Foot and mouth disease and similar virus infections in camelids: a review

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Summary
Foot and mouth disease (FMD) remains the most important animal disease. The FMD virus is highly contagious and occurs almost exclusively among cloven-hoofed animals such as cattle, sheep, goats, Bactrian camels and swine. Old World camels (OWCs) and New World camels (NWCs) inhabit FMD-endemic countries in South America, North and East Africa, and the Middle and Far East. Results of experimental infection of OWCs with the virus, and several clinical observations from the field over a century, confirm that the two closely related camel species of Bactrian and dromedary camels possess noticeably different susceptibilities to FMD. It is now certain that Bactrian camels can contract the disease. In contrast, dromedaries are not susceptible to FMD and do not transmit infection, even when in close contact with susceptible animals. The susceptibility of NWCs to the FMD virus has been demonstrated in the field and in experimental infection trials. However, these animals are not very susceptible and do not represent a serious risk in transmitting FMD to susceptible animal species.

Keywords

Introduction
Foot and mouth disease (FMD) remains the most important animal disease. It is most feared in countries with a large and efficient livestock industry. The virus is highly contagious, occurring almost exclusively among cloven-hoofed animals such as cattle, sheep, goats, Bactrian camels and swine. Both wild and domestic animals are affected. The disease is mainly characterised by vesicular lesions, but necrotising degeneration of the myocardium in calves has also been observed. Infection in humans has been described but is rare and not considered a public health risk (3, 33).

Old World camels (OWCs) inhabit countries in North and East Africa, and the Middle (dromedary) and Far East (Bactrian camel), whereas New World camels (NWCs) live in South America. Most of these areas are endemic for FMD. In the past few years our knowledge of the susceptibility of camelids to the FMD virus has increased through observations in the field and especially through experimental infections (12, 25, 50).

Aetiology and epidemiology
Foot and mouth disease is caused by an RNA aphthovirus of the family Picornaviridae. At least seven immunologically distinct serotypes and over 60 subtypes of the virus have been identified. There is no cross-immunity between strains (26).

The disease is enzootic in parts of Europe, Africa, the Middle East, India, the Far East and South America (Fig. 1). North America, Australia, New Zealand and many countries in Western Europe are free of the disease and have stringent regulations preventing the introduction of the virus. Foot and mouth disease is of great interest to
camel owners because the disease is enzootic in many countries where camels are indigenous. Saudi Arabia, for example, with a camel population of 800,000, imports approximately 6.5 million live animals every year (mainly sheep and goats) from Africa, Asia and Australasia (16, 17, 54). Animals from Africa and Asia bring their own strains of the virus, which spread within the nomadic herds of Saudi Arabia and neighbouring countries (57). It is of great importance to know whether camels play a role in transmission of the virus.

The natural hosts are artiodactyles, including cattle, pigs, sheep and goats, as well as many wild animals. Many ungulate species may become carriers; that is, the virus persists in the oesophageal-pharyngeal region for more than 28 days after infection but the animal does not display clinical signs. The African buffalo (*Syncerus caffer*), for example, may harbour the virus in its pharynx for up to two years without developing vesicular lesions. In contrast, American elk (*Cervus elaphus nelsoni*) (35) most probably do not become long-term carriers.

Most transmission of the virus is via aerosols, usually when animals are in close contact with each other, although under certain circumstances the disease may spread over long distances (31). Study of the epidemiology of FMD has been revolutionised by the use of molecular techniques that enable individual strains of the virus to be characterised. Using these methods, it has been possible to trace the movement of individual strains of the virus from one country to another (21).

**Foot and mouth disease in New World camels**

Several experimental studies on the susceptibility of NWCs to the FMD virus have been performed in the Americas, and all were carried out on the domesticated NWC species, the llama (*Lama glama*) and the alpaca (*Lama pacos*). Some field reports on the susceptibility of NWCs to FMD are also available, as well as a few serological surveys. No information is available on the epidemiology of FMD in the wild NWC species, guanaco (*Lama guanacoe*) and vicuña (*Vicugna vicugna*).

The susceptibility of NWCs to the FMD virus has been demonstrated both in the field and in experimental infections. In one field study, alpacas that showed minor clinical disease were associated with an FMD outbreak in a Puno (Peru) cattle population. However, serotype A24 of the virus was isolated only from the diseased cattle (29). In other field studies the susceptibility of NWCs to FMD has not been confirmed. Thus, during the 1981 outbreak of FMD at the Assam Zoo in India, where a large number of
Inoculation and transmission studies have been conducted in three countries: in Peru (28), in the United States at the Foreign Animal Disease Diagnostic Laboratory (27) and at the Instituto Nacional de Tecnologia Agropecuaria near Buenos Aires, Argentina (11). All the experiments showed that NWCs can be infected with various serotypes and through different routes. Llamas and alpacas reacted with mild-to-severe clinical signs. Nevertheless, transmission of the virus to llamas and other susceptible animals was demonstrated in only two of the investigations, in a limited number of animals (27, 28).

The ability of the FMD virus to infect susceptible llamas exposed either directly or indirectly to affected livestock was evaluated in a well-executed study using virus serotypes A79, C3 and O1 (11). Six pigs were inoculated with the three serotypes by different routes. Thirty llamas were placed with the infected pigs and later interspersed with an additional 30 llamas after the initial exposure. Forty susceptible livestock animals (pigs, bovine calves, goats and sheep) were then added to the overall group of 60 llamas to detect possible transmission of the virus from the llamas. Only two of 30 llamas directly exposed to the infected pigs developed (minor) lesions, seroconverted, and yielded virus in blood or oesophageal-pharyngeal fluid. A third llama from this group seroconverted but showed no lesions and did not shed virus. None of the control animals introduced to the 30 contact-exposed llamas developed lesions or antibodies and all failed to yield any FMD virus.

All experimental studies on FMD in NWCs have clearly shown that it was not possible to isolate FMD virus from either oesophageal-pharyngeal fluid or blood more than 14 days post exposure. This is of paramount importance. Unlike cattle, which are known to carry the virus for more than three years (21, 26), llamas do not become carriers (6, 27). It should be noted that not all animals coming into contact with the FMD virus become persistently infected and that carriers are not necessarily contagious. Under experimental conditions, around 50% of cattle become carriers. Both the animal species and the virus strain appear to be determinants in the development and persistence of the carrier state. Transmission of the virus by carriers other than African buffaloes (Syncerus caffer) and cattle has never been convincingly demonstrated (43). Pigs do not become carriers (7) and eventually eliminate the virus (21).

Although experimental infections in NWCs using differing routes and virus serotypes have resulted in detection of antibodies in routine serological tests (11, 27, 28), serological field investigations (4, 6, 20, 34, 37) in llamas and alpacas in South America did not reveal any antibodies to the FMD serotypes tested. All the studies were conducted on farms where NWCs were intermingled with cattle, sheep and goats, as well as with wild ungulates. Outbreaks of FMD had occurred on some of the farms, with buccal, lingual and labial lesions in cattle (6).

Foot and mouth disease in Bactrian camels

Many old publications from the former Soviet Union described outbreaks of FMD in the genus Camelus, but without differentiating between the Bactrian camel and the dromedary camel. This created some uncertainty among the scientific community until Larska et al. (25) demonstrated in intensive infection trials that FMD can be contracted only by Bactrian camels and not by dromedaries.

In Kazakhstan and Russia, several researchers (23, 24, 40, 41, 44, 47) reported on clinical signs of FMD in camels that were clearly Bactrian. Their investigations were summarised by Skomorochov (41) and Bojko and Suljak (5) in their veterinary books. One of the first reports of FMD in Bactrian camels goes back to 1893 (47) and describes two forms of the disease: lesions in the mouth and lesions at the feet. Kovalevskij (23) described the clinical picture of FMD in Bactrian camels as resembling lesions observed in cattle, with primary aphthae at the virus entrance site and severe lesions on the feet. Increased body temperature, hypersalivation and general weakness were also noted. Another Russian researcher, Krasovskij (24), observed several outbreaks of FMD in Bactrian camels between 1921 and 1927 and began infection trials in the animals. In these experiments, material from a cow was injected into the scarified lips of a Bactrian camel, FMD material from a pig was injected into the interdigital skin of another Bactrian, and lymph fluid from an FMD cow was injected intravenously into a third Bactrian. Only the Bactrian camel that received the intravenous infection developed the disease. Krasovskij concluded that spontaneous FMD in Bactrian camels is rare and artificial infection succeeds only when high virus doses are given intravenously. Krasovskij also described an FMD outbreak at Moscow Zoo in 1958/1959 in which 55 ungulates were involved, including moufflon, ibex, deer, reindeer, musk deer, llamas and camels. During this outbreak llamas and camels were not affected, whereas other ungulates suffered severe losses. Bojko and Suljak (5) described another outbreak in 1958, near Astrakhan. On one camel farm, 32 Bactrian camels developed severe clinical signs of FMD and a further 31 showed only mild lesions. The camels were off their feed, developed an increased body...
temperature, the soles of the feet detached, and some of the skin sloughed off at the carpal and tarsal joints, and at the chest and knee pads. A clear exudate was visible underneath the necrotic skin. Another comprehensive description of natural FMD infection in Bactrian camels in ‘Middle Asia’ was provided by Kobec (22):

- 1st day: weakness, recumbency, no rumination, off feed, 40.2°C fever, hyperaemic lips and gingival along the tooth row
- 2nd day: fever 40.5°C, inside lips and along the tooth mucosa and tip of the tongue small aphthae with yellow fluid visible, aphthae had the size of peas, off feed, recumbent, putrid nasal discharge
- 3rd day: 39.4°C, some aphthae had ruptured and ulcers were visible, salivation with sticky threads
- 4th day: 37°C, ulcers start to heal, camel starts to eat and ruminate, after six days camel was back to normal.

The author did not mention foot lesions but the camels were recumbent.

Krasovskij (24) infected Bactrian camels artificially and described the disease. After 48 h the first aphthae appeared at the inoculation site, followed by blisters at the feet; all the infected animals recovered after seven days. The clinical signs of FMD in camels were described as similar to those observed in cattle, but with less involvement of the legs (5). Suckling camel calves that received milk from affected dams developed viraemia followed by gastroenteritis and death. Krasovskij also described peracute cases with sudden death syndrome in Uzbekistan; this probably resembles the known tiger heart disease in bovine calves. The infection sources for FMD in camels are sheep and goats, which are always kept together.

Regular outbreaks of FMD in East Asia continue to the present day. The disease invaded the countries of East Asia between 1997 and 2000, all outbreaks being caused by FMD virus serotype O. In March 2000 the disease reached Mongolia and eastern Russia (38). In Mongolia, the subtype O/MNG/2000 infected cattle, sheep, goats and Bactrian camels in which typical lesions were observed (56). In May 2010 another serotype O outbreak in Mongolia affected more than 25,000 livestock animals, among which more than 20,000 were culled (50). Again the Bactrian camel was also infected in this endemic, many animals displaying typical lesions of FMD. One of the main features was the detaching of the soles of the feet (Fig. 2). This was the first time that an FMD virus had been isolated from a Bactrian camel that showed typical clinical signs of naturally acquired FMD.

The clinical signs that occurred during the FMD outbreak in Mongolian Bactrian camels in 2000 were described by Hohoo et al. (19) and appeared to resemble those observed in cattle. However, it appears that no camel specimens from these FMD outbreaks were sent to any investigation centre; several isolates of the virus were dispatched to the All-Russian Research Institute for Animal Health in Vladimir but they all stemmed from cattle and none from the camels. Moreover, although the World Reference Laboratory for FMD at the Pirbright Institute in the United Kingdom has received camelid samples for FMD diagnosis at various times, including samples from the Middle East, no FMD virus has ever been isolated from such samples.

Because of these uncertainties, scientists from the Central Veterinary Research Laboratory (CVRL) in Dubai and from Denmark conducted infection trials in both dromedary and Bactrian camels (25). In a study in two Bactrian camels, FMD virus serotype A from a suspension of bovine vesicular epithelium was injected subepidermolingually into the tongues of two animals (Fig. 3).
Both camels developed moderate-to-severe clinical signs of FMD with lameness of the hind feet, fever and recumbency (Figs 4, 5 & 6), and both animals lost the entire soles of both hind feet on day 14 post injection. The health of the animals then gradually improved and the lesions healed after 21 days. No lesions were observed at the inoculation site on the tongue. Both camels developed high antibody titres to the inoculated virus 7 to 10 days after injection. Only low and transient amounts of virus were detected in mouth swabs and probang samples. These findings indicate that, although Bactrian camels become acutely infected with FMD virus, they probably do not harbour the virus in their pharynx for more than 14 days and do not become long-term carriers.

Du et al. (8) observed that, although there is no information on receptors for FMD virus in camels, integrins are likely to be important molecules in the susceptibility of cloven-hoofed animals to FMD virus infection. The close relationship of integrin genes from Bactrian camels with those of pigs and cattle has been demonstrated, and Du et al. (8) therefore postulate that host tropism of FMD virus may in part be related to the divergence in integrin subunits among different species.

**Foot and mouth disease in dromedaries**

Current knowledge on FMD in camelids was reviewed by Wernery and Kaaden in 2004 (50). All observations on natural and experimental FMD virus infection in dromedaries have failed to show convincingly that this camel species possesses the same susceptibility to the virus as cattle and pigs. To date, there are only two field reports where the FMD virus has been isolated from dromedaries, and experimental research has been conducted in only very few animals, with one serotype and in one country. The results are published in little-known journals and the design and executions of most of the experiments are outdated. The conclusions are therefore questionable.

Scientists from Denmark and the CVRL in Dubai carried out four infection trials with FMD virus serotypes O and A in dromedaries in Dubai (2, 49, 52). High doses of virus were inoculated subepidermolingually into a total of 23 camels (Fig. 7). The titre of the virus was 107.6 TCID50/ml as assayed in primary bovine thyroid cells. Sheep and several other dromedaries were placed in the same pen in direct contact with the inoculated animals. Two heifers and two sheep inoculated with virus serotypes O and A served as positive controls. Modern laboratory techniques such as virus isolation, real-time polymerase chain reaction (PCR), enzyme-linked immunosorbent assay (ELISA) and virus neutralisation tests were used to

**Fig. 6**

Severe lesions on the hind-leg footpads of a Bactrian camel

**Fig. 4**

Lameness of the hind feet in a Bactrian camel, no lesions on the front feet

**Fig. 5**

Recumbency and depression in Bactrian camels
diagnose the infection. All inoculated and in-contact animals were monitored and regularly sampled, including with the probang cup (Fig. 8). None of the inoculated dromedaries or contact animals showed any clinical signs of FMD, whereas the positive control sheep and heifers developed typical disease and seroconverted. None of the inoculated dromedaries developed viraemia or specific antibodies despite the high dose of virus inoculum. Unlike Bactrian camels, dromedaries remain resistant to high doses of FMD virus and therefore do not play any significant role in transmitting the virus to susceptible animals. There are similar differences between closely related species of elephant: the African elephant (Loxodonta africana) is resistant to FMD virus, whereas the Asian elephant (Elephas maximus) is susceptible (46).

Several scientific papers deal with humoral antibody production in dromedaries, both in field surveys and after artificial infection. The results are contradictory, however: virus antibodies were detected in some serological field surveys but not in others. In most of the investigations, serum samples were taken from dromedaries that were grazing together with cattle, sheep and goats and free-ranging wild herbivores. No clinical evidence of FMD was observed in the dromedaries, although many of them had daily contact with infected ruminants (9, 18). Moreover, many thousand dromedary sera in Africa and the United Arab Emirates have been tested for evidence of FMD antibodies but with negative results. Furthermore, no antibodies were detected in testing samples from 1,119 dromedary milking camels with the Ceditest® cELISA (53), which detects antibodies to field strains (non-structural 3ABC proteins), and Habiela et al. (15) did not detect any antibodies to FMD virus in 176 Sudanese camels tested with a liquid-phase blocking ELISA.

Seroconversion has been reported in dromedaries in Ethiopia and Egypt (1, 36). Nevertheless, Moussa (30) is of the opinion that the antibodies identified by Richard (36) were non-specific inhibitory substances frequently observed in camel sera. The differences in serological FMD results in dromedary sera noted by Abou-Zaid (1) can be attributed to the laboratory methodology used. The ELISA technique appears more sensitive than other tests for detection of FMD antibodies. Several experimental infections with FMD virus in dromedaries have revealed that the animals do seroconvert. This was confirmed by Frederiksen et al. (13), who vaccinated five dromedaries against serotypes O, A and Asia 1 (triple vaccine Afiovax®). Although the reaction of the camels to primary vaccination was very limited, they reacted rather well to the second vaccination. However, the serological response declined to low levels 120 days after the second vaccination.

**Diagnosis**

The clinical signs of FMD are indistinguishable from other vesicular diseases such as vesicular stomatitis, vesicular exanthema of swine (*calicivirus*) and vesicular disease in pigs (*enterovirus of the Picornaviridae* family). Laboratory methods are therefore necessary for diagnosis (Table I). There are several commercially available ELISAs that can differentiate between field virus antibodies and vaccine antibodies. The virus can be isolated on various cell lines, including fetal camel kidney cells (10) and Vero cells (26).

**Treatment and prevention**

There is no cure for FMD. The most effective preventive measure is to prohibit introduction of animals or animal products into FMD-free countries from other countries that have the disease. Many European countries have banned routine vaccinations against FMD because most of
the outbreaks have been traced to improperly inactivated vaccines or escape of the virus from the production site (26). Furthermore, ruminants (cattle, in particular) continue to carry live virus in their pharynx after contact. Animals immune to FMD virus infection after vaccination can still become carriers after contact with field strains during outbreaks. Cattle can harbour the virus for up to three years (21, 26). The vaccine against FMD is an inactivated preparation; attempts to take advantage of new molecular biological technology to produce better vaccines have been unsuccessful. The duration of immunity after FMD vaccination is rarely longer than six months (21). In countries where vaccines are used, virus from an outbreak must be typed to determine whether the field strain is homologous to the current vaccine strain. There are no official reports on FMD vaccines in camelids, although experimental vaccination has been conducted in a few dromedaries, achieving seroconversion (13).

Other picornavirus infections in camelids

Equine rhinitis A virus was also isolated from aborted dromedary fetuses during an abortion storm in Dubai (51). Approximately 10% of the 258 breeding camels aborted at six to eight months’ gestation. The dromedary herd had direct contact with horses housed in a retirement home on the outskirts of the camel camp. Among the 57 retired horses tested, 80% were seropositive for the virus. Although not proven, it was highly likely that the dromedaries contracted their infection from these horses.

Experimental infection of two pregnant dromedaries with the isolated equine virus induced abortion in both animals, thus fulfilling Koch’s postulates (51). The gross pathology in all aborted fetuses retrieved from the field and in the two aborted fetuses from experimentally infected dromedaries was similar and revealed oedema of placenta and umbilical cord. Severe subcutaneous, generalised oedema was observed in all aborted fetuses and the abdominal and thoracic cavities were completely filled with dark haemolytic fluid. Diagnosis was based on serology (serum neutralisation test) and virus isolation, on Vero cells, of samples from placenta and fetal organs. Real-time PCR was positive in this abortion outbreak.

It should be noted that placentation in Camelidae is diffuse epitheliochorial, similar to that in equine species, and this anatomical particularity may partly explain the susceptibility of dromedaries to an equine virus. The mingling of horses and camels should therefore be avoided. There is no commercial vaccine for the protection of camels from equine rhinitis A virus-induced abortion.

Another picornavirus, encephalomyocarditis virus, has been isolated from a two-year-old dromedary in an American zoological collection (48). Gross pathology consisted of excessive pericardial fluid, epicardial haemorrhages and pale foci within the myocardium. The virus was isolated from the heart. It is believed that rodents may have transmitted the virus.

Other vesicular diseases resembling picornavirus infections in camelids

Vesicular stomatitis (VS) is another vesicular disease, indistinguishable from FMD, and is caused by a rhabdovirus. There are two major types: New Jersey and Indiana. There have been few studies on the susceptibility of NWCs to VS virus. It is believed that natural infection

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**Table I**

Routine laboratory methods for diagnosis of foot and mouth disease

<table>
<thead>
<tr>
<th>Method</th>
<th>Materials</th>
<th>Technique</th>
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<tbody>
<tr>
<td>Virus isolation</td>
<td>Epithelial lesions</td>
<td>Primary calf thyroid cells</td>
</tr>
<tr>
<td></td>
<td>Vesicular fluid</td>
<td>IB-RS2 cells</td>
</tr>
<tr>
<td></td>
<td>Oropharynx material (not preferred for virus isolation)</td>
<td>BHK cells</td>
</tr>
<tr>
<td>Antigen detection</td>
<td>Epithelial lesions</td>
<td>CFT</td>
</tr>
<tr>
<td></td>
<td>Vesicular fluid</td>
<td>Immunocapture ELISA</td>
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<tr>
<td></td>
<td>Oropharynx material</td>
<td>RT-PCR (virus RNA)</td>
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<td></td>
<td>Blood (viraemic animals)</td>
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<td>Serology</td>
<td>Serum</td>
<td>VNT</td>
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<td>Liquid-phase blocking ELISA, solid-phase competition ELISA</td>
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<td></td>
<td></td>
<td>Vaccinated animals: 3ABC ELISA, Immunoblot</td>
</tr>
</tbody>
</table>

BHK: baby hamster kidney cell line
CFT: complement fixation test
ELISA: enzyme-linked immunosorbent assay
IB-RS2: porcine kidney cell line
RT-PCR: real-time polymerase chain reaction
VNT: virus neutralisation test

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neutralising antibodies to the picornavirus were found in the fetal fluids and in two other llama herds with a similar clinical syndrome of diabetes mellitus.

Equine rhinitis A virus infection in llamas was reported (42) to have caused abortion in 15 animals over a three-and-a-half month period at an average gestation of 220 days. In addition to the picornavirus infection, diabetes mellitus was also observed in the adult llamas. The virus was isolated from two fetuses, and serum
rarely occurs, as llamas that had been in close contact with diseased cattle did not contract the disease (45). The llamas even shared watering and feeding facilities with the diseased cattle but did not seroconvert to VS virus. Further, 270 llamas serologically tested in Oregon were also negative (32). Nevertheless, a natural case of VS in a single NWC has been reported (12). Alpacas and llamas have been shown to be susceptible to experimental infection with VS virus. Vesicles appeared at the inoculation site at the dorsum of the tongue and the animals developed fever and anorexia (14). Fluids taken from the vesicles of the NWCs caused disease in cattle. There are no reports on VS in OWCs.

Conclusion

Research on FMD has been ongoing for many years, reflecting the importance of this viral disease to trade and livestock. Considerable progress has been made in improving diagnostic tests and information exchange, and collaborative networks have been established around the world. The camelid family is now included in this progress as a clearer picture of camelid susceptibility to FMD has emerged from serious field investigations and experimental trials.

The susceptibility of NWCs to FMD virus has been demonstrated in the field and in experimental infection trials. However, NWCs are not very susceptible and do not harbour the virus in their pharyngeal mucosa for more than 14 days. They therefore do not represent a serious risk in transmission of the virus to susceptible animal species.

The results of experimental infections of Bactrian camels with FMD virus, together with clinical observations from the field over a century, confirm that the two closely related camel species of Bactrian and dromedary camels possess noticeably different susceptibilities to FMD. It is now certain that Bactrian camels, in contrast to dromedaries, can contract FMD.

Diagnosis of FMD in Bactrian camels has been made not only through clinical observations but also through infection trials and by isolating the virus from field cases. Under experimental conditions, these camels can be relatively easily infected with the virus and develop the disease. Future research into FMD in Bactrian camels should now concentrate on field outbreaks. Samples from suspected clinical cases should be sent to FMD reference laboratories so that the epidemiology of FMD in Bactrian camels can be better understood.

The lack of susceptibility of dromedary camels to FMD has been shown in both field investigations and experimental infection trials. These camels do not transmit infection, even when in close contact with susceptible animals. The World Organisation for Animal Health (OIE) Ad hoc Group on Diseases of Camelids is expected to recommend that the dromedary is removed from the list of FMD-susceptible animals (55).

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Le point sur la fièvre aphteuse et d’autres maladies virales chez les camélidés

U. Wernery & J. Kinne

Résumé
La fièvre aphteuse demeure encore aujourd’hui la plus importante des maladies animales. Le virus de la fièvre aphteuse, extrêmement contagieux, affecte presque exclusivement les artiodactyles tels que les bovins, ovins, caprins et porcins. Les camélidés de l’Ancien Monde (dromadaires et chameaux bactriens en Afrique du Nord et de l’Est, au Moyen-Orient et en Extrême-Orient) et ceux du Nouveau Monde (lamas et alpagas en Amérique du Sud) vivent dans des régions où la fièvre aphteuse est endémique. Chez les camélidés de l’Ancien Monde, des infections expérimentales ont confirmé les observations cliniques de terrain depuis un siècle, à savoir que les chameaux bactriens et les dromadaires, qui constituent deux espèces très proches, ne présentent pas la même sensibilité au virus de la fièvre aphteuse. Il est désormais établi que les chameaux bactriens peuvent contracter la maladie. En revanche, les dromadaires ne sont pas sensibles à la fièvre aphteuse et ne transmettent pas l’infection, même lorsqu’ils sont exposés à des animaux sensibles. La sensibilité des camélidés du Nouveau Monde au virus de la fièvre aphteuse a été démontrée aussi bien sur le terrain que lors d’infections expérimentales. Néanmoins, il s’agit d’une sensibilité de faible intensité, de sorte que ces animaux ne présentent pas un risque élevé de transmettre la fièvre aphteuse à d’autres espèces animales sensibles.

Mots-clés
Camélidés – Épidémiologie – Fièvre aphteuse – Picornavirus – Sensibilité – Virus de la rhinite équine de type A.

Estudio de la fiebre aftosa e infecciones víricas similares en los camélidos

U. Wernery & J. Kinne

Resumen
La fiebre aftosa es aún hoy la enfermedad animal de mayor importancia. El virus que la provoca, extremadamente contagioso, afecta casi exclusivamente a ungulados como bovinos, ovinos, caprinos y porcinos. Los camélidos del Viejo Mundo y los del Nuevo Mundo viven en países donde esta patología es endémica (en Sudamérica, el Norte y Este de África y el Medio y Lejano Oriente). Los resultados de la infección experimental de camellos del Viejo Mundo con el virus, así como varias observaciones clínicas realizadas sobre el terreno a lo largo de un siglo, confirman que la susceptibilidad a la fiebre aftosa es notablemente distinta en las dos especies de camélido estrechamente emparentadas, el camelio bactriano y el dromedario. Se sabe ahora con seguridad que los camellos bactrianos pueden contraer la enfermedad. En cambio, los dromedarios no son susceptibles a ella ni transmiten la infección, aun cuando estén en estrecho contacto con animales susceptibles. En cuanto a
References


