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CORONAVIRUS DISEASE 2019 UPDATE (551): ANIMAL, PIG, RESEARCH, EXPERIMENTAL INFECTION
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In a study in Emerging Infectious Diseases late last week, Canadian and US researchers found that pigs are susceptible to SARS-CoV-2, the virus that causes COVID-19, highlighting the need for additional livestock assessment to determine the potential role of domestic animals in the pandemic.

Previous studies indicated that swine are not susceptible to SARS-CoV-2 infection, but they did not measure seroconversion (antibody production), the authors note.

They inoculated 19 eight-week-old pigs (6 castrated males and 13 females) with an oronasal solution containing the SARS-CoV-2 virus, using a 10-fold higher infectious dose than that used in previous studies.

The researchers performed physical examinations and collected blood, rectal, oral, and nasal samples at the time of inoculation and every other day from day 3 until day 15. They evaluated samples for viral RNA using reverse-transcription polymerase chain reaction (RT-PCR) testing and tested blood serum for neutralizing antibodies. Necropsies and post-mortem sampling started at day 3 after inoculation and continued until day 29.

Starting at day 1, all of the pigs developed mild ocular discharge -- accompanied by nasal secretion in some of the animals -- which continued through day 3. Animal temperatures remained normal throughout the study, and none of the animals developed clinically observable respiratory distress, but one pig developed a mild cough lasting through day 4.

Among the 16 inoculated animals, 31.3% (5) displayed some level of exposure or an immune response to the virus. Only one pig -- the animal that developed a mild cough -- retained live virus, detected in a post-mortem sample of a lymph node. Two other animals had detectible RNA in a nasal wash sample, and 2 additional pigs had antibodies in blood serum. Among the 5 animals with potential infection, only low levels of viral RNA were detected, and no live viral shedding was identified.

Two control pigs were introduced to the infected pigs at day 10 to evaluate potential animal-to-animal transmission, but no viral infection occurred.

The authors conclude, "To date no SARS-CoV-2 cases among domestic livestock have been documented by natural infection; however, the results of this study support further investigations into the role that animals might play in the maintenance and spread of SARS-CoV-2."

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[The citation for the above reviewed paper is Pickering BS, Smith G, Pinette MM, et al. Susceptibility of domestic swine to experimental infection with severe acute respiratory syndrome coronavirus 2. Emerg Infect Dis. 2021; 27(1): 104-12. https://dx.doi.org/10.3201/eid2701.203399

Its abstract follows:

"Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the agent that causes coronavirus disease, has been shown to infect several species. The role of domestic livestock and associated risks for humans in close contact with food production animals remains unknown for many species. Determining the susceptibility of pigs to SARS-CoV-2 is critical to a One Health approach to manage potential risk for zoonotic transmission. We found that pigs are susceptible to SARS-CoV-2 after oronasal inoculation. Among 16 animals, we detected viral RNA in group oral fluids and in nasal wash from 2 pigs, but live virus was isolated from only one pig. Antibodies also were detected in only 2 animals at 11 and 13 days postinoculation but were detected in oral fluid samples at 6 days postinoculation, indicating antibody secretion. These data highlight the need for additional livestock assessment to determine the potential role of domestic animals in the SARS-CoV-2 pandemic."

The described experimental infection of domestic pigs was carried out in a BSL-3 facility in Winnipeg, Canada, involving 19 pigs (8-week-old American Yorkshire crossbred pigs, 6 castrated males and 13 females) locally sourced from a high health status farm in Manitoba. Sixteen of them, kept in 2 cubicles in the high safety facility, were oronasally challenged; to each group, a naive pig was introduced as in-room transmission control. The remaining uninoculated pig served as a farm control providing negative control tissues.

This trial had been preceded by 2 pig experimental infection trials performed and published earlier in 2020, one in Harbin, China (Ref 1) and the other one in Riems, Germany (Ref 2).

The trial in Harbin (State Key Laboratory of Veterinary Biotechnology, Harbin Veterinary Research Institute, Chinese Academy of Agricultural Sciences) involved 8 pigs (male/female mixed 40-day-old specific pathogen-free [SPF] Landrace and Large White pigs) of which 5 were intranasally inoculated and 3 housed in the same room to monitor the transmission of the virus.

The trial in Riems (Friedrich-Loeffler-Institut [FLI], Germany) involved 12 male pigs (German landrace breed, aged 9 weeks, raised by a commercial breeding farm with a high veterinary hygiene standard) of which 9 were infected intranasally and 3 naive pigs served as contacts, added to the infected animals 24 hours after infection.

The 2 earlier trials did not reveal infections in the challenged pigs or in their contacts. This is attributed by the authors of the current trial as possibly reflecting differences in infectious dose (which was 10-fold in the Winnipeg trial), the viral isolate, as well as the age, breed or colony of the experimental animals; each could have affected the study outcomes.

Genetic differences between infected/exposed animals deserve to be visited. This aspect deserves attention in minks as well.

Additional studies in pigs are warranted - Mod.AS

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2. Schlottau K, Rissmann M, Graaf A, et al. SARS-CoV-2 in fruit bats, ferrets, pigs, and chickens: an experimental transmission study. Lancet Microbe. 2020; 1: e218-25. https://doi.org/10.1016/S2666-5247(20)30089-6]

See Also

COVID-19 update (549): animal, mink, Denmark, erad. Russia, vaccine, China, RFI 20201222.8039549
COVID-19 update (530): animal, mink, research, experimental infection, vaccine 20201210.8009205
COVID-19 update (450): animal, cattle, research, experimental infection 20201022.7883213
COVID-19 update (448): animal, raccoon dog, research, experimental infection 20201022.7880283
COVID-19 update (345): animal, cat, research, experimental infection 20200805.7648370
COVID-19 update (227): animal, cat, dog, research, experimental infection 20200601.7416648
COVID-19 update (183): Japan/USA, animal, research, cat, experimental infection 20200514.7337185
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