# ELMT TECHNICAL BRIEF:

## Camel Sudden Death Syndrome: Outbreak of an Unknown Camel Disease in the Horn of Africa

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**INTRODUCTION**

An unusual high number of deaths were reported in camels starting in Ethiopia in 2005 followed by Somalia in 2006 and Kenya in 2007. Mainly adult camels were reported to be dropping dead without any prior symptoms.

Following the reports various surveys were carried out, starting with a USAID funded investigation in Ethiopia[1] followed by a UNOCHA funded project in Somalia[2] and a FAO supported investigation in Kenya[3].

The results of the investigation of eight post mortem cases in Ethiopia were inconclusive. Parasites such as Haemonchus, Trypanosoma, tapeworm and round worm were found as well as two suspected cases of clostridial entertoxaemia, one case of diarrhoea and dehydration. However in six cases histological examination revealed a lymphocytic myocarditis. The researchers could not isolate any particular virus, but could not rule out the involvement of a viral agent.

The following section describes the findings of two investigations carried out in Puntland by VSF Germany and in Northern Kenya by VSF Suisse in close collaboration with the Kenyan Department of Veterinary Services (DVS).

**METHODOLOGY**

Field investigations were carried out in Puntland and Northern Kenya from May to July 2007. Questionnaires were administered at sites where recent deaths had been reported. Where possible and fresh death cases could be found a post mortem examination was carried out. In addition a survey on heart conditions in slaughterhouses in Puntland was conducted. In Kenya veterinary teams also collected blood samples from herds that had been in contact with outbreak cases.

[1] Wernery, U., Metwalley, S., Mohamed, F., (2006), Camel Disease Investigation in Ethiopia, January 8-17 funded by USAID Ethiopia

[2] "Sudden Death Emergency Investigation in Camel in Puntland" (HRF-DMA-0256-054) funded by UNOCHA Somalia

[3] "Camel Sudden Death Survey and Diagnostics" (OSRO/RAF/606/NET and OSRO/RAF/706/USA) funded by FAO Kenya

The table below gives a summary of samples collected in Puntland and Kenya.

***Table 1: Summary of samples taken in Puntland and Kenya, 2007***

| Location | No of questionnaires administered | No of post portems carried out | No of heart tissue samples taken | No of blood samples taken |
|---|---|---|---|---|
| **Puntland** | | | | |
| Bari | 7 | | 108 | |
| Karkar | 19 | 1 | | |
| Mudug | 7 | | | |
| Nugal | 56 | 1 | | |
| Saanaq | 2 | | | |
| Not defined | 3 | | | |
| **Subtotal** | **94** | **2** | **108** | |
| | | | | |
| **Kenya** | | | | |
| Wajir District | 6 | 1 | | 99 |
| Garissa District | 15 | 5 | | 103 |
| Isiolo and Samburu Districts | 18 | | | 140 |
| Moyale and Marsabit Districts | 15 | 4 | | 132 |
| Mandera District | 6 | | | |
| **Subtotal** | **60** | **10** | | **474** |
| **TOTAL** | **154** | **12** | **108** | **474** |

In the two countries a total of 154 questionnaires, 108 heart tissues samples and 474 blood samples were collected while a total of 12 post mortem cases were investigated.
Data obtained from the questionnaires were analyzed by a consultant epidemiologist, looking into mortality, descriptive clinical characteristics, and timelines among other aspects. Samples were analyzed for various disease agents at Vetlabs Kabete, Kenya, the University of Veterinary Medicine, Department of Pathology, Hanover, Germany and the Marburg Clinic of Cardiology, Germany.

**FINDINGS**

Disease names: In neither country did pastoralists have a traditional name for the disease, leading to the conclusion that it is new in the region. Various new names had been given recently referring to the quick onset and short course of the disease.

***Box 1: Disease names given by pastoralists***

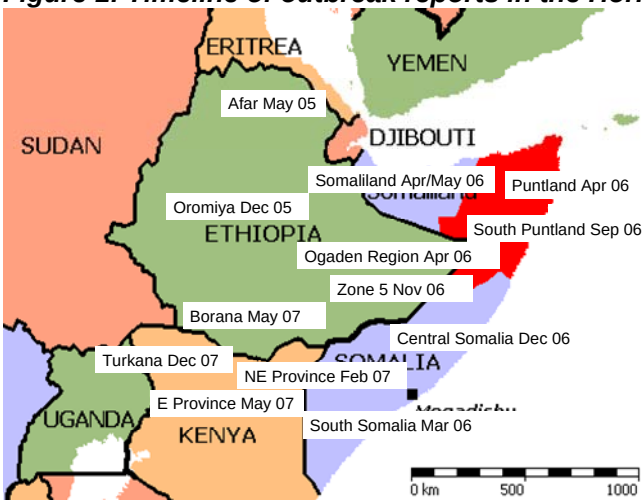
In Somali:
- *Ha igu soo dhicin* — don't fall on me
- *Babta* — collapsed immediately
- *Kedis* — happened suddenly, emergency, surprise
- *Soo dhac* — fall down

In Oromo/Borana:
- *Habaad* — bullet
- *maal oo dhaaf* — milk and abandon

In Swahili:
- *Risasi* — bullet

Investigators and other stakeholders involved in the surveys referred to the disease as Camel Sudden Death (CSD) Syndrome.

***Figure 1: Timeline of outbreak reports in the Horn of Africa***




Working case definition:

Discussion with pastoralists and the analysis of the administered questionnaires led to the development of a working definition in order to narrow down and define the disease as accurately as possible and to ensure only cases within the definition were included in further analysis.

***Box 2: Working case definition of "Camel Sudden Death"***

**Working case definition for "Camel Sudden Death"**

- ✓ Collapse, dyspnoe and rapid death within 1 hour after collapse
- ✓ No prior clinical course at all
- ✓ Sometimes non-specific prodromal (fatigue) symptoms of less than 6 hours
- ✓ Affecting adult or sub-adult camels, i.e. 4 years and above

It was found that 83 out of 94 questionnaires from Puntland and 40 out of 60 questionnaires from Kenya corresponded with the definition and were included in the data analysis.

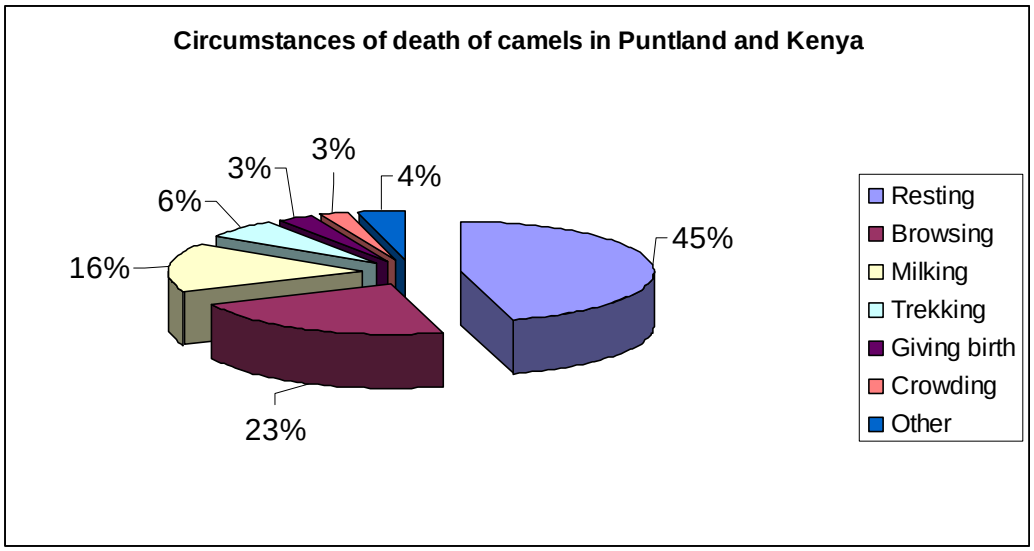
Epidemiological data:

Herd mortality in affected herds was 3.7% and 6.6 % in Puntland and Kenya, respectively. In addition the mean number of cases per herd varied between the two countries. While the mean was 2.0 in Puntland, pastoralists in Kenya reported a mean of 6.8 cases per herd. An explanation for this difference might be the time of the investigation: while the outbreak had already ceased in most parts of Puntland before field investigations started, it was at its peak in Kenya during the field investigations and therefore more present in the minds of pastoralists . Another explanation could be an increase in virulence of the pathogen, hence more cases were found per herd in Kenya as compared to Puntland. A third possible explanation may be related to the breeds/types of camels found in the different regions: camels in Northeast Province of Kenya and in Moyale district of Eastern Kenya are on average 40% heavier than camel breeds in Puntland, heavier animals are more likely to die from cardiac problems (myocarditis).

Mainly females (74% in Puntland and 88% in Kenya) were affected within the herds and out of those all were either dry, pregnant or lactating. The results were comparable in Puntland and Kenya of the females affected 59% were dry and pregnant and 41% lactating females. The average age of affected camels was 9.7 years in Puntland and 9.5 years in Kenya.

A large proportion of the camels were found dead in the enclosure (*boma*) in the morning after resting (45%)[4] and no symptoms were seen prior to death. However, other camels were reported to collapse immediately after physical stress such as milking (16%), trekking (6%), giving birth (3%), and crowding (3%) and some cases of breeding bulls collapsing minutes after intercourse.

***Figure 2: Circumstance of death of camels in Puntland and Kenya***




Post mortem findings:

Post mortem investigations were carried out in two cases in Puntland and in ten cases in Kenya. In Puntland the carcasses looked as "if slaughtered" without any major pathological changes. The trachea was usually full of froth and blood spots (petechia) were found in the heart. In Kenya pathological findings were more prominent and are detailed in the box below.

***Box 3: Summary of post mortem findings in Puntland and Kenya***

| **Puntland** (questionnaire and two post mortem investigations) | **Kenya** (ten post mortem investigations) |
|---|---|
| • Trachea often full of froth,<br>• Normal spleen (ruling out Anthrax),<br>• Sometimes blood spots on the heart;<br>• Sometimes no visible post mortem signs, looks like slaughtered | • Oedema in the lung, massive froth /foam<br>• Trachea: severe haemorrhages on the mucosa<br>• Heart: Petechia on the Myocard, Subendocarditis<br>• Liver: no obvious changes in the liver, histopathology shows |

[4] Human deaths caused by cardiac arrest also peak during night hours

| | |
|---|---|
| | beginning of icterus<br>• Spleen: either shrunk or active<br>• Intestines: Diffuse haemorrhages in the intestines<br>• Blood clotting delayed |

Figure 3: Camel dead in the boma

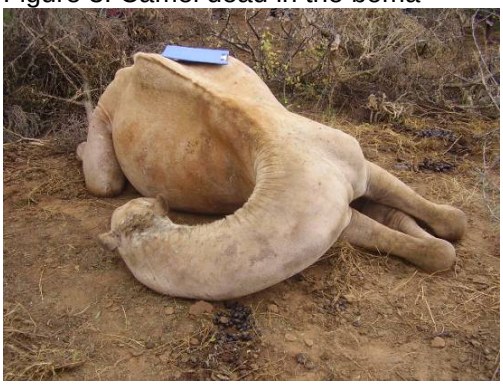


Figure 4: Froth found in trachea

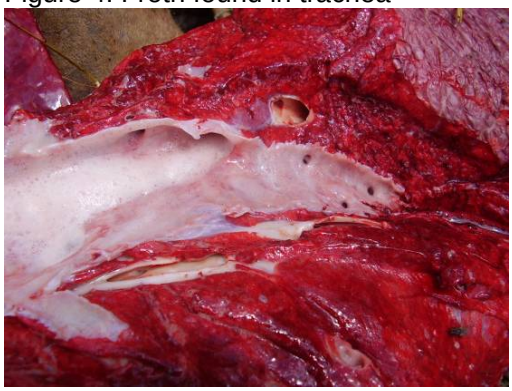


Figure 5: Heart with petechia on the myocard

Figure 6: opened heart with haemorrhages in the endocard

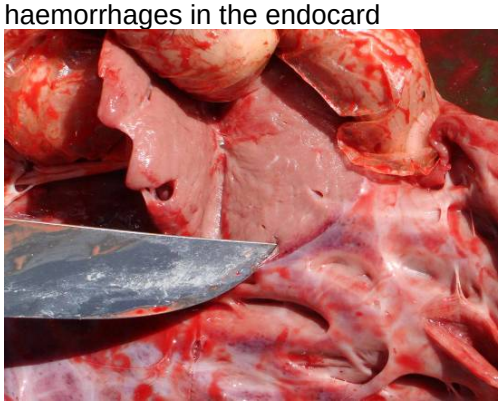


Figure 7: Haemorrhages found in the intestines

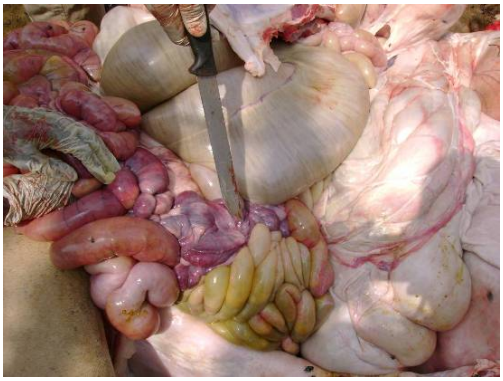


Figure8: Fetus found during post mortem examination

Both Vetlabs Kabete in Kenya and at the Department of Pathology in Hanover, Germany tested blood and post mortem samples for various disease agents including parasites, viruses and bacteria. However none of the commonly known animal disease agents could be confirmed (see Box 4). Even the involvement of the Marburg Clinic of Cardiology in Germany to carry out PCR[5] for identification of additional specific human heart disease agents did not lead to the detection of the causative agent.

***Box 4: Summary of potential causative agents tested***

**Sample analysis (standard bacteriology and parasitology, histology, immuno-histology, electronmicroscopy) in Kenya and Germany for:**

Anthrax – Borna – Neospora – Toxoplasma - Trypanosoma evansi - Morbilli-Virus / PPR Virus- African Horsesickness / Blue tongue Disease / Orbi-Virus – Parvovirus – Herpesvirus –EMC (Encephalomyocarditis) virus - Theilers' Encephalomyelitis Virus - Clostridium perfringens Type A and Clostridium difficile (Toxin analysis) - Rift Valley Fever Virus- Tick borne diseases incl. Rickettsial diseases (Heartwater)

**Samples tested for specific human heart disease agents using PCR in Germany such as:**
Coxsacki B and A virus – Adenovirus – Echo virus/CMV/EBV/Influenza A&B – Parvo B19 (incl. 3 different subtypes) – Q-Fever/Mycoplasma/HHV 6/HSV – Borrelia/Chlamydia pneumoniae/TBC

Attempted virus isolation on Vero Cells at Vetlabs Kabete showed a positive CPE[6] in three cases, leading to the conclusion that viral involvement as cause of the disease outbreak was a possibility. (No fresh organ material was available for viral culture at laboratories in Germany, all samples being fixed formalin tissues.)

Histopathological analysis in Hanover did not give a conclusive picture. However the findings clearly indicate that the collapse of the cardio-vascular system (left sided congestive heart failure) was the cause of death in most cases. The haemorrhages found in the heart (epicard and myocard) take at least two weeks to develop. Other findings such as the depletion of lymphocytes in the lymphnodes, the alterations in the liver and in a few cases the non purulent encephalitis confirm a systemic infectious disease involved in this outbreak.

**CONCLUSION**

Both investigations in Puntland and Kenya showed that "Camel Sudden Death" is a new disease in the region, not known to pastoralists before. The quick onset of the disease made it difficult to investigate the cases as there were no prior symptoms to the death of the camels and carcasses were mostly autolytic by the time the investigation teams arrived. However, based on analysis of the data collected and the laboratory tests done, some conclusions can be made about the course of the disease (summarized in Box 5).

***Box 5: Summary of the findings***

- Based on the inflammatory cell response seen in histology and results from attempted virus isolation carried out at Vetlabs, Kabete it appears that the causative infectious agent is most probably a virus

[5] PCR = Polymerase Chain Reaction
[6] CPE = Cyto Pathological Effect

- Dead camels show myocarditis, myocardial and sub-epicardial bleeding in the heart (heart lesions take 14 days to develop)
- Heart changes seem to be mostly of a sub-clinical nature; healthy looking camels suffer heart damage without showing symptoms
- Froth in the nostrils and lung oedema are a sign of left-sided congestive heart failure
- Camels that die are under increased cardio-vascular stress; the camel category most at risk are pregnant and lactating females
- So far none of the screened viral, bacterial and parasitical agents could be confirmed as causative agent of the disease
- There is clear evidence that the spread of the disease follows herd movements

In addition extension messages were developed in order to give feedback to pastoralists on how to react if case such an outbreak were to re-occur.

***Box 6: Extension messages***

**Extension Messages:**

- ✓ Try to avoid contact with affected herds
- ✓ Do not subject your camels to additional physical stress e.g.
  - o Water your camels on a regular basis in short intervals (every 2-3 days) and try to avoid long (>5 days) watering intervals. Massive water intake puts stress on the circulatory system.
  - o Do not trek your camels for long distances
- ✓ Pregnant females that are still lactating to avoid additional physiological stress on the circulatory system.
- ✓ Feed minerals/salt on a regular basis and try to avoid long intervals and high intake at once, as it puts additional stress on the circulatory system.
- ✓ Do not overwork bulls (e.g. with heavy loads or walking for long distances).

**FURTHER INFORMATION**

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