is needed to fill these gaps in knowledge as many of these are closely linked to the research requirements to develop more effective tools for the control of the disease. Full details of the gaps are shown in the Disease and Product Analysis for Avian Influenza on the DISCONTTOOLS web site.

Conclusions

15. Losses to the poultry and allied industries in an outbreak of HPAI can be severe. Eradication of the disease in poultry relies on early detection and on rapid and strict response to any outbreak. In Europe the rapid implementation of strict controls including stand still, culling and safe disposal of infected or in contact birds and C+D is essential to prevent spread within domestic poultry populations. In countries where national veterinary services are unable to detect and respond rapidly to outbreaks and notifiable AIV has gained endemic status, systematic vaccination should be used as an intermediate control measure.

16. Vaccination is an important method for controlling avian influenza but can pose some risks. It would be possible to 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.