

Contact Infection of Mink with Influenza A Viruses of Avian and Mammalian Origin

Brief Report

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Summary

Avian influenza A virus Hav7N2 was transmitted to mink by contact. Other avian influenza A viruses, Hav4Nav1 and Hav6Nav5, were not transmitted, and human, swine and equine influenza A viruses were transmitted to mink by a similar contact.

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Recently, attention has been focused on avian influenza viruses which have been considered to be the origin of a 'New' pandemic influenza virus (8, 9). Mammalian infection due to avian influenza viruses by intranasal inoculation has been reported in mink (*Mustela vison*) (5); therefore, it is possible that mink and related species of mammals play a role in the epidemiology of human influenza. However, contact infection with influenza viruses was experimentally evidenced in mink only with H3N2 (5). In the present study, avian as well as mammalian influenza A viruses were examined whether they could be transmitted to mink by contact.

The viruses used were A/duck/Hokkaido/5/77 (Hav7N2) (2), A/budgerigar/Hokkaido/1/77 (Hav4Nav1) (4), A/dunling/Hokkaido/1015/79 (Hav6Nav5) (Submitted for publication), A/Hokkaido/3/78 (H1N1) (Unpublished data), A/New Jersey/8/76 (Hsw1N1) and A/equine/Miami/63 (Heq2Neq2). These viruses were propagated in the allantoic cavity of 11-day-old embryonated chicken eggs for 3 days at 35° C. Allantoic fluids which were harvested and stored at -80° C were used as inocula. The inocula had 10^{8.0} EID₅₀ per 0.5 ml.

Female Sapphire mink, 4- to 9-months-old and weighing 600 to 900 g, were used. Before inoculation, the sera were tested for antibodies to the 6 influenza viruses used; no antibodies were detected. Skin temperature was taken twice daily

by electrothermometer. The mink were housed individually in separate cages before contact. Experimental contact infections were carried out as described previously (5); the mink were anaesthetized with ether and received 0.25 ml of the inoculum in each nostril by means of a metallic catheter inserted about 1.0 cm into the nostrils. Each uninfected mink was paired in the same cage with a mink which had been inoculated intranasally with each virus 24 hours before contact.

Nasal swabs were taken daily until 14 days after contact and dropped into 1 ml broth, pH 7.4, containing antibiotics. After mixing, 0.2 ml of the broth was inoculated into the allantoic cavity of 2 11-day-old embryonated eggs. The recovered viruses were identified by the hemagglutination inhibition (HI) test, which was done by micromethods (7).

Avian influenza A virus Hav7N2 was recovered from 3 (Nos. 14, 16 and 18) of the 4 contact mink (Table 1). The virus recovery from the nasal swabs of the contact mink was positive 2—9 days after contact. Antibody response was positive in these mink at the second week after contact; the maximum HI titers until the third week after contact was 1:64. The remaining mink (No. 20) was not infected. Other avian influenza A viruses, Hav4Nav1 and Hav6Nav5, were not transmitted to mink by contact.

Mammalian influenza A viruses were recovered from contact mink without exception. The virus recovery from the nasal swabs of the contact mink was positive 1—9 days (H1N1), 2—10 days (Hsw1N1) and 2—11 days (Heq2Neq2) after contact. Antibody response against these viruses was positive at the second week; the maximum HI titers until the third week were 1:256 (H1N1 and Hsw1N1) and 1:64 (Heq2Neq2). Clinical signs such as sneezing and nasal discharge were seen only in the mink infected by contact with H1N1 and Hsw1N1 from the second to third days after contact.

Table 1. *Virus recovery and antibody response in contact mink*

Virus	Mink No.	Virus recovery (Days after contact with each donor)	Antibody response
Hav7N2	14	5—9	+ (64) ^a
	16	5—7	+ (64)
	18	2, 4—6, 8	+ (64)
	20	No virus recovered	—
Hav4Nav1	22	No virus recovered	—
	24	No virus recovered	—
	26	No virus recovered	—
Hav6Nav5	28	No virus recovered	—
	30	No virus recovered	—
H1N1	2	3, 5—9	+ (128)
	4	1—9	+ (256)
Hsw1N1	6	2, 3, 6—8	+ (256)
	8	3—10	+ (256)
Heq2Neq2	10	2—4, 4—6	+ (64)
	12	3, 5—11	+ (64)

^a Maximum HI titer until the third week after contact

In all the mink which were intranasally inoculated with the avian and mammalian influenza A viruses, virus recovery was positive from nasal swabs of the inoculated mink 3—11 days after inoculation.

We considered that contact infection resembles the natural transmission of influenza viruses more than any other infection route. This study showed that avian influenza virus Hav7N2 was transmitted to mink by contact; this result may be the first evidence of contact infection of an avian influenza virus in mammals.

Of the three avian origin viruses, Hav7N2, Hav4Nav1, and Hav6Nav5, only Hav7N2 was transmitted to the mink by contact. Mammalian influenza viruses H3N2 (5), Heq2Neq2, H1N1, and Hsw1N1 were transmitted to mink by contact. The subtype of the hemagglutinin Hav7 was antigenically similar to H3 of the Hong Kong virus (3). Recently, Hav7 was grouped into a new H3 group together with H3 and Heq2 (1, 6). It is interesting that only the avian virus possessing Hav7 could infect the mink by contact.

Although natural infection of mammals by avian influenza viruses has not been proved by virus isolation, the present experiment may suggest that Hav7 (or H3) may be circulated easily between mammals and birds.

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