

Omicron breakthrough infections in previously infected or vaccinated hamsters

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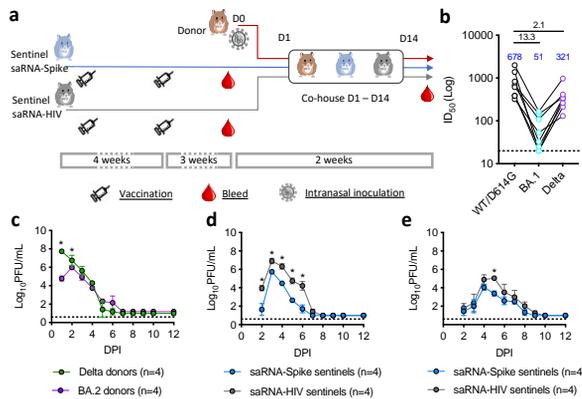
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Introduction

The second and third years of the SARS-CoV-2 pandemic have been marked by the repeated emergence and replacement of 'variants' with genetic and phenotypic distance from the ancestral strains, the most recent examples being Delta and Omicron. Here we describe a hamster contact exposure challenge model to assess protection conferred by vaccination or prior infection against re-infection.

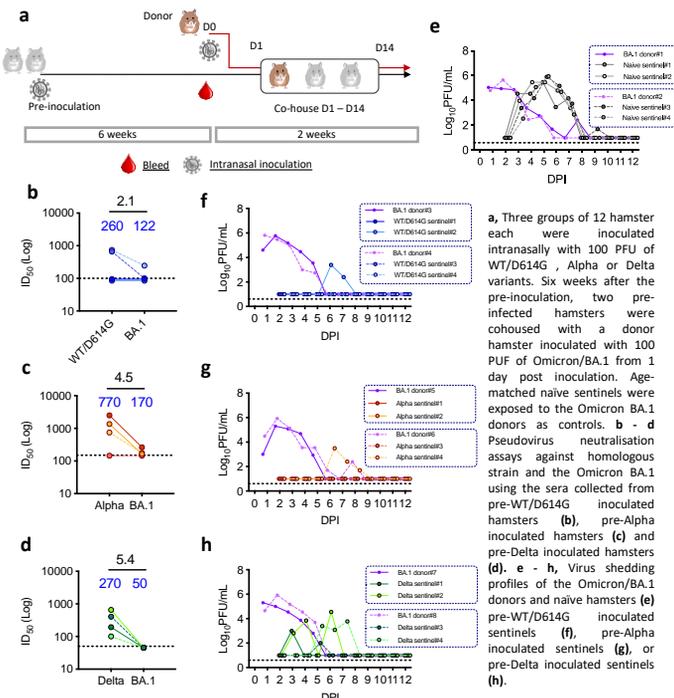
Results

Omicron/BA.1 variant is efficiently transmitted to hamsters vaccinated with a Wuhan-hu-1 Spike saRNA vaccine.



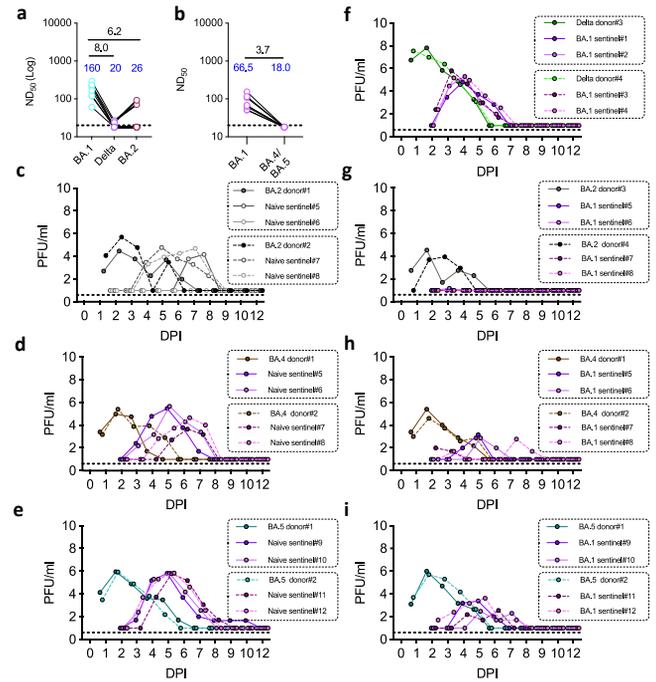
a, Two groups of 16 hamster each were vaccinated with the self-amplified RNA(saRNA) Spike (n=8) or the saRNA-HIV vaccine (n=8). Three weeks after the second dose vaccine, these sentinels were co-housed with the donor hamsters which were inoculated intranasally with 100 PFU Delta or the Omicron BA.1 variant from 1 day post inoculation. b, Pseudovirus neutralisation assays using sentinel hamster sera collected two weeks after the second vaccinations. Geometric means are shown above the symbols. c-e, Virus shedding in nasal wash samples of the donor hamsters (c), the saRNA sentinels exposed to Delta donors (d), and the saRNA sentinels exposed to the BA.1 donors (e).

Reinfection of hamsters infected with earlier VOCs following exposure to Omicron/BA.1.



a, Three groups of 12 hamster each were inoculated intranasally with 100 PFU of WT/D614G, Alpha or Delta variants. Six weeks after the pre-inoculation, two pre-infected hamsters were cohoused with a donor hamster inoculated with 100 PFU of Omicron/BA.1 from 1 day post inoculation. Age-matched naive sentinels were exposed to the Omicron BA.1 donors as controls. b - d Pseudovirus neutralisation assays against homologous strain and the Omicron BA.1 using the sera collected from pre-WT/D614G inoculated hamsters (b), pre-Alpha inoculated hamsters (c) and pre-Delta inoculated hamsters (d). e - h, Virus shedding profiles of the Omicron/BA.1 donors and naive hamsters (e) pre-WT/D614G inoculated sentinels (f), pre-Alpha inoculated sentinels (g), or pre-Delta inoculated sentinels (h).

Reinfection of hamsters previously infected by BA.1 with Delta, BA.4 and BA.5 but not BA.2

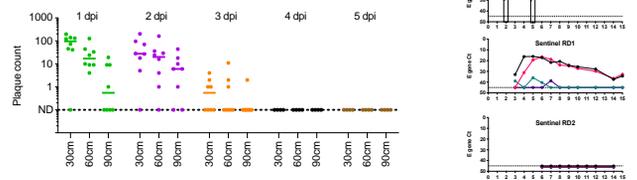


Hamster were inoculated intranasally with 100 PFU of the BA.1 variant. Six weeks after the pre-inoculation, two pre-inoculated hamsters were cohoused with a donor hamster inoculated with 100 PUF of the Delta, BA.2, BA.4 or BA.5 from 1dpi. Age-matched naive sentinels were exposed to donors as controls. a, b Pseudovirus neutralisation assays against Delta and Omicron variants using the sera collected from pre-BA.1 infected hamsters c - e, virus shedding in nasal wash samples of the naive sentinels exposed to the BA.2 (c), BA.4 (d) or BA.5 (e) donors. f - i, Virus shedding profile of the pre-BA.1 infected sentinels exposed to the delta (f), BA.2 (g), BA.4 (h) and BA.5 (i) donors.

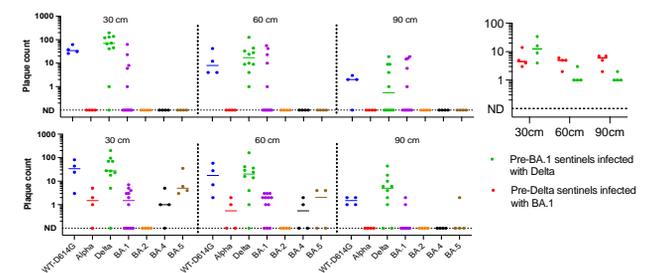
Assessing infectious virus exhaled from (re-)infected hamsters.



IVT measures temporally correlate with RD transmission



Infectious virus emitted into the air from hamsters infected/re-infected with SARS-CoV-2 VOCs.



Conclusion

Hamsters are a useful small animal model for the evaluation of vaccines, and studies on SARS-CoV-2 transmission, re-infection and pathogenicity.