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Diagnostic challenges of swine influenza virus infection

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Swine influenza virus has evolved from a seasonal disease caused by a stable genotype to a year round endemic respiratory disease caused by multiple genotypes undergoing continuous change (Webby et al., in press). Within the U.S. swine population, three subtypes of group A influenza—H3N2, H1N1, and H1N2—are circulating and within the subtypes are different genotypes causing unexpected results.

The increased diversity in the influenza virus population has complicated diagnostic evaluation of influenza virus infection. The most apparent effect on routine diagnostics has been the effort required to identify and interpret some infections serologically. Alternatively, there should not be a great concern for routine post- or antemortem diagnostics as tests used today—polymerase chain reaction (PCR), immunohistochemistry, and virus isolation—will detect all known group A influenza viruses.

Influenza virus identification

The steps to influenza virus identification and characterization may involve initial detection of an influenza virus followed by serologic confirmation. Alternatively, unexpected serology results may lead to an influenza virus search. Regardless, the initial step in virus identification usually involves a group A influenza virus screening test leading to further testing and subtype designation as an H1 or an H3 virus. Unfortunately, subtype identification is no longer as revealing as in the recent past and an additional differential test, hemmagglutinin (HA) gene sequencing, is required. Sequencing the first 600 bases of the HA gene allows for a phylogenetic classification or association to other influenza viruses of the same "H" type and will give an indication of whether this is a new or previously recognized virus—either in the U.S. or within a system. Identification of a genetically unique virus may explain prior unexpected serologic results. Sequencing also provides a record of a virus within a system which may be useful for evaluation of subsequent control programs.

Influenza virus serology

Identification of an influenza virus may lead to serologic testing of the affected pigs for confirmation of infection.

If the virus varies enough from known reference strains used by diagnostic laboratories, hemagglutination inhibition (HI) results may be unexpectedly negative or low. In these cases the influenza isolate can be used in the HI reaction with acute and/or convalescent antisera to demonstrate seroconversion. Additionally, the homologous HI test can be used to measure antibodies in pigs from other stages of production to identify infected groups or the decay of colostral antibody. If there are no or only low HI titers identified with reference strains, inappropriate decisions about exposure status or actual decay of colostral antibody titers may occur. SIV ELISA antibody tests should offer a broader range of cross-reactivity to different influenza viruses but could also suffer from non-reactivity to some influenza viruses. The potential lack of serologic cross-reactivity is also a concern for monitoring SIV-negative herds. SIV-negative herds should use the test with the greatest range of cross-reactivity for monitoring or run multiple HI tests with isolates representing the known influenza viruses in the swine population to best confirm their negative status.

Another use for HI serology is to compare and contrast seroreactions of field influenza virus isolates against antibody (serum) from experimental infections with known isolates—such as antisera against vaccine viruses. A serologic profile comparing known antisera helps to further define a unique SIV isolate in conjunction with sequencing and clinical disease.

Influenza virus diagnosis and characterization has become more complex in the last few years and better methods are available for SIV evaluation to help understand and manage the disease.

Reference

Multiple lineages of antigenically and genetically diverse influenza A virus co-circulate in the United States swine population. Webby, R., Rossow, K., Erickson, G., Sims, Y., and R. Webster. In the Proceedings of the 1st European Influenza Conference. Virus Research; in-press.

