Summary of: Susceptibility of domestic swine to experimental infection with severe acute respiratory syndrome coronavirus 2

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Sever acute respiratory syndrome coronavirus 2 (SARS-CoV-2) causes coronavirus disease (COVID-19) in humans and has been shown to infect several species. While thought to have originated in bats, the origin of SARS-CoV-2 is still under intense investigation. Reports continue to identify the virus ability to infect other species. Detection of natural infections sheds light on knowledge gaps in SARS-CoV-2 transmission and raises concerns of amplifying or reservoir hosts. In turn, clarification of wild and domestic animal susceptibility can help us assess their potential roles and risks for transmission to prevent future disease spread.

Angiotensin-converting enzyme 2 (ACE2) has been identified as the receptor for SARS-CoV-2 in human cells. A BLAST query of the protein database by using translated nucleotide (BLASTx) from the human ACE2 coding sequence predicts 98% coverage and 81% coverage identity for the homologous receptor in swine. Using the same search, mink show 82% similar identity and domestic felines show 85% similar identity to human ACE2 for their cognate receptors. Moreover, mink and cats have both been reported to be susceptible to SARS-CoV-2 and have shown transmission to other animals. A case of anthropomorphic transmission to farmed mink and subsequent zoonotic transmission to people has been documented. Domestic swine, one of the most highly produced agricultural species, previously have impacted public health and can serve as a source for zoonotic disease. Therefore, the potential role of pigs in the spread of SARS-CoV-2 should be investigated.

Nineteen 8-week-old American Yorkshire crossbred pigs were locally obtained from a high health status farm in order to better determine the risk to farmed pigs in Canada. The pigs were oronasally challenged with SARS-CoV-2 via 1 mL per nostril and 1 mL in the distal pharynx. The pigs were divided into two, separately housed groups 1 naive pig was introduced to each group on day 10 post challenge. Physical examination of each pig and sample collection were performed at the time of inoculation (day 0) and every other day beginning at 3 days postinoculation (dpi). Samples collected were rectal, oral, and nasal swabs, blood, and nasal wash. Necropsies and post mortem sampling began 3 days dpi. Group oral fluids from rope chews were collected daily.

The study found that domestic swine are susceptible to low levels of SARS-CoV-2 viral infection. Among 16 experimentally inoculated animals, 5 (31.3%) displayed some level of exposure or elicited an immune response to the virus. Only 1 pig in our study retained live virus, but 2 other animals had detectible RNA measured in nasal wash, and 2 developed antibodies. One pig displayed mild, nonspecific clinical signs, including coughing and depression. Then, over the 9 days between cessation of clinical signs and postmortem evaluation, it was found to have maintained the virus in the submandibular lymph node, but virus was undetected in other tissues from this animal. Multiple pigs demonstrated mild ocular and nasal discharge that appeared during the immediate postinfection period. Among the 5 animals with potential infection, only low levels of viral RNA were detected. No live viral shedding was identified.

The results of this study contradict previous reports indicating swine are not susceptible to SARS-CoV-2 infection. Previous studies did not detect RNA in swabs or organ samples, and no seroconversion was measured. Infectious dose, viral isolate, age, and breed or colony of swine could affect study outcomes. Of note, a 10-fold higher viral dose for experimental infection than was used in previous studies. Pigs were specifically obtained from a high health farm in Manitoba rather than a specific pathogen-free colony in order to determine the risk to farmed pigs in Canada.

Altogether, these findings indicate that further investigations into the susceptibility of additional domestic livestock species should be conducted to assess their risk for infection and zoonoses.

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