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Efficacy of a swine influenza virus (SIV) vaccine in pigs challenged with heterologous reassortant H1N1 and H3N2 viruses

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Introduction

Since the introduction of the H3N2 virus into the U. S. swine population, reassortant events have resulted in the emergence of new genetic clusters of both H1 and H3 viruses.[1-11] Three H1 clusters (reassortant-like, H1N2-like and human-like) have essentially replaced the classic-like H1N1 viruses. Cluster IV viruses have become the predominant H3 genotype. Antigenic diversity among SIV viruses may have implications on efficacy of SIV vaccines containing viruses representing older clusters. Two studies were conducted to evaluate the efficacy of an SIV vaccine against challenge with viruses representing the human-like H1 and Cluster IV H3 clusters.[12]

Materials and Methods

Three-week-old SIV-negative pigs were randomly allocated into treatment groups and vaccinated twice, two-weeks apart, with an inactivated, adjuvanted SIV vaccine or with an adjuvanted placebo (n = 11 to 15 per group). Pigs in Studies 1 and 2, respectively, were inoculated 2-weeks later with a Cluster IV H3N2 virus or a human-like H1N1 virus, administered endotracheally. The challenge viruses were heterologous to the vaccine strains. Clinical observations and nasal swabs for virus isolation were collected prior to challenge and then daily post-challenge. At 5 days post-challenge, pigs were necropsied, lung lesions scored, and bronchial alveolar lavage (BAL) fluids collected for virus isolation. The variables analyzed were macroscopic lung lesions (% involvement) at necropsy, hemagglutination inhibition (HI) antibody titers, virus isolation from nasal swabs and BAL, clinical observations and rectal temperatures (SAS/STAT Version 9.1). The level of significance was set at 0.05%. Stratified mitigated and prevented fractions were also evaluated for lung lesions and virus isolation, respectively. The animal phase of this study was conducted according to the guidelines of Pfizer Animal Health's Institutional Animal Care and Use Committee.

Results

Compared to the placebo controls, the vaccinated pigs responded with significantly higher hemagglutination inhibition (HI) antibody titers to the vaccine and SIV challenge strains. The SIV vaccine helped prevent respiratory disease in pigs challenged with both the Cluster IV H3N2 and the human-like H1N1 viruses. For H3N2, the vaccinated groups had a significant reduction of lung lesions and virus titers in nasal swabs and BAL fluids. For H1N1, the vaccinated groups had a significant reduction in virus titers in nasal swabs and BAL fluids and a significant reduction in rectal temperatures on the first day post-challenge. For both challenges, efficacy was also apparent by mitigation of lung lesions and less virus isolation from nasal swabs and BAL using prevented fraction analysis. Respiratory signs produced by either challenge virus were generally mild and were not sufficient for demonstrating a clinical difference between treatments.

Discussion

These studies demonstrated efficacy of an SIV vaccine against experimental challenge of pigs with two newly emerging SIV genetic clusters: human-like H1N1 and Cluster IV H3N2.

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