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Analysis of seroconversion to porcine circovirus 2 among veterinarians from the United States and Canada

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Porcine circovirus 2 (PCV 2) was first isolated from lesions of pigs with postweaning multisystemic wasting syndrome in 1997.1,2 Subsequently, this virus has been directly associated with a wide variety of diseases in swine, including respiratory and reproductive disorders.1 Porcine circovirus 2 is genetically and antigenically different from a related, apparently nonpathogenic virus, porcine circovirus 1 (PCV 1), that was first identified as a contaminant in cultures of porcine cells in 1974.4,5 Available data suggest that a high percentage of swine in North America and Europe are seropositive for PCV 2.3,6,7

A previous study8 found antibodies to PCV 1 in serum samples from swine, cattle, mice, and humans. In contrast, other studies9,10 did not find antibodies to PCV 1 in serum samples from a range of domestic animal species or from people in Europe. Similarly, there are conflicting data regarding whether PCV 2 causes infection in species other than swine.11,12 As a further step to improving our understanding of the host range and zoonotic potential of PCV 2, the purpose of the study reported here was to determine prevalence of seropositivity to PCV 2 among individuals with close and prolonged contact with pigs. We elected to test this high-risk population to maximize the potential of detecting seroconversion among clinically normal, apparently immunocompetent, human beings.

Materials and Methods

Blood samples were collected from 50 volunteers attending the 1999 American Association of Swine Practitioners Meeting. All 50 volunteers were veterinarians in swine practice who reported having blood-to-blood contact with swine. Forty-four were from the United States, 5 were from Canada, and 1 was from the Philippines. Mean ± SD age was 51.7 ± 7.5 years (range, 37 to 74 years). Mean ± SD time in practice was 26 ± 8.3 years. Thirty-one (62%) were in private practice, 2 (5%) were in academic practice, and 17 (33%) were in industrial practice.

Blood samples were also collected from 6 academic veterinarians and laboratory workers who had been involved in the first recognition of postweaning multisystemic wasting syndrome and in the first isolation of PCV 2. These individuals had had extensive contact over several years with tissues from pigs with postweaning multisystemic wasting syndrome, with cultures of PCV 2 and PCV 1, or both. Additional blood samples were collected from 33 randomly selected healthy blood donors in Memphis, Tenn. Mean ± SD age was 31.2 ± 8.0 years (range, 18 to 47 years).

All 88 serum samples were tested for antibodies to PCV 1 and PCV 2, using 3 assays to maximize the potential for detection of seropositive samples.13 A competitive ELISA based on competitive binding with a monoclonal antibody that reacts with all isolates of PCV 2 from North America and Europe tested to date, but not with any PCV 1 isolates, was used to test samples for antibodies to PCV 2. The assay was performed as described14; results were considered negative for samples with <30% inhibition. A whole-cell ELISA, using PK15 cells infected with PCV 2, was also used to test samples for antibodies to PCV 1, and a similar whole-cell ELISA, using PK15 cells infected with PCV 1, was used to test samples for antibodies to PCV 1. Assays were performed as described14, using 1:10 and 1:50 dilutions of serum samples and biotinylated protein A as the secondary reagent. Assays were examined visually for PCV-reactive cells, and results were scored...
as negative or positive. Control samples for the whole-cell ELISA consisted of swine serum samples containing high anti-PCV antibody titers and additional swine serum samples that did not contain any detectable anti-PCV antibodies.

**Results**

For all samples, results of the competitive ELISA were negative (percentage inhibition ranged from 0 to 25%). Similarly, results of the whole-cell ELISA for antibodies to PCV 2 and of the whole-cell ELISA for antibodies to PCV 1 were negative.

**Discussion**

Results of the present study are in agreement with results of previous studies in which antibodies to PCV 1 were not found in healthy human beings, and antibodies to PCV 2 were not found in healthy human blood donors in the United Kingdom. However, data from the present study are unique, because they represent results for a population of veterinarians considered to be at high risk for infection. To our knowledge, studies of seropositivity to PCV 1 and PCV 2 in a high-risk population have not been published previously.

In the present study, we used 3 assays to detect reactivity to PCV 1 and PCV 2. This parallel testing approach was used to increase the overall sensitivity of testing. The uniformly negative results, therefore, would seem to have high negative predictive value. Results of the present study, taken together with results of several previous studies involving different human populations, suggest that PCV 2 does not readily infect or cause disease in healthy immunocompetent human beings, even in individuals who have had extensive close contact with infected pigs or pure cultures of PCV 2.

With increasing interest in the use of pigs as donors for tissues for xenotransplantation, there has been a growing concern about the zoonotic potential of various viruses that infect swine. Much of this concern has been focused on the endogenous swine retroviruses, which have been shown to infect human cells in vitro. However, other apparently ubiquitous agents such as PCV 1, PCV 2, and porcine hepatitis E virus are also a concern, especially because PCV 2 has been directly associated with multisystemic disease in swine involving organs that could be used for xenotransplantation, including liver, kidney, lung, and heart.

Although antibodies to PCV 2 were not detected in this high-risk population of veterinarians and laboratory workers, the possibility that the virus could infect and cause disease in immunocompromised individuals such as transplant patients cannot be excluded. The availability of a recently developed specific assay for PCV 2 will allow further studies on the zoonotic potential of this agent in a wider variety of human populations.

**References**


