Are Dromedary Camels Susceptible or Non-Susceptible to Foot-and-Mouth Disease Serotype O

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FMD
WIDE HOST RANGE
Cattle, sheep, goats and pigs
African & water buffalo
Kudu, impala, warthog, deer
Some other animals, including camels, may possibly be infected
Man extremely seldom, mild and transient
Are Dromedary Camels Susceptible or Non-Susceptible to Foot-and-Mouth Disease Serotype O

Experiment 1

- Virus: FMDV O UAE 542-99 (WRLO UAE 7/99) isolated in Dubai from minor epithelial lesions from Arabian gazelles. Used as 5th BHK passage
- Animals: 2 dromedary camels and 2 heifers inoculated subepidermally with $10^{7.6}$ TCID$_{50}$
- Results:
  - Heifers: Clinical disease (relatively mild), viraemia and virus detected in swabs and probangs and development of antibodies
  - Camels: NO clinical disease, NO viraemia, NO virus detected in swabs and probangs and NO development of antibodies
- Conclusion: no signs of infection in dromedary camels with this inoculum

Camel Experiment 2
Experiment 2

- **Virus**: FMDV O UAE 542-99 (WRL 7/99) as in experiment 1, but prepared from secondary vesicular epithelium from a heifer in experiment 1, i.e. used as 1st cattle passage
- **Animals**: 5 dromedary camels (3 naive and 2 from experiment 1) inoculated subepidermo-lingually with $10^7.8$ TCID$_{50}$. 5 naive dromedary camels as direct contacts and 4 sheep as contacts. Also had 2 sheep kept separately and inoculated in the coronary band as "positive controls".
- **Results**: "Positive control sheep": Clinical disease (relatively mild), viraemia and development of antibodies. Typical for FMD in sheep. Contact Camels and contact sheep: NO clinical disease, NO viraemia, and NO development of antibodies. Inoculated camels: NO clinical disease, but 1/3 naive camels had a one day increase in temperature and developed a viraemia and subsequently antibodies to FMDV. The 2 previously exposed camels from Exp. 1 developed antibodies to FMDV
- **Conclusion**: 1 out of 3 inoculated naive camels developed a viraemia but did not transmit infection to contact camels or sheep

Experiment 2 - continued

- **Sequencing of virus**: Sequenced nearly the complete genome (the L-fragment) of FMDV from the serum of camel 34 at pid 3 (after a single passage in bovine thyroid cells), the inoculum from the heifer and the original 5th BHK inoculum. The virus from the camel is identical to the input virus from the heifer. Interestingly, this virus (from the heifer and from camel 34) is slightly different from the original inoculum, i.e. the 5th BHK inoculum.

The original 5th BHK passage had 8 sequence differences in the L fragment when compared to the two in vivo viruses. Of the 8 differences, 3 were non-coding (2 differences in 2C and 1 difference in 3D).

Of the 5 coding differences, 1 is in VP-3 (aa # 158 proline to serine); 2 differences are in VP-1 (aa #13 alanine to threonine and aa # 144 alanine to valine); and 2 differences in 3A at amino acid # 104 (glycine to asparagine) and #129 (alanine to threonine).

May potentially have to do with BHK cell culture and subsequent in vivo adaptation as the VP-3 change may reflect on heparan sulphate binding, the VP-1 changes (in particular at aa# 144 just before the RGD motif) may change receptor interaction and the 3A changes may also have to do with adaptation to host cells.
Future experiments

- **As experiment 2 has indicated** that FMD serotype O under certain circumstances infect camels (caused viraemia, antibodies and elevated body temperature in 1 out of 3 camels) when using a fully virulent serotype O isolate, it may also be worthwhile to continue these experiments to get better statistical data.

  Next use 10 naive camels directly inoculated with the heifer 144 type O inoculum - have no contact camels as experiment 2 indicated that contact spread is of no significance.

- **Continue the experiments using FMD serotype A** as this is the other serotype that has been found in the area in or around UAE. An isolate from the region (A SAU 22/92 original epi suspension) from infected cattle material has been agreed upon among Ulli Wernery, Soren Alexandersen and Nigel Ferris/David Paton at the FMD-WRL in Pirbright.

- Clearly, the preliminary results from experiment 2 suggest that there is much more experimental work to do in order to conclude on the relative, but **low, susceptibility of dromedary camels** to infection with FMDV.
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SUMMARY

Experiment 1
5th BHK passage FMDV O UAE 7/99 inoculum
2 dromedary camels and 2 heifers inoculated in the tongue with $10^{7.6}$ TCID$_{50}$

Heifers: Clinical disease (relatively mild) and virus and antibody detected
Camels: NO clinical disease, NO viraemia, NO virus detected and NO development of antibodies

Conclusion: no signs of infection in dromedary camels with this inoculum

SUMMARY

Experiment 2
FMDV O 7/99 as in experiment 1, but prepared from secondary vesicular epithelium from heifer in experiment 1, i.e. used as 1st cattle passage

5 dromedary camels (3 naive and 2 from experiment 1) inoculated in the tongue with $10^{7.8}$ TCID$_{50}$. 5 naive dromedary camels and 4 sheep as contacts. 2 inoculated sheep kept separately (“positive controls” got typical disease, viraemia and development of antibodies).

Contact Camels and contact sheep: NO clinical disease, NO viraemia, and NO development of antibodies

Inoculated camels: NO clinical disease, but 1/3 naive camels had a one day increase in temperature and developed a viraemia and antibodies. The 2 previously exposed camels from Exp. 1 developed antibodies

Original 5th BHK virus had 8 sequence differences in the L fragment compared to the two in vivo viruses. Of 8 differences, 5 were coding differences; 1 in VP-3, 2 in VP-1 and 2 differences in 3A.

Conclusion: 1 out of 3 inoculated naive camels developed a viraemia but did not transmit infection to contact camels or sheep