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Effect of vaccination on flu bioaerosol spread

Montse Torremorell; Victor Neira; Cesar Corzo; Matt Allerson; Marie Gramer
Swine Disease Eradication Center, College of Veterinary Medicine, University Of Minnesota

Introduction

The recent influenza pandemic has highlighted the constant threat that influenza viruses represent for people and animals. Because influenza viruses are shared between humans, avian and mammals, understanding interspecies transmission and the risk for regional spread is a priority. Influenza in pigs in particular, is a potential liability to the swine industry because of the risk of infecting farm workers and generating new strains that could spread further into the pig or other species population such as poultry or even into rural communities.

Both contact and aerosol transmission has been documented as being the main routes for influenza transmission (Torremorell et al., 2012). Although aerosol transmission of influenza virus in pigs is considered significant only limited experimental information is available on the significance of this route. Pilot studies conducted at the University of Minnesota have documented the detection of flu virus in aerosols generated from experimentally infected pigs and have documented the detection of influenza virus in aerosols generated from pigs with passive immunity (Corzo et al., 2012). Additionally, Corzo et al., (2012) have recently reported an association between pig farm proximity as a risk factor for influenza infection in turkey farms. This information points at the relevance and potential risk that infected aerosols play in influenza dissemination within farms and also the role that pigs play in regional virus dissemination. Therefore strategies directed at minimizing and preventing the risk of flu transmission and spread through aerosols are needed.

Influenza vaccination is commonly used in pigs to reduce the clinical effects and the economic impact of flu infection. Vaccination has shown to have an effect in reducing lung lesions and shedding in experimentally infected pigs (Van Reeth et al, 2001). In addition, vaccination has been shown to reduce the rates of virus transmission within populations and the likelihood to decrease acute outbreaks (Romagosa et al., 2011). However, limited information is available in regards to the effect that flu vaccination may have in reducing the risk of aerosol transmission and what effect vaccination may have in reducing the amount of virus shed into the air. By understanding the impact of flu vaccination in pig farms and its role in the generation of bioaerosols, veterinarians and producers will have more options to reduce the risk of airborne transmission to nearby farms.

Materials and methods

Groups of 3 week-old pigs were distributed in four groups and allocated in groups of vaccinated or non-vaccinated pigs. Vaccinated groups included a group vaccinated with a commercial autogenous vaccine prepared with the challenge virus, a group vaccinated with a multivalent commercial vaccine, and a group vaccinated with a commercial monovalent vaccine. The combination of vaccinated groups was selected to represent a broad range of conditions representative of field settings and also to obtain varying degrees of partial immunity against the challenge strain. The control group was sham vaccinated with sterile saline solution.

Pigs were intranasally and intratracheally inoculated with the challenge virus A/Sw/IA/00239/04 H1N1 two weeks after the second vaccination was completed. Pigs were monitored daily by nasal RT-PCR and virus was quantified.

Air samples were collected using an air cyclonic collector three times a day: in the morning, at noon and in the evening, approximately. Samples were tested by RT-PCR, virus quantified and isolated following standard procedures. Temperature and relative humidity parameters were electronically logged and collected every 5 minutes throughout the study.

Results

Pigs in the control unvaccinated group had higher titers of virus in nasal swabs compared to vaccinated pigs. Among vaccinated pigs, pigs vaccinated with the autogenous commercial vaccine had lower titers than pigs vaccinated with the multivalent or monovalent commercial vaccines.

Overall, influenza virus was detected in air samples collected from non-vaccinated pigs but not from vaccinated pigs. Influenza virus was detected from air samples collected at three different days post infection. However, the degree of virus detection in non-vaccinated pigs was low compared to previous studies, most likely due to higher environmental temperatures and/or relative humidities.

In summary, vaccination against influenza virus reduced the amount shed in nasal secretions and the overall load of virus detected in aerosols. Further studies are needed to evaluate the effect of vaccination on influenza aerosols generated under field conditions.

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