



OFFLU avian influenza vaccine guidance

Continued evaluation and updating of vaccine seed strains to protect against emergent variant field virus strains

Historically, H5 LPAI inactivated vaccine seed strains and recombinant fowl poxviruses with H5 gene inserts have shown broad cross protection in chickens against challenge by diverse H5 HPAI viruses from Eurasia and North American (4–6,8). However, avian influenza vaccines have had limited use in the field until 1995 when the H5N2 HPAI outbreak occurred in Mexico and vaccine use was implemented as part of the control program (9). The HPAI strains were eradicated by June 1995, but as H5N2 LPAI viruses have continued to circulate, vaccination was maintained in the region as one of the control tools for these H5N2 LPAI strains. Within a few years, multiple lineages of antigenically variant H5N2 LPAI field viruses emerged that escaped from immunity induced by the original 1994 vaccine seed strain used in the conventional inactivated vaccine (3). Similarly, emergent H5N1 HPAI field viruses have arisen in China, Indonesia and Egypt since 2005 that escaped from immunity induced by classical H5 inactivated vaccine seed strains used in commercial vaccines (1,7). It is not entirely clear whether the emergence of these antigenic variants is related solely to use of vaccines.

All avian influenza vaccination programs should have an epidemiologically relevant surveillance program to check for emerging variants and representative isolates of AI viruses obtained should be assessed for genetic and antigenic variation. Screening can be done by HI testing using genetic variant field viruses and vaccine seed strains as antigen, and isolates suspected of being antigenic variants should then be analyzed by methods such as antigenic cartography (2). H5 and H7 LPAI vaccine seed strains used in inactivated vaccines and recombinant vaccine viruses with AI hemagglutinin gene inserts should be re-evaluated and seed strains that are not protective should be discontinued: a) whenever there is evidence of emergence of antigenic variants or vaccine failure (clinical disease in vaccinated flocks with a solid immune response to the vaccine antigen); or b) every 2–3 years for efficacy against circulating field viruses, and the use of seed strains that are not protective should be discontinued. The vaccine seed strain evaluation should include field viruses from all relevant geographic regions and production sectors, and sequence analyses of such viruses to identify genetic variants

that can be further evaluated for antigenic change that may reduce the efficacy of the vaccine(s) in use. Strains representative of the major circulating antigenic lineage(s) plus selected antigenic variants should be used in challenge trials against current licensed vaccine seed strains, as well as potential future seed strains. Based on this scientific information, the competent veterinary authority within the country should establish, in consultation with leading veterinary vaccine scientists and international organizations, naturally isolated or reverse genetics LPAI vaccine seed strains for conventional inactivated vaccines, and H5 and H7 hemagglutinin gene insert cassettes for recombinant vaccines. In some situations, more than one seed strain may be necessary to cover all production sectors within a country. Only high quality and potent vaccines should be licensed and used in AI control programs. Proper administration of high quality, potent vaccines is critical in inducing protective immunity in poultry populations.

References

1. Chen,H. & Bu,Z. (2009). – Development and application of avian influenza vaccines in China. *Curr.Top.Microbiol.Immunol.*, **333**, 153–162.
2. Fouchier Ron,A.M. & Smith,D.J. (2010). – Use of antigenic cartography in vaccine seed strain selection. *Avian Dis.*, **54**, 220–223.
3. Lee,C.W., Senne,D.A., & Suarez,D.L. (2004). – Effect of vaccine use in the evolution of Mexican lineage H5N2 avian influenza virus. *J.Virol.*, **78** (15), 8372–8381.
4. Swayne,D.E., Beck,J.R., Garcia,M., & Stone,H.D. (1999). – Influence of virus strain and antigen mass on efficacy of H5 avian influenza inactivated vaccines. *Avian Pathol.*, **28**, 245–255.
5. Swayne,D.E., Beck,J.R., Perdue,M.L., & Beard,C.W. (2001). – Efficacy of vaccines in chickens against highly pathogenic Hong Kong H5N1 avian influenza. *Avian Dis.*, **45** (2), 355–365.
6. Swayne,D.E., Garcia,M., Beck,J.R., Kinney,N., & Suarez,D.L. (2000). – Protection against diverse highly pathogenic avian influenza viruses in chickens immunized with a recombinant fowl pox vaccine containing an H5 avian influenza hemagglutinin gene insert. *Vaccine*, **18** (11–12), 1088–1095.
7. Swayne,D.E. & Kapczynski,D.R. (2008). – Strategies and challenges for eliciting immunity against avian influenza virus in birds. *Immunological Reviews*, **225** (1), 314–331.
8. Swayne,D.E., Lee,C.W., & Spackman,E. (2006). – Inactivated North American and European H5N2 avian influenza virus vaccines protect chickens from Asian H5N1 high pathogenicity avian influenza virus. *Avian Pathol.*, **35** (2), 141–146.
9. Villareal,C.L. & Flores,A.O. (1998). – The Mexican avian influenza (H5N2) outbreak. *In: Proceedings of the Fourth International Symposium on Avian Influenza* (D.E.Swayne & R.D.Slemons, eds.). U.S. Animal Health Association, Richmond, Virginia, 18–22.