Equine influenza at the human animal interface

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Interspecies transmission of H3N8 equine viruses

- Dogs – racing greyhounds in Florida
  >95% sequence homology with recent equine viruses
- Now endemic, epidemiologically independent of equine influenza and diverging in the USA.
- Pigs – 2004-2006 surveillance in China
Historical Thoughts

- Anecdotal reports – hearsay and speculation, prior to virology
- 1299, 1328 (Yemen), 1404 (European),
- 1648-1916 documentation of close temporal-geographical association between equine and human influenza like disease – 67/112 years in Europe and 21/56 years in America
- Typical pattern- equine influenza 3wks before human
- 1872  equine panzootic – “epizooty”
19th-century urban horse hotel for workhorses in city
Experimental Infection

Human volunteers inoculated i/n with A/eq/ Miami/63 (H3N8)
Virus shedding in all volunteers
14/15 seroconverted

<table>
<thead>
<tr>
<th>No. of men</th>
<th>Type of illness</th>
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<tbody>
<tr>
<td>8/15</td>
<td>Febrile upper respiratory and systemic</td>
</tr>
<tr>
<td>2/15</td>
<td>Febrile upper and lower respiratory and systemic</td>
</tr>
<tr>
<td>3/15</td>
<td>Afebrile upper respiratory</td>
</tr>
<tr>
<td>2/15</td>
<td>None</td>
</tr>
</tbody>
</table>

## Experimental Infection

Ponies inoculated i/n with A2/Hong Kong/68 (H3N2)

<table>
<thead>
<tr>
<th>No. of ponies</th>
<th>Response to human influenza</th>
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</thead>
<tbody>
<tr>
<td>6/10</td>
<td>Febrile (1-3days)</td>
</tr>
<tr>
<td>9/10</td>
<td>Virus shedding (1-5days)</td>
</tr>
<tr>
<td>4/10</td>
<td>Antibody response</td>
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H3g1 – mainly avian, human and swine H3N2
H3g2 – equine and canine H3N8
Human H3 calculated to have originated approx 1965 (avian)
Equine H3 calculated to have originated 1952 (avian)
Receptor Specificity

• Correlation between receptor binding characteristics and host-range of equine influenza viruses

• N-glycol sialic acid $\alpha 2$-$3$ galactose in equine trachea

• N-acetyl sialic acid $\alpha 2$-$6$ galactose in human
  Canine – primarily SA $\alpha 2$-$3$ galactose (some $\alpha 2$-$6$)
Interspecies transmission

- Broad pathogenic potential of the H3 HA (Man, swine, horses, canine, bat, mink, cattle, bear, deer etc.)
- Primarily during pandemics/panzootics
- Level of exposure – husbandry, contact
Sha Tin Racecourse

- Multi-storey stables
- 1200 horses, 450 attendants
- Filtered fresh air cycles
- Computer monitoring of humidity and temperature
Interspecies transmission during disease epidemics/pandemics

Australia 2007

- >76 thousand horses affected in 4 months
- One racecourse > 700 horses in 5 days
- New infected premises 249 per day in NSW
- > 10,500 properties
- Evidence of infection of dogs
Serological surveys

- Heterologous serum antibody response to human influenza viruses occur in naturally infected horses
- HI difficult to interpret
- NA insensitive
- Need sensitive and specific assays
Detection by RT-PCR

• Matrix primers - Type A influenzas
• Investigation of clinical cases
• Targeted surveillance in contact species
Conclusions

• No evidence that horses are reservoirs of virus for humans.
• Potential for such transmission is demonstrable
• Surveillance necessary to determine if exchange of viruses between horses and people occasionally occurs.
• Need improved serological tools
• Target cross-species surveillance by RT-PCR
• Considerable contact between both species.
• International air travel could facilitate virus spread.
Thank you

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