An investigation of camelpox outbreaks in two principal camel (Camelus dromedarius) rearing areas of Kenya

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Summary
In 1992, during an investigation into camelpox in two principal camel-rearing areas of Kenya, the disease was found in 1,100 camels at a prevalence of 6% in Turkana and 27% in Samburu. In Turkana, outbreaks were detected in two herds of young animals, while in Samburu, outbreaks were found in two herds of adult animals, as well as in two herds of young camels. In all cases, there was 100% morbidity in the affected herds. When young camels were involved, the main lesions were confined to the mouth, nose and muzzle as distinct pustular lesions. In adults, there was also extensive oedema of the head and neck. Direct electron microscopy and virus isolation on tissue culture were used to confirm the orthopoxvirus infection. The outbreaks appeared related to the stress of weaning and, in the case of the adults, to recent long-distance travel.

Keywords
Camelpox – Camels – Clinical signs – Epidemiology – Kenya.

Introduction
Camelpox is a contagious disease which primarily affects young animals (11) and causes benign to severe generalised pox lesions (14). It has been widely reported in almost all camel-rearing countries (2, 5, 9, 12, 17).

Camelpox virus has previously been isolated in Kenya (3) and serological evidence indicates that the disease is enzootic in this country (4, 13). There has, however, been no description of the clinical manifestation of the disease within Kenya. It is accepted that different strains of the virus exist with variable pathogenicity (8, 14). It is also known that the clinical signs of infected animals are often indistinguishable from lesions caused by parapox (camel contagious ecthyma) and simultaneous infections with both orthopox and parapox viruses have been described (16, 18). An investigation of camelpox outbreaks in the districts of Samburu and Turkana, two principal camel-rearing areas of Kenya, was conducted in the dry months of September and October 1992. The disease manifestations occurring in the different outbreaks were investigated.

Materials and methods

Epidemiology
Two districts, Turkana and Samburu, were chosen as they represent two different agro-ecological zones in which camels are reared. Turkana is an arid district, receiving less than 500 mm of rainfall per annum. Approximately 100,000 camels are kept by Turkana herdsmen in herds ranging from a few to 70 animals. Several remote areas in the district were visited during the dry month of September 1992, and 600 camels from 25 herds were examined.

Samburu is a semi-arid area, receiving about 600 to 750 mm of evenly distributed rainfall per annum. Approximately 66,000 camels are reared by Samburu herdsmen in herds ranging from a few to 70 animals. This district was visited in the dry month of October 1992, and 500 camels from 20 herds were examined.

Scabs and sera, representative of different outbreaks, were obtained from the sick camels. Sera were also obtained from apparently healthy animals in both areas.
Electron microscopy

Skin lesions from the affected camels were ground and re-suspended in a minimum volume of phosphate-buffered saline (pH 7.2). A formvar-coated copper grid was floated on a drop of virus suspension for two minutes, removed and blotted with the edge of the blotting paper, then placed on a drop of 2% sodium phosphotungstate (pH 6.6). After 90 seconds, the grid was blotted, air-dried and examined in a Zeiss EM 10 C/R transmission electron microscope, operating at 60,000 V.

Cell cultures

Primary lamb kidney cell cultures were prepared by trypsin digestion of kidney cortex tissue from healthy foetal lambs. Cell cultures were grown in medical flat bottles of 500 ml and on 6 × 4 well plates, 5 cm in diameter, in Eagle's minimal essential medium with non-essential amino acids plus 10% foetal calf serum (FCS). These cultures were maintained with medium 199 plus 5% FCS during virus growth.

Virus

Dried scabs were homogenised in cell culture medium using a frozen mortar and frozen, then thawed, three times in succession. The suspension was then filtered using a millipore filter (0.22 µ), and inoculated onto lamb kidney cells which were examined over ten days. The H520 camelpox virus was kindly provided as a reference strain by F.G. Davies (3).

Neutralisation

Neutralising antibody titres in both healthy and camelpox-infected camels were determined using 96-well microtitre plates. Serial doubling dilutions of test and control serum (50 µl) were prepared in microtitre wells, with an equal volume of the H520 reference virus (100 TCID50, 50% tissue culture infective dose) per ml) added to each well. After a seven-day incubation period, cultures were examined microscopically for cytopathic effects. Serum-neutralising antibody titres were expressed as the reciprocal of the highest dilution showing 50% inhibition of the virus growth. The Student’s T test was performed to find the variation between serum antibody titres against camelpox virus from healthy camels in Turkana and those in healthy camels from Samburu. The same test was used to establish the variation of antibody titres against camelpox virus between healthy and infected camels from both Samburu and Turkana. A positive control H520 virus antiserum was kindly provided by F.G. Davies (3).

Results

Camelpox outbreaks were confirmed in both districts with a disease prevalence of 6% in Turkana and 27% in Samburu. In Turkana, camelpox was found in two herds of young animals, one from Lokichar in the south and the other from Kisima in the north. In Samburu, camelpox was found in four herds: two herds of young animals and two of adult animals, respectively, as indicated in Table I. These four herds were located in different geographical areas. In regard to the adult herds, the herd in Kisima had walked 700 km from Galana to Kisima the previous week. The herd in Wamba had also walked, from the Somalia/Kenya border to Wamba, a distance of 1,000 km, six days before the outbreak. In the affected calves from both districts, there was a history of weaning two weeks prior to the outbreak.

Table I

<table>
<thead>
<tr>
<th>Area</th>
<th>Number of camels examined</th>
<th>Number of camels affected</th>
<th>Age of camels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkana district</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kisima</td>
<td>250</td>
<td>24</td>
<td>10 months</td>
</tr>
<tr>
<td>Lokichak</td>
<td>350</td>
<td>12</td>
<td>10 months</td>
</tr>
<tr>
<td>Subtotal</td>
<td>600</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Samburu district</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kisima</td>
<td>180</td>
<td>45</td>
<td>4-5 years</td>
</tr>
<tr>
<td>Womba</td>
<td>220</td>
<td>60</td>
<td>5-6 years</td>
</tr>
<tr>
<td>Merti</td>
<td>40</td>
<td>10</td>
<td>10 months</td>
</tr>
<tr>
<td>Maralal</td>
<td>80</td>
<td>20</td>
<td>10 months</td>
</tr>
<tr>
<td>Subtotal</td>
<td>500</td>
<td>135</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,100</td>
<td>171</td>
<td></td>
</tr>
</tbody>
</table>

In all cases, morbidity was 100%. When calves were involved, the main lesions were confined to the lips, muzzle and nose as distinct pox lesions which interfered with feeding (Fig. 1). The infection passed through the classical roseolar, papular, vesicular, pustular and desquamative stages of pox infection. The pox lesions were variable in size, and the rough, raised plaques of the early stages were difficult to remove and left raw, hyperaemic areas. Late-stage lesions were easy to remove and left areas which were partially healed. Enquiries directed to the herders revealed that similar lesions occurred commonly in young calves but rarely in adult camels.

Where adults were involved, as in Samburu, the lesions were more severe. In addition to pox lesions around the mouth, severe oedema of the neck and ocular discharges were also found (Fig. 2), and in the Samburu outbreaks two camels died, although the actual cause of death was not determined. There was visible enlargement of the mandibular lymph nodes in many of the affected camels.

A poxvirus was identified by negative-stain transmission electron microscopy (Fig. 3). Virions were brick-shaped and measured 280 × 180 nm. All the poxvirus isolates were successfully propagated on lamb kidney monolayers and produced giant cells after three days. Camelpox virus neutralisation test results are shown in Table II. The endpoints were taken when 50% or more of the cytopathic effects of the virus were suppressed as the reciprocal of the dilution. The table indicates the frequencies of positive reactors per titre.
level. There was no significant difference between antibody titres of healthy camels from Turkana and Samburu (P > 0.05). There was a significant difference in antibody titres between healthy and infected camels from Turkana and Samburu (P < 0.05). Cameipox virus isolates from both areas were neutralised by specific cameipox virus serum.

Discussion
Camelpox has been reported in many camel-rearing areas of the world. Young animals of between two and three years old are principally affected. The higher prevalence in the Samburu district is associated with a wet region which receives an
annual average of 600 to 750 mm of evenly distributed rainfall throughout the year. Turkana district, on the other hand, receives an average annual rainfall of less than 500 mm and, in the low arid areas, figures as low as 200 mm have been recorded. It has been documented that many camelpox outbreaks recur during the rainy season (11).

During this investigation, the main lesions were found in the area of the head, which differs from the widespread lesions described in other countries (8, 10). It has been reported, however, that strains of variable pathogenicity can exist, even within the same area (8). Generalised camelpox exanthema, possibly associated with a fall in immune status (9), is more

**Table II**
Camelpox virus-neutralising antibody titres from healthy and infected camels in Samburu and Turkana, Kenya, in 1992

<table>
<thead>
<tr>
<th>Titres*</th>
<th>Healthy camels</th>
<th>Camelpox-infected camels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Samburu</td>
<td>Turkana</td>
</tr>
<tr>
<td>20</td>
<td>60</td>
<td>43</td>
</tr>
<tr>
<td>40</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>80</td>
<td>60</td>
<td>50</td>
</tr>
<tr>
<td>160</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>320</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>640</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>1,280</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>2,560</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>5,120</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total number of samples</strong></td>
<td><strong>200</strong></td>
<td><strong>200</strong></td>
</tr>
</tbody>
</table>

* Reciprocal of serum dilution showing 50% inhibition of virus growth
common during or shortly after the rainy season. One problem associated with investigations at this time of the year is that certain areas are inaccessible.

The prevalence of clinical camelpox in both areas was low, as work was conducted in the dry season. Electron microscopy and virus isolation were used to confirm the diagnosis. Other methods of identification, such as the dot blot assay and polymerase chain reaction (PCR), have recently been described (15). The enzyme-linked immunosorbent assay (ELISA) has been used to provide serological differentiation between camelpox and camel contagious ecthyma infections (1). Serological evidence in this study concurs with that in other work (4, 13), and shows that camelpox is enzootic in camel-rearing areas of Kenya.

In this study, the different outbreaks affected both young and adult camels. In the adults, the pox lesions were more severe and were associated with oedema of the neck, which interfered with feeding, and an ocular discharge. In the calves, the lesions were less severe but, nevertheless, the pox lesions on the lips, mouth and muzzle also interfered with feeding. All the affected calves had recently been weaned.

The affected adults had all recently been moved from their place of origin to Samburu. Since there had been no camelpox outbreaks in the surrounding farms, which also keep camels of varying ages, the ‘importation’ is assumed to have contributed to their susceptibility, either because of stress during transportation or exposure to camelpox virus strains of variable pathogenicity. As stated earlier, strains of different pathogenicity can exist even within the same area (8). Camelpox virus isolates from both areas were, however, neutralised by specific H520 camelpox virus serum.

Reports obtained later indicated that many camels which were brought to Maralal, Samburu, to take part in a camel Derby, died from severe camelpox one week after they had returned to Laikipia.

At present, camels are not vaccinated in Kenya. An attenuated camelpox virus strain, 'Jouf-78', has been found by other workers to induce good immunity in camels (6). Another similar, high-passage camelpox virus strain was also found to be protective (7). Since the use of camels is increasing, and more regional movement will inevitably follow, vaccination with one of the proven vaccines is recommended a few weeks prior to movement to avoid losses due to this disease.

Acknowledgements

The author is grateful to F.G. Davies for providing an H520 camelpox virus reference strain and positive control H520 virus antiserum. Thanks are also due to D.M.O. Akabwai from Turkana and J.O. Evans from Laikipia for their technical assistance in the field.

Enquête sur des foyers de variole caméline dans deux grandes régions d'élevage de dromadaires (Camelus dromedarius) au Kenya

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Résumé

En 1992, lors d'une enquête sur la variole caméline, menée dans deux grandes régions d'élevage de dromadaires au Kenya, la maladie a été constatée chez 1 100 dromadaires avec une prévalence de 6 % au Turkana et de 27 % au Samburu. Alors qu'au Turkana, la maladie était présente dans deux troupeaux de jeunes dromadaires, au Samburu des foyers ont été découverts à la fois dans deux troupeaux d'animaux adultes et dans deux autres d'animaux jeunes. Dans tous les cas, le taux de morbidité était de 100 % chez les troupeaux atteints. Chez les jeunes dromadaires, les pustules ont principalement été observées sur la bouche, les naseaux et le museau. Chez les adultes, on a également observé de larges œdèmes au niveau de la tête et du cou. L'observation directe en microscopie électronique et l'isolement du virus en culture cellulaire ont permis de confirmer
Investigación de brotes de viruela del camello en dos de las principales zonas de cría de camellos (*Camelus dromedarius*) de Kenia

C.G. Gitao

Resumen
En el año 1992, una investigación sobre la viruela del camello en dos de las principales zonas de cría de Kenia permitía detectar la enfermedad en 1.100 animales, con una prevalencia del 6% en Turkana y del 27% en Samburu. En Turkana se observaron brotes en dos manadas de animales jóvenes, mientras que en Samburu se registraban brotes en dos manadas de camellos adultos y otras dos de camellos jóvenes. En todos los casos, los rebaños afectados exhibían una tasa de morbilidad del 100%. Las lesiones más importantes de los camellos jóvenes, en forma de claras lesiones pustulares, se localizaban sólo en la región de la boca, la nariz y el hocico. En cuanto a los adultos, éstos presentaban también grandes edemas en la cabeza y el cuello. Para confirmar la presencia de ortopoxvirus como agente infeccioso, se utilizaron técnicas de microscopía electrónica y de aislamiento del virus en cultivos tisulares. Los brotes parecen relacionados con el estrés que acompaña al destete y, en el caso de los adultos, con recientes desplazamientos a larga distancia.

Palabras clave
Camellos - Epidemiología - Kenia - Signos clínicos -Viruela del camello.

References


