



Published Date: 2022-01-30 04:27:25 CET

Subject: PRO/AH/EDR> COVID-19 update (36): animal, human, China (Hong Kong), hamster, foreign origin

Archive Number: 20220130.8701158

CORONAVIRUS DISEASE 2019 UPDATE (36): ANIMAL, HUMAN, CHINA (HONG KONG), HAMSTER, FOREIGN ORIGIN

A ProMED-mail post

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Date: Sat 29 Jan 2022

Source: Preprints with the Lancet, SSRN [abridged, edited]

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4017393

Citation: Yen Hui-Ling, Sit THC, Brackman CJ, et al. Transmission of SARS-CoV-2 (Variant Delta) from Pet Hamsters to Humans and Onward Human Propagation of the Adapted Strain: A Case Study. Available at SSRN: <https://ssrn.com/abstract=4017393>

Abstract

Background

Transmission of SARS-CoV-2 from humans to other mammals, including pet animals, has been reported. However, with the exception of farmed mink, there is no previous documentation that these infected animals can infect humans, nor of further onward spread among humans. Following a confirmed SARS-CoV-2 infection of a pet store worker, animals in the store and the warehouse supplying it were tested for evidence of SARS-CoV-2 infection.

Methods

Viral swabs and blood samples from pet animals were collected in a pet shop and the warehouse supplying it and tested by SARS-CoV-2 RT-PCR and serological assays, respectively. SARS-CoV-2 RT-PCR positive samples were studied by full genome sequencing analysis.

Findings

Over 50% of individually tested Syrian hamsters in the pet shop (8/16) and warehouse (7/12) were positive for SARS-CoV-2 infection in RT-PCR or serological tests. None of dwarf hamsters (n = 77), rabbits (n = 246), Guinea pigs (n = 66), chinchilla (n = 116) and mice (n = 2) were confirmed positive in RT-PCR tests. SARS-CoV-2 viral genomes deduced from human and hamster cases in this incident all belong to delta variant of concern (AY.127) that had not been circulating locally prior. These sequences are highly similar, but distinct. The viral genomes obtained from hamsters are phylogenetically related with some sequence heterogeneity and phylogenetic dating suggest infection in these hamsters occurred around 21 Nov 2021. Two separate transmission events to humans are documented, one leading to onward household spread.

Interpretation

Pet hamsters can be naturally infected in "real-life" settings. The virus can circulate within hamsters and lead to human infections. Both genetic and epidemiological results strongly suggest that there were 2 independent hamster-to-human transmission and that such events can lead to onward human transmission. Importation of infected hamsters was the most likely source of virus infection.

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Communicated by:

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[The following 6 edited excerpts from the paper include selected facts and findings which had not been available in earlier reports.

"1. The hamsters at the affected warehouse were imported from Netherlands to Hong Kong in 2 different batches (arrival dates: 22 Dec 2021 and 7 Jan 2022. The consignment that arrived on 22 Dec 2021 was transported by Qatar Airways and transited in Doha, Qatar, involving change of aircraft, the transit time was around 15 hours. Water was topped up but no food was provided. This consignment had 96 rabbits, 990 *Phodopus sungorus* (white dwarf hamster) and 90 *Phodopus roborovskii* (roborovski dwarf hamster). The consignment that arrived on 7 Jan 2022 was transported by KLM which stopped over in Bangkok but without change of aircraft. The cargo hold was opened for off-loading the cargo designated for Bangkok but the animals did not leave the aircraft. No additional water or food was provided. The transport cages had a mesh covering, so contamination during transit cannot be excluded. This consignment had 116 rabbits, 720 *P. sungorus* (white dwarf hamster), 118 *Mesocricetus auratus* (Syrian hamster), 25 Guinea pigs and 30 chinchillas.

2. The hamsters were initially kept in the warehouse on arrival and smaller consignments delivered to the retail shops. The warehouse did not operate on an all-in, all-out basis. Some hamsters arriving on 7 Jan 2022 consignment were transferred to pet shop A on the day of arrival.

3. Chronology of outbreak investigation

22 Dec 2021: Arrival of pet animals at warehouse, with no Syrian hamster in this shipment

4 Jan 2022: Patient 2 (Mother) and Patient 4 (Daughter) visited pet shop A.

7 Jan 2022: Arrival of 1009 pet animals at warehouse, with 118 Syrian hamsters in this shipment. Some of these imported Syrian hamsters in the warehouse were transferred to different pet shops belonging to the same retail chain.

8 Jan 2022: Patient 2 (Mother) and Patient 4 (Daughter) visited pet shop A.

11 Jan 2022: Patient 1 (Pet shop A worker) experienced 1st symptoms.

12 Jan 2022: Patient 2 experienced first symptoms.

15 Jan 2022: Patient 1 tested RT-PCR positive for COVID-19.

16 Jan 2022: Patient 1 formally registered as a positive case by a 2nd confirmatory RT-PCR test.

17 Jan 2022: Patient 2 tested RT-PCR positive for COVID-19. Patient 3 (Father) experienced 1st symptoms. Screening investigation at the pet shop A.

18 Jan 2022: Patient 2 formally registered as a positive case by a 2nd confirmatory RT-PCR test. Patient 3 tested RT-PCR positive for COVID-19.

Screening investigation at the warehouse. Follow-up investigation at pet shop A.

19 Jan 2022: Patient 3 formally registered as a positive case by a 2nd confirmatory RT-PCR test. Patients 4 (daughter) and 5 (Son) remained asymptomatic, but tested RT-PCR positive for COVID-19. Follow-up investigation at the warehouse. Screening investigations at pet shops B to F. Hong Kong government ordered mass recall and culling of hamsters.

20 Jan 2022: Pet shop C with 2 hamsters tested positive for COVID-19.

21 Jan 2022: Patients 4 and 5 formally registered as positive cases by a 2nd confirmatory PCR test.

All 5 patients had previously been vaccinated twice (dates and vaccine details, included in the paper).

4. Remarks addressing the sequencing results of human patients.

The deduced sequences from the human and hamster cases are highly similar, but not identical. Viral genomes from patient samples differ from those from hamsters by 1 to 13 nucleotides. The divergent date of this cluster of human and hamster viruses is estimated to be on 21 Nov 2021. The virus from Patient 1 differs from that in Patients 2 and 3 by 5 nucleotides. However, some virus sequences from hamsters in pet shop A only differ by 1 nucleotide with those of Patient 1. Patients 2 and 3 have viruses with genetic sequence closer (3 nucleotide difference) to hamster sample 7 in pet shop A. These results highly suggest that Patient 1 and Patient 2 independently acquired the infection from hamsters at the pet shop rather than having been infected by each other. As Patient 3 did not visit the pet shop, these findings further suggest that the SARS-CoV-2 virus circulating in hamsters allowed at least 1 human-to-human transmission.

5. Remarks addressing the sequencing results of hamsters.

The virus sequences in hamsters are genetically closely related to recent AY.127 viruses detected in multiple European countries. By contrast, none of the AY.127 sequences previously detected from returning travelers in Hong Kong is genetically similar to the sequences detected in this outbreak. This further supports the hypothesis that this outbreak was caused by a recent introduction of AY.127 virus from Europe. Using some recent and genetically closely related European AY.127 viral sequences from humans as references, there are 4 unique non-silent mutations that can be reproducibly found in both studied human and hamster cases.

6. Summary of the discussion:

In summary, we provide convincing evidence of pet hamsters naturally acquiring SARS-CoV-2 variant delta and being the source of human infection. We also provide evidence suggesting the possibility of international movement of SARS-CoV-2 infection via the pet trade. The relatively low level of SARS-CoV-2 transmission in the period of this outbreak and the "One Health" approach to outbreak investigations likely allowed the detection and investigation of this outbreak. Similar events may be occurring, unsuspected, in many other parts of the world. These findings highlight that SARS-CoV-2 may be spilling over to other animal species unsuspected and providing a secondary reservoir for the virus for further adaptation and zoonotic spillover back to humans.

The findings highlight the need for awareness, surveillance and for appropriate quarantine and control policies for the pet animal trade."

The following note was included in the above SSRN preprint with the Lancet:

"Preprints with The Lancet is part of SSRN's First Look, a place where journals identify content of interest prior to publication. Authors have opted in at submission to The Lancet family of journals to post their preprints on Preprints with The Lancet. The usual SSRN checks and a Lancet-specific check for appropriateness and transparency have been applied. Preprints available here are not Lancet publications or necessarily under review with a Lancet journal. These preprints are early stage research papers that have not been peer-reviewed. The findings should not be used for clinical or public health decision making and should not be presented to a lay audience without highlighting that they are preliminary and have not been peer-reviewed".

The preprint includes 4 tables and a figure (dendrogram).

The regulation, including certification procedures of international trade in pet animals deserve being addressed by the relevant international institutions. - Mod.AS

ProMED map:

Hong Kong: <https://promedmail.org/promed-post?place=8701158,198>]

See Also

COVID-19 update (31): animal, human, China (Hong Kong) hamster, origin discussed 20220126.8701086

COVID-19 update (26): animal, China (Hong Kong) hamster, OIE 20220122.8701017

COVID-19 update (23): China (Hong Kong) animal, hamster, public health hazard 20220119.8700956

COVID-19 update (19): animal, Slovenia (LJ) pet ferret, OIE 20220117.8700917
2021

COVID-19 update (413): animal, Canada, wild deer 20211202.8700020

COVID-19 update (373): animal, USA, wild deer, transmission 20211102.8699412

COVID-19 update (276): animal, Poland, mink, research 20210811.8587558

COVID-19 update (260): animal, USA, wild deer, exposure, RFI 20210729.8554149

COVID-19 update (170): candidate animal models, potential hosts, research 20210515.8362876

COVID-19 update (530): animal, mink, research, experimental infection, vaccine 20201210.8009205

COVID-19 update (448): animal, raccoon dog, research, experimental infection 20201022.7880283

COVID-19 update (71): animal, mink, WHO/FAO/OIE risk assessment 20210218.8200008

2020

02.02.22, 11:37Promed Post - ProMED-mail

COVID-19 update (520): Denmark, Netherlands, mink, human-animal interface, WHO 20201204.7994061
COVID-19 update (516): China (Hong Kong) animal, dog, Lithuania, mink, OIE 20201203.7986508
COVID-19 update (387): Netherlands, mink, animal & public health, research 20200902.7740793
COVID-19 update (374): animal, ferret, research, epidemiology 20200825.7715862
COVID-19 update (330): China (Hong Kong) animal, cat, OIE 20200724.7609215
COVID-19 update (280): animal, pangolin, research 20200623.7502805
COVID-19 update (189): Netherlands (NB) animal, farmed mink, research, cat, dog 20200517.7344274
COVID-19 update (183): Japan/USA, animal, research, cat, experimental infection 20200514.7337185
COVID-19 update (166): China (Hong Kong) animal, cat, OIE, resolved 20200508.7314521
COVID-19 update (154): Netherlands (NB) animal, farmed mink, research 20200503.7294846
COVID-19 update (88): Germany, animal, research, pig, chicken, bat, ferret 20200407.7196506
COVID-19 update (75): China (Hong Kong) animal cat, OIE 20200403.7179945
COVID-19 update (70): China (Hong Kong) animal, cat, pets & stock 20200402.7173286
COVID-19 update (57): animal China (Hong Kong) dog, OIE 20210210.8182259
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