RESEARCH REPORT

SWINE HEALTH

Title: Transmission of Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) to Age-Matched Sentinel Pigs **- NPB # 98-15**

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Abstract

Understanding the ecology of porcine reproductive and respiratory syndrome virus (PRRSV), particularly its transmission, is imperative in the development of successful prevention programs. This study was designed to determine, through a systematic approach, how long PRRSV-infected pigs remain contagious to age-matched sentinel pigs. Five pigs (principals) housed in one isolation room were inoculated with PRRSV. Pairs of seronegative sentinel pigs were placed in direct contact with the principal pigs for two-week periods of time with one-week intervals between pairs of sentinel pigs. Sentinel pigs were held for two weeks in an isolation room after removal from the principals' room. Serum was collected from the sentinel pigs at the end of the two weeks in the isolation room and tested for anti-PRRSV antibodies (ELISA) to determine if transmission had occurred between the principal and the sentinel pigs. Eight pairs of sentinel pigs were rotated through the principals' room over a 167 day period. The principal pigs were found to be contagious through day 62 but not after day 69. Future research is needed to determine the effect of different factors such as time since exposure, gender, age of principals, age of sentinels, breed, and strain of virus on transmission. Until the effect of these factors are better understood it is dangerous to assume that the relatively short contagious period found in this study is typical of transmission between similar aged pigs.

Introduction

Porcine reproductive and respiratory syndrome virus (PRRSV) causes a potentially devastating disease in swine herds. Understanding the ecology of PRRSV, particularly its transmission, is imperative in the development of successful prevention programs. This study was designed to determine, through a systematic approach, how long PRRSV infected pigs remain contagious to age-matched sentinel pigs. This information is necessary to understand the dynamics of the spread of PRRSV within a herd.

Research under experimental conditions has documented transmission between pigs in direct contact and allowed some estimation of how long pigs remain infectious. In one such study, a sow infected 99 days earlier transmitted virus to negative finisher pigs (Zimmerman et al., 1992). The use of a convalescent, asymptomatic sow illustrated the potential of "recovered" animals to be the source of infection to naive herds and demonstrated for the first time that PRRSV may persist *in vivo*. In another study, sentinel pigs seroconverted after they were placed in contact with pigs experimentally infected with PRRSV 56 days earlier (Terpstra et al., 1992). However, in this case, transmission to sentinel pigs no longer occurred when they were placed in contact with pigs infected 140 days earlier or 182 days earlier and immunosuppressed with prednisolone-acetate. How long pigs remained contagious was also investigated in a study in which the principal pigs became infected from their experimentally inoculated dams (Albina et al., 1994). The study demonstrated that pigs were still harboring infectious virus 105 days after initial seroconversion. Researchers at South Dakota State University have also reported transmission of PRRSV from pigs infected *in utero* up to 112 days of age (Benfield et al., 1997).

Objectives

Although it is evident from previous studies that PRRSV-infected pigs remain contagious for extended periods of time, important questions remain. The objective of the proposed research was to further characterize the transmission of PRRSV. The specific research questions to be answered were:

1) How long does a group of PRRSV infected pigs remain contagious to age-matched sentinel pigs?
2) Are serologically negative pigs as measured by an ELISA test contagious to age-matched sentinel pigs?
3) If serologically negative pigs are contagious, can PCR analysis of serum be used to demonstrate presence of PRRSV infection.

Procedures

Thirty-five segregated-early-weaned pigs were obtained from a herd known to be free of PRRSV through frequent serological testing. Following weaning at 12-14 days of age, the pigs were placed in isolation rooms until the beginning of the experiment 24 days later. Pigs were randomly assigned to one of two groups: sentinel pigs (n = 30) or principal pigs (n = 5). All sentinel and principal pigs were serologically tested and found negative before the start of the experiment. Pigs in the principal group were given approximately 10^5 $TCID_{50}$ of PRRSV intranasally. The sentinel pigs were divided into 4 groups of 7 or 8 pigs each. Each group of pigs was housed in a separate isolation room.

Six days after inoculation of the five principal pigs, two sentinel pig were randomly selected from one of the sentinel groups. The two selected sentinel pigs were placed in direct contact with the principal pigs. After two weeks of direct contact, the sentinel pigs were removed and placed in a sixth isolation room (seroconversion room). One week after the first sentinel pigs were removed from the principal room, two more sentinel pigs were randomly selected as before and placed in contact with the principals. Two weeks after being placed in the seroconversion room, these sentinel pigs were removed and the room disinfected. This sequence was followed through 8 cycles so that a total of 8 pairs of sentinel pigs were placed in contact with the principals.

Serum samples were collected from the principal pigs when sentinel pigs were introduced into and removed from the principals' room. Serum samples were collected from the pair of selected sentinel pigs just prior to placing in contact with principals, at the time of removal from the principals' room, and two weeks after removal from the principals' room. PRRSV serology using ELISA kits (IDEXX Laboratories, Westbrook, Me) and virus isolation using MARC 145 cells were conducted on all serum samples. Virus isolation was also conducted on tonsil scrapings collected from the principal pigs at the time new sentinel animals were put in contact with them.

Results

Virus isolation results indicated the principal pigs were all viremic on day 6. Virus was not isolated from serum from the principal pigs after day 20. Tonsil scrapings from the 3 of 5 principal pigs were virus isolation positive on day 6 and 3 of 5 were positive on day 28. Tonsil scrapings collected on day 48 were negative. All principal pigs seroconverted before day 20 and remained seropositive for the remainder of the trial.

The first two sentinel pigs were seropositive on day 20, the day they were removed from the principals' room. The two sentinel pigs exposed to the principal pigs on day 27 and removed on day 41 were seronegative on both days 41 and 55. The third sentinel group was exposed on day 48 and removed on day 62. Both pigs were seropositive on days 62 and 76. The third sentinel group was the last one to become infected. The experiment was ended following five more consecutive exposure cycles without evidence of virus transmission.

The results indicate the principal pigs remained contagious through day 62 but did not transmit the virus after day 69. The absence of transmission of virus between the principal pigs and the second sentinel group suggests that the level of virus shed by the principal pigs during that time was less than required for transmission or the contact between principals and sentinels was not intimate enough for transmission to occur. Possible explanations for the successful transmission between the principals and the third sentinel group include a resurgence in the levels of virus shed and more intimate contact through increased fighting.

One of the objectives of the study was to determine if infected pigs that returned to seronegative status were still capable of transmitting PRRSV to age-matched sentinels. The experiment was terminated before the principals had returned to seronegative status. However, the principals remained seropositive for at least 3 months after they were last shown to be contagious to age-matched sentinel pigs.

Future research is needed to determine the effect of different factors such as time since exposure, gender, age of principals, age of sentinels, host genetics, degree of contact, and strain of virus on transmission. Until the effect of these factors are better understood it is dangerous to assume that the relatively short contagious period found in this study is typical of transmission between similarly aged pigs. A second trial is underway using a different virus strain with pigs from a different genetic source to investigate the reproducibility of these results under different conditions.

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