

Guidelines
for the Training
of Veterinary Professionals
on Camel Health and Diseases



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Funded by:



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Introduction

Over 70% of Kenya's land mass consists of arid and semi-arid lands (ASALs). Extensive livestock grazing, in a nomadic pastoral production system, is seen as a suitable means of utilizing these agro-ecological areas.

Camels are well adapted to the harsh conditions of the ASALs and have been kept for centuries by various pastoral communities in the Greater Horn of Africa. The dromedary camel constitutes an important part of their livelihood, it is essential to their subsistence economy. Many argue that dromedaries are the most important livestock species in terms of food security. First and foremost, the camel contributes to the pastoral livelihood via its milk and meat for household consumption. Milk is the most important product of the camel, and contributes between 50 – 60 % of the nutrient intake of some of the pastoralist communities of sub Saharan Africa, especially during the dry season. In addition sales of milk, meat, hides and live animals contribute to household income. The camel represents a saving mechanism and contributes draught power mainly for transport but recently also for land preparation. Last but not least the camel plays an important role for the socio-cultural interaction of the community. The camel is used for payment of dowry, settlement of fines in tribal feuds and recreational activities. Especially the Somali, who represent the largest and oldest camel keeping tribe, see camels as a banking system or security against drought, disease, and other natural disasters that affect smaller stock more seriously.

In the past decades the interest in the camel sector has continuously risen. Various stakeholders, including the Government, Universities, Scientists, Development Actors and the Private Sector are currently trying to support camel keeping communities in improving health, husbandry, production, products and marketing – even the introduction of camels into traditionally non-camel keeping communities (for example the Maasai and Samburu tribes in Kenya) becomes a common programmatic approach.

Availability of and access to information, knowledge and educational material on camel health and diseases is very limited. Only recently the camel has been included in the curriculum of veterinary studies i.e. in Kenya.

The aim of these training modules including the training guidelines is to improve the availability and accessibility of teaching material on camel health and disease topics, especially for those veterinary professionals already working with camel keeping communities. It is anticipated to enhance the knowledge of these professionals on the most common camel diseases, their epidemiology, diagnosis and treatment covering the theory as one aspect but focusing more on the practical side, to help veterinary professionals in their diagnosis when confronted with a sick camel in the field.

How to use the Modules

The target audience for this training are veterinary professionals who have a basic knowledge of camels. However the groups can be split into two:

GROUP A, representing veterinary professionals with NO field experience of camels and their diseases and

GROUP B, representing veterinary professionals with field experience of camels and their diseases.

It is advisable to know the level of experience of the trainees beforehand, in order to plan the training accordingly.

GROUP A will need two extra days in order to cover the theory of the diseases in a more classic classroom style prior to starting with the more participatory training sessions.

Trainees of GROUP B can move straight to the participatory training sessions.

Suggested time table:

Day 1	Disease groups 1 – 4	Group A only
Day 2	Disease groups 5 – 8	Group A only
Day 1	Module 1 Session 1 A – C Module 2 Session 2 A – C	Group A and B
Day 2	Module 3 Session 3 A – B Module 4	Group A and B
Day 3	Module 5 Session 5 A – B Module 6 Session 6 A – B	Group A and B
Day 4	Module 7 Session 7 A – B Module 8 Session 8 A – B	Group A and B
Day 5	Module 9 Session 9 A – F	Group A and B

MODULE 1:

Lead Symptom:

Weight Loss

Diseases Covered:

- *Trypanosoma Evansi* – Acute
- *Trypanosoma Evansi* – Chronic
- Gastrointestinal Helminths



AIM OF THIS MODULE:

The aim of this first module is

- 1) to enable the trainee to differentiate between acute and chronic Trypanosomosis and the infection with gastrointestinal helminths when confronted with a sick camel showing the lead symptom of weight loss in the field;
- 2) to enhance the knowledge of the trainee on the two covered diseases especially on their epidemiology, diagnosis and treatment focusing on field conditions.

Handouts to be used:

- Module 1/Handout 1/Herd 1
- Module 1/Handout 1/Herd 2
- Module 1/Handout 1/Herd 3
- Module 1/Handout 1/Summary
- Module 1/Handout 2



SESSION 1/A:

Group work:

The trainees are split into three groups and Module 1 Handout 1 Herd 1/Herd 2/Herd 3, one per group are distributed.

Each of the handouts describes a case of a camel presented by a herdsman with the lead symptom of weight loss. It further includes some pre-empted questions and answers and examination results.

The task of the group is to

1. define a clinical diagnosis;
2. support the clinical diagnosis with main observations;
3. describe what additional examinations or diagnostic tests they would carry out and how;
4. define the recommended therapy;
5. name three most important differential diagnoses and their major differences to support the clinical diagnosis;
6. give a practical advice to the herder on how to control the disease.



TIME FRAME:

Each group has one hour to discuss their specific case.



SESSION 1/B:

Each group should select a presenter to present their specific case and findings according to the tasks given in Session 1/A to the plenary followed by discussions.

The aim of this session is to discuss the three covered diseases in plenary to

- highlight the differences between the diseases, in order to support the diagnosis

- discuss possible examination and diagnostic sampling, laboratory analysis to support the diagnosis (comparing the ideal scenario as taught with practical field conditions)
- discuss treatment and control strategies
- highlight extension messages that should be passed on to the herder

At the end of the session each trainee should receive
Module 1/Handout 1/Summary



TIME FRAME:

One hour



SESSION 1/C:

Summary of each disease in plenary, developing “disease summary cards”.

For each disease so called “disease summary cards” will be developed together with the facilitator including:

- causative agent and transmission
- epidemiology
- clinical findings
- diagnosis (clinical examination, laboratory and post mortem)
- treatment
- differential diagnosis
- prevention and control

At the end of the session Module 1 Handout 2 will be given to each participant.



TIME FRAME:

One hour

MODULE 2: Lead Symptom: Skin Lesions

Diseases Covered:

- Camel Pox
- ORF (Contagious Ecthyma)



AIM OF THIS MODULE:

The aim of this module 2 is

- 1) to enable the trainee to differentiate between camel pox and Orf when confronted with a sick camel showing the lead symptom of weight loss in the field;
- 2) to enhance the knowledge of the trainee on the two covered diseases especially on their epidemiology, diagnosis and treatment focusing on field conditions.

Handouts to be used:

- Module 2/Handout 1/Herd 1
- Module 2/Handout 1/Herd 2
- Module 2/Handout 1/Herd 3
- Module 2/Handout 1/Summary
- Module 2/Handout 2

Handouts to be used:

- Module 1/Handout 1/Herd 1
- Module 1/Handout 1/Herd 2
- Module 1/Handout 1/Herd 3
- Module 1/Handout 1/Summary
- Module 1/Handout 2



SESSION 2/A:

Group work:

The trainees are split into three groups and Module 2 Handout 1 Herd 1/Herd 2/Herd 3, one per group are distributed.

Each of the handouts describes a case of a camel presented by a herdsman with the lead symptom of pox like skin lesions. It further includes some pre-empted questions and answers and examination results.

The task of the group is to

1. define a clinical diagnosis;
2. support the clinical diagnosis with main observations;
3. describe what additional examinations or diagnostic tests they would carry out and how;
4. define the recommended therapy;
5. name three most important differential diagnoses and their major differences to support the clinical diagnosis;
6. give a practical advice to the herder on how to control the disease.



TIME FRAME:

Each group has one hour to discuss their specific case.

SESSION 2/B:

Each group should select a presenter to present their specific case and findings according to the tasks given in Session 2/A to the plenary followed by discussions.

The aim of this session is to discuss the three covered diseases in plenary to

- highlight the differences between the diseases, in order to support the diagnosis
- discuss possible examination and diagnostic sampling, laboratory analysis to support the diagnosis (comparing the ideal scenario as taught with practical field conditions)
- discuss treatment and control strategies
- highlight extension messages that should be passed on to the herder

At the end of the session each trainee should receive Module 2/Handout 1/ Summary



TIME FRAME:

One hour

SESSION 2/C:

Summary of each disease in plenary, developing “disease summary cards”.

For each disease so called “disease summary cards” will be developed together with the facilitator including:

- causative agent and transmission
- epidemiology
- clinical findings
- diagnosis (clinical examination, laboratory and post mortem)
- treatment
- differential diagnosis
- prevention and control

At the end of the session Module 2 Handout 2 will be given to each participant.



TIME FRAME:

One hour

MODULE 3: Lead Symptom: Respiratory Distress

Diseases Covered:

- Nasal Bot Fly
- Tuberculosis
- Pneumonia (Acute, Chronic) due to
 - Viral Infections (Influenza like)
 - Bacterial Infections



AIM OF THIS MODULE:

The aim of module 3 is

- 1) to discuss and share knowledge and experience of the trainee on the lead symptom: respiratory distress and finally be able to differentiate between nasal bot fly, tuberculosis, acute and chronic pneumonia, influenza-like viral infections and bacterial infections;
- 2) to enhance the knowledge of the trainee on the covered diseases especially on their epidemiology, diagnosis and treatment focusing on field conditions.

Handouts to be used:

- Module 3/Handout 1
- Module 3/Handout 2



SESSION 3/A:

Plenary discussion

The facilitator will ask the participants to name known diseases with the lead symptom of respiratory in plenary. All named diseases will be written down on a black board/flip chart.

Note: Try to narrow the named diseases down as much as possible (the mentioned diseases in the module will act as a guide and should be covered).



TIME FRAME:

30 minutes

The participants are then divided into two groups. Each group will discuss half of the named diseases written on the blackboard/flip chart with the following task:

1. Describe the main symptoms of each disease;
2. Describe the condition of the camel and the progression of the disease;
3. Describe treatment and control measures.



TIME FRAME:

One hour

Each disease will then be presented by various participants from the groups to the plenary.



TIME FRAME:

30 minutes



SESSION 3/B:

Divide the trainees into four groups. The work task of this session is to develop “Handouts” by each of the group covering one disease. The task of each group is as follows:

1. Describe how a herdsman would present each disease
2. What relevant questions would you ask and what answers would you expect?
3. What examination would you undertake?
4. What would support your diagnosis to exclude possible differential diagnosis?
5. What additional examination/laboratory analysis could be carried out – how feasible is it?
6. What are the treatment and control measures?
7. Are there any important extension messages for the herdsman?

Handouts of Module 1 and 2 can be used as guidelines. At the end of this session a similar handout should have been produced for each disease by the four groups.



TIME FRAME:

One hour

Presentation of the “Handouts” by each group to the plenary and discussions. It is anticipated that after each presentation a discussion with the other trainees will take place in order to include other ideas and questions and share experience and knowledge.



TIME FRAME:

One hour

At the end of the session Module 3 Handout 1 and 2 will be distributed.

The information of both Handouts should be used by facilitator as a guide to facilitate the presentation and discussions in Session 3/B.

MODULE 4: Lead Symptom: Sick Calf

Diseases Covered:

- Tick Paralysis
- Diarrhoea in Suckling Camel Calves
Lack of Colostrum & Meconium Retention
- Peri-Arthricular
- Abscesses & Navel Ill



AIM OF THIS MODULE:

The aim of module 4 is

- a) to discuss and share knowledge and experience of the trainee on the lead symptom: sick calf and finally be able to differentiate between tick paralysis, diarrhoea in suckling camels calves, lack of colostrums & meconium retention, peri-arthricular abscesses & navel ill;
- b) to enhance the knowledge of the trainee on the covered diseases especially on their epidemiology, diagnosis and treatment focusing on field conditions.

Handouts to be used:

- Module 4/Handout 1
- Module 4/Handout 2



SESSION 4/A:

Plenary discussion

The facilitator will ask the participants to name known diseases with the lead symptom of sick calf in plenary. All named diseases will be written down on a black board/flip chart.

Note: Try to narrow the named diseases down as much as possible (the mentioned diseases in the module will act as a guide and should be covered).



TIME FRAME:

30 minutes

The participants are then divided into two (or more if necessary) groups. Each group will discuss half of the named diseases written on the blackboard/flip chart with the following task:

1. Describe the main symptoms of each disease;
2. Describe the condition of the camel and the progression of the disease;
3. Describe treatment and control measures.



TIME FRAME:

One hour

Each disease will then be presented by various participants from the groups to the plenary.



TIME FRAME:

30 minutes



SESSION 4/B:

Divide the trainees into four groups. The work task of this session is to develop “Handouts” by each of the group covering one disease. The task of each group is as follows:

1. Describe how a herdsman would present each disease
2. What relevant questions would you ask and what answers would you expect?
3. What examination would you undertake?
4. What would support your diagnosis to exclude possible differential diagnosis?
5. What additional examination/laboratory analysis could be carried out – how feasible is it?
6. What are the treatment and control measures?
7. Are there any important extension messages for the herdsman?

Handouts of Module 1 and 2 can be used as guidelines. At the end of this session a similar handout should have been produced for each disease by the four groups.



TIME FRAME:

One hour

Presentation of the “Handouts” by each group to the plenary and discussions. It is anticipated that after each presentation a discussion with the other trainees will take place in order to include other ideas and questions and share experience and knowledge.

MODULE 5: Lead Symptom: Central Nervous Problems

Diseases Covered:

- Rabies
- Viral and Bacterial
- Meningitis
- *Capparis Tomentosa* Poisoning
- Central Nervous Form of Trypanosomosis



AIM OF THIS MODULE:

The aim of module 5 is

- to enhance the trainees capacity to develop the anamnesis of cases with the lead symptom: central nervous symptoms and finally be able to differentiate between rabies, viral and bacterial meningitis, *Capparis tomentosa* poisoning and central nervous form of Trypanosomosis;
- to enhance the knowledge of the trainee on the covered diseases especially on their epidemiology, diagnosis and treatment focusing on field conditions.

Handouts to be used:

- Module 5/Handout 1
- Module 5/Handout 2



SESSION 5/A:

Participants will be split into four groups and each group receives Module 5/Handout 1.

Task:

Preparation phase: Handouts should be read by all participants.

- Each group will play the role of the herdsman presenting a case for one selected disease to another group. The case should be developed beforehand in such a way that possible questions can be answered, and condition of camels can be described when “examined”.
- Each group will play the role of the veterinarian, trying to diagnose the presented case by another group. The questions should be developed before, taking into consideration important differences in the diagnosis. The group will not know, what disease they will have to investigate.

The following table is an example of how the diseases and the roles can be distributed to the groups:

	Group A	Group B	Group C	Group D
Presents as herdsman the following disease	Rabies	Viral and Bacterial meningitis	<i>Capparis tomentosa</i> poisoning	Central nervous form of Trypanosomosis
Investigates as veterinarian the following diseases	Viral and bacterial meningitis	Rabies	Central nervous form of Trypanosomosis	<i>Capparis tomentosa</i> poisoning

Note: Each group will only be given the name of the disease they should develop as herdsman.



TIME FRAME:

1.5 hours



SESSION 5/B:

Task:

Role play

Each group selects one person to play the role of the herdsman and one person to play the role of the veterinarian.

- Group A herdsman will present their case to Group B veterinarian while Group C and D watch.
- Group B herdsman will present their case to Group A veterinarian while Group C and D watch.
- Group C herdsman will present their case to Group D veterinarian while Group A and B watch.
- Group D herdsman will present their case to Group C veterinarian while Group A and B watch.

Each case is to be presented in form of a role play until the diagnosis has been done.

After the presentation discussions can be held on positive and negative things the audience observed (e.g. type of questions, behaviour, things that were forgotten, things that were done very well etc). Again emphasis should be put on the diagnosis and potential differential diagnosis of each disease and how the diagnosis can be supported!

Module 5 / Handout 2 will be given to all participants.

MODULE 6:

Lead Symptom:

Acute death in adult camels

Diseases Covered:

- Anthrax
- Acute Trypanosomosis
- Haemorrhagic Septicaemia
- Camel Sudden Death Syndrome
- Snakebites



AIM OF THIS MODULE:

The aim of module 6 is

- a) to enhance the trainees capacity to develop the anamnesis of cases with the lead symptom: acute deaths in adult camels and finally be able to differentiate between Anthrax, Acute Trypanosomosis, “Haemorrhagic Septicaemia”, Camel Sudden Death Syndrome;
- b) to enhance the knowledge of the trainee on the covered diseases especially on their epidemiology, diagnosis and treatment focusing on field conditions.

Handouts to be used:

- Module 6/Handout 1
- Module 6/Handout 2



SESSION 6/A:

Participants will be split into four groups already formed in Session 5 and each group receives Module 6/Handout 1.

Task:

Preparation phase: Handouts should be read by all participants.

- Each group will play the role of the herdsman presenting a case for one selected disease to another group. The case should be developed beforehand in such a way that possible questions can be answered, and condition of camels can be described when “examined”.
- Each group will play the role of the veterinarian, trying to diagnose the presented case by another group. The questions should be developed before, taking into consideration important differences in the diagnosis. The group will not know, what disease they will have to investigate.

The following table is an example on how the diseases and the roles can be distributed to the groups:

	Group D	Group B	Group A	Group C
Presents as herdsman the following disease	Anthrax	Acute Trypanosomosis	“Haemorrhagic Septicaemia”	Camel Sudden Death Syndrome
Investigates as veterinarian the following diseases	Acute Trypanosomosis	Anthrax	Camel Sudden Death Syndrome	“Haemorrhagic Septicaemia”

Note: Each group will only be given the name of the disease they should develop as herdsman. Groups should be switched so that a group will present to a different group in this session.



TIME FRAME:

1.5 hours



SESSION 6/B:

Task:

Role play

Each group selects one new person to play the role of the herdsman and one new person to play the role of the veterinarian.

- Group D herdsman will present their case to Group B veterinarian while Group C and A watch.
- Group B herdsman will present their case to Group D veterinarian while Group C and A watch.
- Group A herdsman will present their case to Group C veterinarian while Group D and B watch.
- Group C herdsman will present their case to Group A veterinarian while Group D and B watch.

Each case is to be presented in form of a role play until the diagnosis has been done.

After the presentation discussions can be held on positive and negative things the audience observed (e.g. type of questions, behaviour, things forgotten, things done very well etc). Again emphasis should be put on the diagnosis and potential differential diagnosis of each disease and how the diagnosis can be supported!

Module 6 / Handout 2 will be given to all participants.

MODULE 7:
Lead Symptom:
Skin problem

Diseases Covered:

- Ringworm
- Mange
- Contagious Skin Necrosis
- Lymphnode Abscesses



AIM OF THIS MODULE:

The aim of module 7 is

- a) to enhance the trainees capacity to develop the anamnesis of cases with the lead symptom: skin diseases and finally be able to differentiate between Ringworm, Mange, Contagious skin Necrosis, Lymphnode abscess;
- b) to enhance the knowledge of the trainee on the covered diseases especially on their epidemiology, diagnosis and treatment focusing on field conditions.

Handouts to be used:

- Module 7/Handout 1
- Module 7/Handout 2



SESSION 7/A:

Participants will be split into four groups already formed in Session 5 and each group receives Module 7/Handout 1.

Task:

Preparation phase: Handouts should be read by all participants. Tasks are the same as in session 5 & 7. Lessons learnt from the previous day should be briefly discussed in plenary with all participants in order to improve this session.

- Each group will play the role of the herdsman presenting a case for one selected disease to another group. The case should be developed beforehand in such a way that possible questions can be answered, and condition of camels can be described when “examined”.
- Each group will play the role of the veterinarian, trying to diagnose the presented case by another group. The questions should be developed before, taking into consideration important differences in the diagnosis. The group will not know, what disease they will have to investigate.

The following table is an example on how the diseases and the roles can be distributed to the groups:

	Group B	Group C	Group D	Group A
Presents as herdsman the following disease	Ringworm	Mange	Contagious skin necrosis	Lymphnode abscess
Investigates as veterinarian the following diseases	Mange	Ringworm	Lymphnode abscess	Contagious skin necrosis

Note: Each group will only be given the name of the disease they should develop as herdsman. Groups should be switched so that a group will present to a different group in this session.



TIME FRAME:

1.5 hours



SESSION 7/B:

Task:

Role play

Each group selects one new person to play the role of the herdsman and one new person to play the role of the veterinarian.

- Group B herdsman will present their case to Group C veterinarian while Group D and A watch.
- Group C herdsman will present their case to Group B veterinarian while Group D and A watch.
- Group D herdsman will present their case to Group A veterinarian while Group C and B watch.
- Group A herdsman will present their case to Group D veterinarian while Group C and B watch.

Each case is to be presented in form of a role play until the diagnosis has been done.

After the presentation discussions can be held on positive and negative things the audience observed (e.g. type of questions, behaviour, things forgotten, things done very well etc). Again emphasis should be put on the diagnosis and potential differential diagnosis of each disease and how the diagnosis can be supported!

Module 7 / Handout 2 will be given to all participants.

**Module 8:
Lead Symptom:
abortion**

Diseases Covered:

- Brucellosis
- Rift Valley fever
- Abortion due to Trypanosomosis
- Other Abortion causes (Camel Pox, Q-Fever,
- Chlamydomphila, Salmonella)



AIM OF THIS MODULE:

The aim of module 8 is

- a) to enhance the trainees capacity to develop the anamnesis of cases with the lead symptom: abortion and finally be able to differentiate between Brucellosis, Rift Valley fever, Trypanosomosis and other abortion causes (e.g Camel pox, Q-fever, Chlamydomphila, Salmonella);
- b) to enhance the knowledge of the trainee on the covered diseases especially on their epidemiology, diagnosis and treatment focusing on field conditions.

Handouts to be used:

- Module 8/Handout 1
- Module 8/Handout 2



SESSION 8/A:

Participants will be split into four groups already formed in Session 5 and each group receives Module 8/Handout 1.

Task:

Preparation phase: Handouts should be read by all participants. Tasks are the same as in session 5, 6 & 7. Lessons learnt from the previous day should be briefly discussed in plenary with all participants in order to improve this session.

- Each group will play the role of the herdsman presenting a case for one selected disease to another group. The case should be developed beforehand in such a way that possible questions can be answered, and condition of camels can be described when “examined”.
- Each group will play the role of the veterinarian, trying to diagnose the presented case by another group. The questions should be developed before, taking into consideration important differences in the diagnosis. The group will not know, what disease they will have to investigate.

The following table is an example on how the diseases and the roles can be distributed to the groups:

	Group C	Group D	Group A	Group B
Presents as herdsman the following disease	Brucellosis	Rift Valley fever	Trypanosomosis	Other causes
Investigates as veterinarian the following diseases	Rift Valley fever	Brucellosis	Other causes	Trypanosomosis

Note: Each group will only be given the name of the disease they should develop as herdsman. Groups should be switched so that a group will present to a different group in this session.



TIME FRAME:

1.5 hours



SESSION 8/B:

Task:

Role play

Each group selects one new person to play the role of the herdsman and one new person to play the role of the veterinarian.

- Group C herdsman will present their case to Group D veterinarian while Group A and B watch.
- Group D herdsman will present their case to Group C veterinarian while Group A and B watch.
- Group A herdsman will present their case to Group B veterinarian while Group C and D watch.
- Group B herdsman will present their case to Group A veterinarian while Group C and D watch.

Each case is to be presented in form of a role play until the diagnosis has been done.

After the presentation discussions can be held on positive and negative things the audience observed (e.g. type of questions, behaviour, things forgotten, things done very well etc). Again emphasis should be put on the diagnosis and potential differential diagnosis of each disease and how the diagnosis can be supported!

Module 8 / Handout 2 will be given to all participants.

Module 9: Examination of the Camel



AIM OF THIS MODULE:

The aim of module 9 is

- a) to enhance the trainees capacity on doing practical clinical examination of the camel taking into consideration signs of diseases and discussing differential diagnosis

Handouts to be used:

- Module 9/Handout 1
- Module 9/Handout 2



SESSION 9/A:

This session is ideally done in the field using at least 2 or 3 camels.

The first examination of the camel is done step by step with the whole group.



TIME FRAME:

1.5 hours



SESSION 9/B

Depending on the number of camels available the group is split accordingly.

Task for each group is to examine their allocated camel carefully, noting down any possible clinical signs and differential diagnosis. Each group will need a trainer to guide them through the examination and act as a back-up for questions.

MODULE 1

HANDOUT 1 & 2

LEAD SYMPTOM: WEIGHT LOSS

DISEASES COVERED:

***TRYPANOSOMA EVANSI* – ACUTE
TRYPANOSOMA EVANSI – CHRONIC
GASTROINTESTINAL HELMINTHS**

Module 1: Weight loss and poor condition in a lactating (or adult) camel

HANDOUT 1/HERD 1

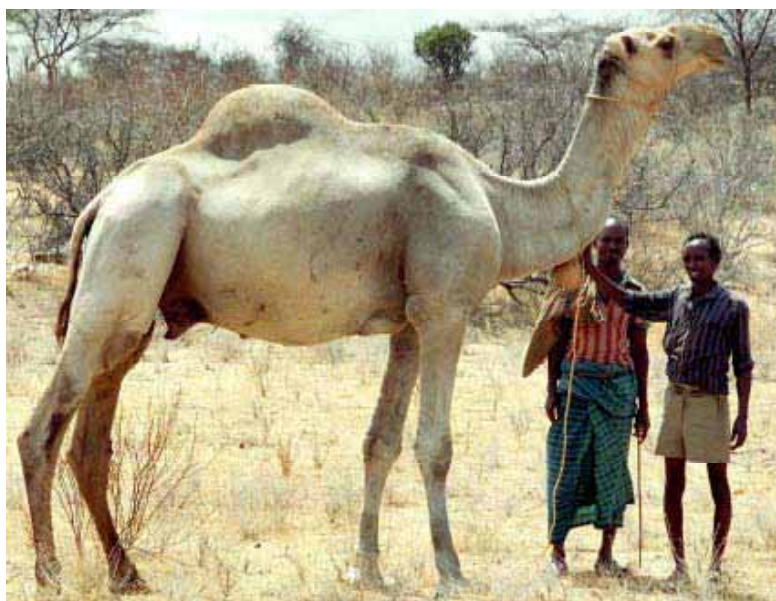


Photo: Dioli

Herdsmen: "My camel is in poor condition and is losing weight."

	Herd 1
Q	When was the problem observed for the first time?
A	Three weeks ago
Q	Are other camels in your herd sick?
A	No
Q	How is the camel feeding
A	Feeding, but rests when other camels are feeding
Q	What do you think about the condition of your camel?
A	Hump is shrinking
Q	Is the camel still giving milk?
A	Very little, has almost stopped giving milk
E	Examination of the skin
F	Skin is dull
Q	Did you observe any swelling of the skin?
A	Yes, but only in the morning
E	Examination of the skin II
F	No oedema
Q	Did you observe any other signs?
A	Lacrimation
E	Examination of the eye
F	Lacrimation, pale or pink mucosa
E	Examination of the subcutaneous lymphnodes
F	Not enlarged
Q	Are the signs of the disease becoming worse?
A	Yes

Q = Question; A = Answer; E = Examination; F = Findings;

Task:

- What is your clinical diagnosis?
- What main observations support your clinical diagnosis?
- What additional examinations or diagnostic tests would you carry out?
- What therapy would you recommend?
- Name three most important differential diagnoses and the major differences to rule them out in this case!
- What advice would you give the herder to control the disease?

Module 1: Weight loss and poor condition in a lactating (or adult) camel

HANDOUT 1/HERD 2

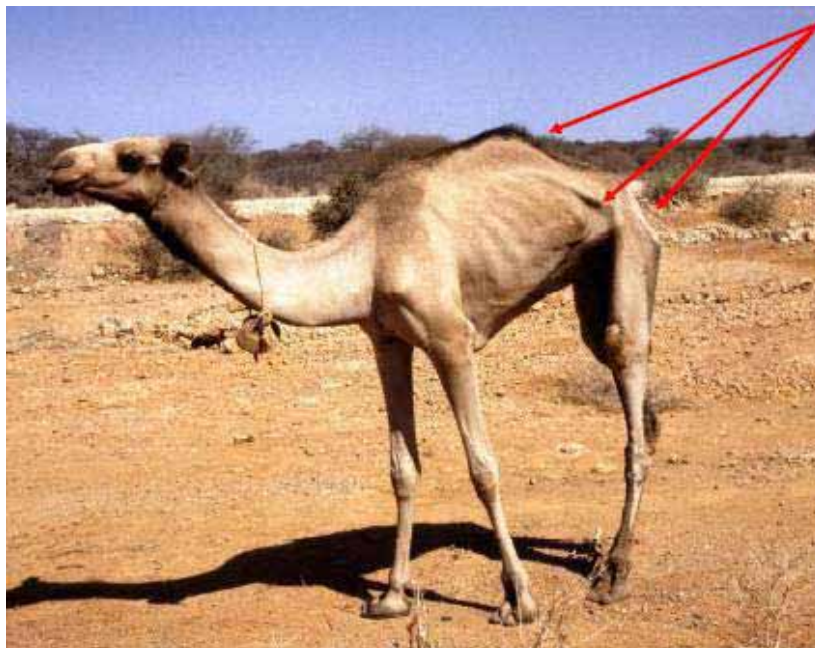


Photo: Dioli

Herdsmen: "My camel is in poor condition and is losing weight."

	Herd 2
Q	When was the problem observed for the first time?
A	Three months ago
Q	Are other camels in your herd sick?
A	No
Q	How is the camel feeding
A	Not feeding at all, is very sleepy
Q	What do you think about the condition of your camel?
A	Hump is gone, abdomen retracted, muscle atrophy
Q	Is the camel still giving milk?
A	Has stopped giving milk
E	Examination of the skin
F	Very rough skin, tail hair coming off easily
Q	Did you observe any swelling of the skin?
A	Yes
E	Examination of the skin II
F	Palpable oedema on the lower neck, abdomen and/or limbs
Q	Did you observe any other signs?
A	Lacrimation of both eyes, breath and urine smell musty, like slightly rotten fruit
E	Examination of the eye
F	Lacrimation on both sides, very pale mucosa
E	Examination of the subcutaneous lymphnodes
F	Enlarged
Q	Are the signs of the disease becoming worse?
A	It is already very bad since a long time

Q = Question; A = Answer; E = Examination; F = Findings;

Task:

- What is your clinical diagnosis?
- What main observations support your clinical diagnosis?
- What additional examinations or diagnostic tests would you carry out?
- What therapy would you recommend?
- Name three most important differential diagnoses and the major differences to rule them out in this case!
- What advice would you give the herder to control the disease?

Module 1: Weight loss and poor condition in a lactating (or adult) camel

HANDOUT 1/HERD 3



Photo: Dioli

Herdsman: "My camel is in poor condition and is losing weight."

	Herd 3
Q	<i>When was the problem observed for the first time?</i>
A	Some time after the rain
Q	<i>Are other camels in your herd sick?</i>
A	Yes
Q	<i>How is the camel feeding?</i>
A	Feeding normally
Q	<i>What do you think about the condition of your camel?</i>
A	The hump is small
Q	<i>Is the camel still giving milk?</i>
A	Is still giving milk, but the yield is low
E	Examination of the skin
F	Rough skin
Q	<i>Did you observe any swelling of the skin?</i>
A	No
E	Examination of the skin II
F	No oedema
Q	<i>Did you observe any other signs?</i>
A	Loose faeces at times
E	Examination of the eye
F	Pink to pale mucosa
E	Examination of the subcutaneous lymphnodes
F	Normal
Q	<i>Are the signs of the disease becoming worse?</i>
A	No, not much change

Q = Question; A = Answer; E = Examination; F= Findings;

Task:

- What is your clinical diagnosis?
- What main observations support your clinical diagnosis?
- What additional examinations or diagnostic tests would you carry out?
- What therapy would you recommend?
- Name three most important differential diagnoses and the major differences to rule them out in this case!
- What advice would you give the herder to control the disease?

Module 1: Weight loss and poor condition in a lactating (or adult) camel

Herdsmen: "My camel is in poor condition and is losing weight."

	Herd 1	Herd 2	Herd 3
Q	When was the problem observed for the first time?		
A	Three weeks ago	Three months ago	Some time after the rain
Q	Are other camels in your herd sick?		
A	No	No	Yes
Q	How is the camel feeding		
A	Feeding, but rests when other camels are feeding	Not feeding at all, is very sleepy	Feeding normally
Q	What do you think about the condition of your camel?		
A	Hump is shrinking	Hump is gone, abdomen retracted, muscle atrophy	Hump is small
Q	Is the camel still giving milk?		
A	Very little, has almost stopped giving milk	Has stopped giving milk	Is still giving milk, but the yield is low
E	Examination of the skin		
F	Skin is dull	Very rough skin, tail hair coming off easily	Rough skin
Q	Did you observe any swelling of the skin?		
A	Yes, but only in the morning	Yes	No
E	Examination of the skin II		
F	No oedema	Palpable oedema on the lower neck, abdomen and/or limbs	No oedema
Q	Did you observe any other signs?		
A	Lacrimation	Lacrimation of both eyes, breath and urine smell musty, like slightly rotten fruit	No
E	Examination of the eye		
F	Lacrimation, pale or pink mucosa	Lacrimation on both sides, very pale mucosa	Pink to pale mucosa
E	Examination of the subcutaneous lymphnodes		
F	Not enlarged	Enlarged	Not enlarged
Q	Are the signs of the disease becoming worse?		
A	Yes	It is already very bad since a long time	No, not much change
D	What is your clinical diagnosis		
D	<u>Recent T.evansi infection</u>	<u>Chronic T.evanis infection</u>	<u>Gastro-intestinal parasites</u>
D	What main observations support your clinical diagnosis?		
D	Drowsiness	Lethargy	Normal sensorium and appetite
D	Additional examination / diagnostic tests		
D	Blood sample (haematocrit / PCV, microscopic detection of the parasite)	Blood sample (haematocrit / PCV, microscopic detection of the parasite)	Faecal sample (EPG)
DD	Are you sure this animal does not suffer from malnutrition / mineral deficiency?		
DD	Yes, nutritional deficiency would affect more than one animal in the herd	Yes, nutritional deficiency would affect more than one animal in the herd	No
DD	Any other disease to be considered?		
DD	Chronic wasting disease, e.g. Tuberculosis can look like chronic infection with parasites		
T	What therapy do you recommend?		
I	<u>Trypanocide</u>	<u>Trypanocide</u>	<u>Anthelmintic</u>

Q = Question; A = Answer; E = Examination; F = Findings; D=Diagnosis; DD= Differential Diagnosis; T= Treatment

Brief on diseases listed under Module 1

Trypanosomosis / Surra

In the Greater Horn of Africa this is an endemic and very common disease of camels leading to major economical losses. The subacute and chronic forms typical for *Trypanosoma evansi* infection of camels (Arabic "Surra") are characterized by sleepiness. Surra is predominantly a disease of adult camels and very uncommon in animals below one year of age.

Epidemiology & Clinical Symptoms:

- *T. evansi* is transmitted mechanically by blood-sucking flies (*Tabanids*), including the camel fly (a large shiny reddish coloured fly that sucks blood specifically from camels, *Hippobosca camelina*).
- Transmission occurs over short distance, mostly within the herd or between herds that are close together (e.g. during watering).
- Transmission rates and disease incidence are higher during rainy season, when insect vectors are more abundant.
- Early symptoms in female camels are sudden drop in milk production and abortion.
- Pale mucous membranes and frequent lacrimation (both eyes) are typical.
- The picture emerging over months is that of a chronic 'wasting disease' characterized by progressive weight loss and deteriorating general condition.
- **Camels appear "sleepy" - they sit down and rest while other camels are feeding.**
- Dull coat, the long hairs at the tail coming off easily.
- Immune-suppression, camels become susceptible to many other diseases (e.g. pneumonia).
- Urine and breath develop a characteristic smell (signs of ketosis).
- In majority of cases death occurs after long illness; spontaneous self-cure occurs, but is very rare.
- At **post-mortem** there are no specific lesions, camels are anaemic and have a lot of fluid in the abdomen and also in the thorax; the post-mortem picture is influenced by secondary infections.
- In clinically healthy pregnant camels abortion is very common soon after infection; see Module 'Abortion'.
- There is an acute central nervous condition in camels caused by *T. evansi*, see Module 'Central Nervous Disease'.

Diagnosis:

Trypanosoma evansi can be seen in the buffy-coat of centrifuged EDTA blood samples. *Trypanosoma evansi* infected camels generally show a very low parasitaemia. For this reason a negative blood test does not rule out the presence of *T. evansi* infection. Antigen EIA for *T. evansi* if available offers a more sensitive diagnosis. A low haematocrit (<17%) is an indication for *T. evansi* infection. – In the field treatment decisions are mostly based on tentative clinical diagnosis.

Differential Diagnosis:

- Heavy worm infestation.
- Internal abscesses and tuberculosis.
- Malnutrition.

Treatment:

Trypanocides are relatively toxic. Do not inject dehydrated camels with trypanocides, they can collapse and die. Water and rest such animals before injecting the drug.

1. A combination of quinapyramine- salt and pro-salt (Triquin®) is available in a vial containing 2.5 g pale yellow/whitish powder that has to be dissolved in sterile water (provided with the drug, otherwise use boiled water that has cooled down). The preparation is administered through subcutaneous injection at a dose of 0.03 ml per kg live body weight. Treat sick camels as early as possible for high success rates. **Chronic cases do not respond well to treatment.** Also Triquin does not enter the brain and cannot cure CNS disease caused by *T. evansi*. The drug is highly irritating and should not be used other than subcutaneously. It is very important to observe clean injection practices by using new disposable needles to avoid contamination that can lead to abscesses. A total dose of 20 ml should not be exceeded for one camel. The drug may also be used for chemoprophylaxis and protects camels against *T. evansi* infections for 6 to 12 weeks.
2. Isomethamidium chloride (Samorin®, Trypamidium®) - This drug is applied as a 1% solution, i.e. contents of the 1 g sachet dissolve in 100 ml sterile water (or boiled water that has cooled). Administer the solution intravenously or by deep intramuscular injection at 0.5 mg/kg live body weight (equal to 1 ml/20 kg). **The drug is irritating and toxic and should preferably be used intravenously. Most camels with Triquin® resistant *T. evansi* infection when treated with Isomethamidium do not respond to treatment and may suffer from toxic effects.**
3. Melarsamine hydrochloride (Cymelarsan®) - is available as a ready-made 0.5% solution and administered at 0.25 mg/kg live body weight by deep intramuscular injection into the neck muscles. The drug has only short activity and cannot be used for prophylaxis; **only for curative treatment** (drug of 2nd choice in cases where resistance of parasites to other Trypanocides is suspected). Cymelarsan crosses the blood-brain-barrier and is the only Trypanocide that can be used to treat acute CNS disease in camels.

Caution:

Do not use products that contain **diminazene aceturate (Berenil®, Veriben®, Diminasan®, Dimaze®, Diminatryp®)** because this drug is **very toxic for dromedary camels and can cause mortality!**

Prevention:

Reduce risk of exposure to biting flies by avoiding highly infested areas where possible. Use pour-on insecticides when flies are troublesome. In areas known to have high seasonal incidence of Trypanosomosis, administer Quinapyramine (Triquin®) preparations for protective cover (Chemoprophylaxis) following the onset of the rainy season. Chemoprophylaxis is especially important for pregnant camels.

Triquin® Dosage Table

Body wt (kg)	Volume (ml)	Body wt (kg)	Volume (ml)	Body wt (kg)	Volume (ml)
10	0.3	150	4.5	400	12.0
20	0.6	200	6.0	450	13.5
40	1.2	250	7.5	500	15.0
60	1.8	300	9.0	550	16.5
100	3.0	350	10.5	600	18.0

Isomethamidium (1% solution) Dosage Table

Body wt (kg)	Volume (ml)	Body wt (kg)	Volume (ml)	Body wt (kg)	Volume (ml)
100	5.0	300	15.0	500	25.0
150	7.5	350	17.5	550	27.5
200	10.0	400	20.0	600	30.0
250	12.5	450	22.5		

Carry out correct weight estimate and dose carefully – Trypanocide drugs are more toxic than other veterinary drugs that are used in camels.

Gastrointestinal Helminths

For practical purposes two groups, blood-sucking and non-blood-sucking roundworms or helminths can be differentiated. Both groups include stomach worms, which live in the abomasums, are difficult to see with the eye, but cause more damage than the intestinal worms. The largest stomach worm in camels is *Haemonchus longistipes*, which is a blood-sucker and causes chronic anaemia in camels.

While causing similar clinical symptoms in the animal, helminth species do vary in pathogenicity. When present in large enough numbers they cause general weakness and reduced productivity. With moderate infestation levels, the animals are alert and feed well but lose condition progressively (subclinical infections). Clinical manifestations of helminth infections are especially severe in growing and young camels, in female camels under lactation stress and in animals on very poor pastures.

Epidemiology & Clinical Symptoms of Helminth Infestation:

- **Non-bloodsucking helminths** cause poor absorption of nutrients which manifests itself as diarrhoea, rough hair coat, bloated stomach, chronic weight loss and stunted growth in young camels; helminths in the abomasum (*Trichostrongylus* and *Ostertagia*) are very common and can cause severe problems.
- **Bloodsucking helminths** (esp. *Haemonchus*) are attached to the wall of the stomach and cause mainly anaemia; diarrhoea can also occur. *Haemonchus* infestation causes severe anaemia, loss in body condition and can kill young animals; other symptoms of heavy *Haemonchus* infestation are diarrhoea, weight loss and oedema on the lower limbs.
- **Tapeworms** (*Moniezia*) are the biggest gastrointestinal worms and are easily detectable in the faeces; they can cause obstruction and colic in young camel calves.
- Camels become mainly infected when it is wet, but high worm burdens can be carried into dry season and negatively affect absorption of nutrients and performance under dry conditions.
- High worm burdens in camels mostly occur about **3-4 weeks after the start of the rains**.
- At **post-mortem** the worms are present in the abomasum and in the intestines (e.g. *Trichuris*), but can be overlooked (esp. *Trichostrongylus*) if the post-mortem is performed in the field and without applying correct (and time-consuming!) parasitological post-mortem techniques.

Differential Diagnosis:

- Trypanosomosis (anaemia, oedema, weight loss).
- Other causes of diarrhoea (viruses, bacteria, coccidia).
- Chronic wasting conditions (chronic malnutrition; internal abscesses; tuberculosis).

Treatment:

Anthelmintic treatment should target the animals most at risk (young growing camels, lactating females). – Due to underestimation of body weight and under-dosing resistance to anthelmintics is becoming more and more common. Certain species of helminths (*Haemonchus contortus*) are shared between camels and goats/sheep and resistance to anthelmintics can

occur. It is very important to correctly estimate the body weight before dosing. – Due to underdosing and/or use of sub-standard drugs previous deworming of camels by the owner may not have been effective!

Most dewormers used for cattle can be used at the same dose rate in camels. Levamisole is not recommended for camels because it shows late and inconsistent action.

Albendazole is widely used in camels at a recommended dosage of 7.5 mg/kg; some **dosage examples**:

As drench:

- 12 ml drench (10%) for a calf of 120 kg body weight.
- 25 ml drench (10%) for a young adult of 250 kg body weight.
- 50 ml drench (10%) for an adult camel of 500 kg body weight (difficult to administer the total volume).

As bolus:

- One 600 mg Bolus for a calf of 120 kg body weight.
- Half a 2500 mg Bolus for a young adult of 250 kg body weight.
- One 2500 mg Bolus for an adult camel of 500 kg body weight.
- One 3000 mg Bolus for heavy adult camel of 600 kg.

Prevention:

Treat groups most at risk early to avoid build up of a too high worm burden; deworm groups of high risk animals when the first animal in the group starts showing clinical signs of helminth infestation. There is no need to deworm the whole herd - treating the entire herd can promote resistance to anthelmintics.

Avoidance of prolonged grazing of camels on the same pasture, especially when overstocked with sheep and goats, is the most important prophylaxis.

Module 2: Pox - like skin lesions

HANDOUT 1/HERD 1:



Photo: Gluecks

Herdsmen: "My camels are not feeding well and have pustules on their skin."

Herd 1	
Q	Are all camels in your herd affected?
A	Only suckling calves are sick
Q	Are your camels still feeding normally?
A	Yes most of the calves are still suckling their dams
Q	Have you heard of other herds in this area with similar problems?
A	No sure about this
Q	When did the problem start?
A	About one to two weeks ago
E	Examination of the skin
F	Pustules around the mouth
E	Examination of the head and inside the mouth
F	A foul breath can be notice
Q	Are the dams or lactating females still giving milk?
A	Yes they still give milk
Q	Have any your camels died since the disease outbreak?
A	No
Q	Have you observed any other signs or symptoms in the camels?
A	No

Q = Question; A = Answer; E = Examination; F= Finding;

Task:

- What is your clinical diagnosis?
- What main observations support your clinical diagnosis?
- What additional examinations or diagnostic tests would you carry out?
- What therapy would you recommend?
- Name three most important differential diagnoses and the major differences to rule them out in this case!
- What advice would you give the herder to control the disease?

Module 2: Pox - like skin lesions

HANDOUT 1/HERD 1:



Photo: Gluecks

Herdsmen: "My camels are not feeding well and have pustules on their skin."

	Herd 2
Q	<i>Are all camels in your herd affected?</i>
A	Mainly young and weaned camels are affected
Q	<i>Are your camels still feeding normally?</i>
A	No, some of them really have difficulties in feeding normally
Q	<i>Have you heard of other herds in this area with similar problems?</i>
A	Not sure
Q	<i>When did the problem start?</i>
A	It started one to two weeks ago
E	Examination of the skin
F	Pustules around the mouth
E	Examination of the head and inside the mouth
F	There is a foul breath and the head is swollen including the lips. In some cases the swelling even reaches the eyes so that the camel cannot open its eyes
Q	<i>Are the dams or lactating females still giving milk?</i>
A	Yes they still give milk.
Q	<i>Have any of your camels died since the disease outbreak?</i>
A	No
Q	<i>Have you observed any other signs or symptoms in the camels?</i>
A	No

Q = Question; A = Answer; E = Examination; F = Findings;

Task:

- What is your clinical diagnosis
- What main observations support your clinical diagnosis?
- What additional examinations or diagnostic tests would you carry out?
- What therapy would you recommend?
- Name three most important differential diagnoses and the major differences to rule them out in this case!
- What advice would you give the herder to control the disease?

Module 2: Pox-like skin lesions

HANDOUT 1/HERD 3:



Photos: Dioli

Herdsmen: "My camels are not feeding well and have pustules on their skin."

	Herd 3
Q	<i>Are all camels in your herd affected?</i>
A	All the young camels are sick and many of the old ones
Q	<i>Are your camels still feeding normally?</i>
A	No, some have stopped feeding
Q	<i>Have you heard of other herds in this area with similar problems?</i>
A	Yes, my neighbour has the same problem
Q	<i>When did the problem start?</i>
A	It started one to two weeks ago.
E	Examination of the skin
F	Pustules around head, teats and under the tail. Some camels have lesions all over their body with pus which attracts the flies
E	Examination of the head and inside the mouth
F	Pustules can be found, but are all over the body
Q	<i>Are the dams or lactating females still giving milk?</i>
A	Most of the females have stopped giving milk
Q	<i>Have any of your camels died since the disease outbreak?</i>
A	Yes, one of my male adult camels died. But this was before I saw any lesions on the other camels.
Q	<i>Have you observed any other signs or symptoms in the camels?</i>
A	Yes, two of my female camels aborted, some of the weaners have difficulties with breathing, and one camel has a problem with the udder (mastitis)

Q = Question; A = Answer; E = Examination; F= Finding;

Task:

- What is your clinical diagnosis?
- What main observations support your clinical diagnosis?
- What additional examinations or diagnostic tests would you carry out?
- What therapy would you recommend?
- Name three most important differential diagnoses and the major differences to rule them out in this case!
- What advice would you give the herder to control the disease?

Module 2: Pox - like skin lesions

Herdsman: "My camels are not feeding well and have pustules on their skin."

	Herd 1	Herd 2	Herd 3
Q	Are all camels in your herd affected?		
A	Only suckling calves are sick	Mainly young and weaned camels are affected	All the young camels are sick and many of the old ones
Q	Are your camels still feeding normally?		
A	Yes most of the calves are still suckling their dams	No, some of them really have difficulties in feeding normally	No, some have stopped feeding
Q	Have you heard of other herds in this area with similar problems?		
A	Not sure about this	Not sure about this	Yes, my neighbour has the same problem
Q	When did the problem start?		
A	About one to two weeks ago	About one to two weeks ago	About one to two weeks ago
E	Examination of the skin		
F	Pustules around the mouth	Pustules around the mouth	Pustules around head, teats and under the tail. Some camels have lesions all over their body with pus which attracts the flies
E	Examination of the head and inside the mouth		
F	A foul breath can be noticed	There is a foul breath and the head is swollen including the lips. In some cases the swelling even reaches the eyes so that the camel cannot open its eyes	Pustules can be found, but are all over the body
Q	Are the dams or lactating females still giving milk?		
A	Yes they still give milk	Question not applicable	Most of the females have stopped giving milk
Q	Have any of your camels died since the disease outbreak?		
A	No	No	Yes, one of my male adult camels died. But this was before I saw any lesions on the other camels
Q	Have you observed any other signs or symptoms in the camels?		
A	No	No	Yes, two of my female camels aborted, some of the weaners have difficulties with breathing, and one camel has a problem with the udder (mastitis)

Q = Question; A = Answer; E = Examination; F = Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control

D	What is your clinical diagnosis		
D	<u>Most likely Orf</u>	<u>Most likely Orf</u>	<u>Camel Pox</u>
D	What main observations support your clinical diagnosis?		
D	Only calves and weaners affected, but no other herds.	Only calves and weaners affected, but no other herds.	All age groups affected; additional symptoms like abortion, respiratory distress and sudden death; other herds also affected
D	Additional examination / diagnostic tests		
D	Skin lesion can be examined with electron microscope if available		
DD	Any other disease to be considered?		
DD	Other skin conditions, however they usually do not cause fever. Anthrax can cause the swelling of the head, but no skin lesions found.		
T	What therapy do you recommend?		
I	Keep lesion soft with Vaseline or milking fat, use antiseptic mouth wash, in severe cases inject with penicillin & streptomycin and use iodine or gentian violet spray for the skin lesions. Treatment is only symptomatic.		
C	What control measures do you recommend?		
C	Ideally camels should get infected at an early age. The progression of the disease will then be milder.	Ideally camels should get infected at an early age. The progression of the disease will then be milder.	A vaccine against camel pox does exist (Ducapox®) however it is not available in East Africa.
	In general infected animals, or an infected herd should be kept separated from other herds. Rest and good nutrition should be ensured as well as no additional stress factors (e.g. trekking long distances, limited water and food etc.)		

Q = Question; A = Answer; E = Examination; F= Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control

MODULE 2

HANDOUT 2

LEAD SYMPTOM: POX-LIKE SKIN LESIONS

DISEASES COVERED:

POX

ORF

Brief on Diseases Listed under Module 2

Camel Pox

Camel Pox is endemic in camel - keeping regions and are caused by *Orthopoxvirus cameli*, which is specific to and affects only camels. Short distance transmission between and within camel herds is mainly through inhaling, but the virus also enters the body through skin injuries and/or through insect bites. – **Camel Pox severely disrupts reproduction and milk production in the herd!**

Epidemiology & Clinical Symptoms:

- Due to the lifelong immunity in all recovered animals, successive regional Camel Pox outbreaks are separated by several Pox-free years. During epizootics the spread of Pox in a wider region is slow and mainly through contact. The disease is particularly dangerous in isolated camel herds that have not been part of the regular Pox infection cycles (adults, sub-adults and young are all fully susceptible!)
- During rainy season wet and dirty conditions aggravate Pox disease due to more frequent transmission of bacteria (abundance of biting flies) causing severe secondary infections. **Pox lesions** start as small red patches; they swell and become liquid - filled pustules with a depressed centre (= **the Pox**), these then rupture and turn into blisters (it is at this ruptured stage that most lesions are seen on the skin).
- Acute swelling of the head can occur before any Pox lesions appear on the skin; this causes breathing problems.
- **Mild form:** Pox found only around nose, mouth, eyes and under the tail, recovery without any problems.
- **Severe form:** High fever, the animal is very dull and almost completely off feed, swollen lymph nodes; generalized Pox lesions appear all over the skin surface on all parts of the body; secondary infection of the Pox lesions by bacteria (transmitted by flies!) result in camels developing multiple purulent skin lesions, which can lead to extreme weakness and sometimes death; healing can take 4-6 weeks.
- Especially in young camels, Pox lesions also develop inside the respiratory tract and can lead to secondary bacterial pneumonia and death if not treated early with antibiotics; in severe outbreaks, 3 out of 10 infected young camels can die from secondary infections.
- Pox lesions on the teats make milking difficult which regularly leads to mastitis; **almost all pregnant females abort.**
- **Peracute form** (only seen in adults): Severe swelling of the head and throat, leading to rapid death (anaphylactic shock with oedema, asphyxia and death occur within less than 24 hours), no skin lesions.

Differential Diagnosis:

- Orf - mild Camel Pox and Orf look exactly the same!
- Mange, Ringworm and Contagious Skin Necrosis can also result in purulent skin lesions and produce confluent scabs, but no Pox lesions.

Treatment:

There is no specific treatment for Pox virus; in severe cases especially when young camels start showing signs of bacterial pneumonia or when skin lesions become purulent Penicillin-Streptomycin (daily injection for 5 days) or Oxytetracycline 20% (long-acting, repeat injection on day 4) should be used for symptomatic treatment. If available, also inject vitamin A (normally available only as vitamin ADE combination), which helps in recovery. Petroleum jelly should be applied to the lesions especially around the mouth the keep them soft and prevent them from cracking and prevent further secondary bacterial infection.

Prevention:

Vaccination is possible. There is a commercial vaccine, which is available in the UAE but not in East Africa (Ducapox®, two successive vaccinations confer lifelong immunity). When a camel herd is going through a Pox outbreak, ensure rest and good nutrition and avoid all stress. During outbreaks avoid all contact with other camel herds.

Orf (Contagious Ecthyma)

Orf is endemic in all camel keeping regions. It is caused by *Parapoxvirus ovis* and is a typical and very common disease of suckling camel calves. Orf can occasionally also occur in adults. It is more severe in older animals than in young calves.

Epidemiology & Clinical Symptoms of Orf:

- Some *Parapoxvirus ovis* strains are shared between lambs, kids and camel calves and outbreaks in all three species can occur simultaneously.
- Virus transmission is sustained via healthy carrier camels present in the herd. Orf outbreaks occur mostly in relation to calving cycles and affect especially suckling camel calves, elder calves and weaners below three years of age. It can occur in adult camels as well.
- The general picture is characterized by Pox-like swellings on the head, around the mouth, lips and nose. – Generalised Orf can occur in weak animals.
- Before skin lesions appear there can be acute severe swelling of the head, especially of the lips, causing breathing problems and completely preventing the animal from suckling or feeding.
- From the start the calves lacrimate and are very dull.
- The swellings and nodules turn into blisters that look exactly like Pox lesions.
- The Pox-like lesions then form scabs that can become confluent on the head.
- The same lesions as on the skin also appear inside the mouth and nose.
- In severe cases Pox-like lesions can spread to the alimentary tract (seen in the oesophagus and stomach at post-mortem).
- In relation to secondary bacterial infections other symptoms include stinking breath and swollen lymph nodes.
- Throughout the clinical illness calves have serious difficulties in suckling and feeding.
- In mild Orf, only a few blisters/scabs form around the mouth and heal quickly.
- Adult camels show swollen, oedematous heads, especially around lips and eyes together with the Pox-like lesions. They have difficulties in breathing and feeding and lose condition.

Differential Diagnosis:

- Camel Pox, although Orf and Pox present a somewhat different epidemiological pattern the two diseases cannot be differentiated on clinical grounds.
- Contagious Skin Necrosis, Ringworm and Mange all do not cause Pox-like lesions, but can form confluent skin scabs.

Treatment:

Severe cases should be treated with penicillin-streptomycin daily until recovery (at least for 5 consecutive days). Good nursing and antiseptic mouth washes (e.g. iodine) are very important. Petroleum jelly should be applied on the affected areas to soften the skin. Sick calves must be assisted to suckle if necessary, including bottle feeding in extreme cases. Injecting vitamin ADE helps with the recovery.

Prevention:

Practically every camel will become infected by Orf once in its' lifetime. There is no specific vaccine for camels. Camel calves and weaners in good condition recover fast. Good management of lactating mothers, allowing calves to suckle enough milk and timely deworming of elder calves and weaners are important.

MODULE 3

HANDOUT 2

LEAD SYMPTOM: RESPIRATORY DISTRESS

DISEASES COVERED:

NASAL BOT FLY

TUBERCULOSIS

PNEUMONIA (ACUTE, CHRONIC)

VIRAL INFECTIONS (INFLUENZA LIKE)

BACTERIAL INFECTIONS

Brief on Diseases Listed under Module 3

Respiratory Disease

Knowledge on respiratory diseases of camels is limited to outbreak reports and remains sketchy to date. Similarities with other livestock species do exist and camels share respiratory pathogens with ruminants and with equines. One has to be careful not to go too far in assuming that all details of respiratory diseases established in other livestock species also apply to camels in the same way.

Respiratory pathogens described in camels include:

- Parainfluenza virus 3: serological evidence in Africa and Middle East and suspected involvement in respiratory camel disease outbreaks in Ethiopia and in Somalia.
- PPR virus: serological evidence, implicated in respiratory disease outbreaks in Ethiopia and in Sudan.
- Adenovirus: only serological evidence
- Bacterial pathogens described in camels include: beta-haemolytic *Streptococci*, *Staphylococcus aureus*, *Klebsiella* spp., *Pasteurella* spp., *Mannheimia* spp., *Mycobacterium* spp., *Burkholderia pseudomallei*.

(Lungworms of camels only play a role in cold parts of Asia.)

The following sub-division of respiratory disease syndromes is based on practical clinical considerations.

1. Infection of the Upper Respiratory Tract

Clinical & Epidemiological Features:

- Spread within the herd is quick and a large number of animals is affected within a short period (1-2weeks), some outbreaks probably caused by Parainfluenza virus 3.
- Main symptoms are sneezing, serous secretion from the nose and conjunctivitis, also mild cough.
- Animals develop fever and may be off feed for a short time, most will resume feeding while still recovering.
- In the absence of climatic (wet & chilly) and/or nutritional stress (emaciated animals coming out of a drought) recovery is mostly swift and complete in less than two weeks (per individual case).
- Secretion from the nose may turn purulent, coughing become more severe and breathing painful due to secondary bacterial infections; bacteria involved include saprophytic *Streptococci* that are very common in the nasopharynx of healthy camels; animals that develop secondary infections remain dull and feed only very little or are completely off-feed.

Treatment:

It is important to rest camel herds during outbreaks of respiratory disease, driving them at most only over short distances. There is no specific treatment for viruses affecting the respiratory tract. In cases with prolonged recovery and signs of secondary bacterial infection antibiotic therapy is indicated. For Kenya, based on antibiotic sensitivity testing of isolates from the respiratory tract of camels and on empirical evidence from treatment of respiratory infections in camels, *Penicillin-streptomycin* (treatment for at least 5 days) appears to be the drug of choice. Other drugs that have been successfully used for treating respiratory disease in camels are amoxicillin (long-acting) and 20% oxytetracycline (Long-Acting).

Camel Nasal Botfly (*Cephalopina titillator*)

Maggots of this fly commonly inhabit the nose and nasal sinuses of camels. Heavy infestation can lead to congestion of the nasal cavity, blockage of the sinuses and severe rhinitis. Sneezing and secretion of thick pus are seen especially in the morning but do not affect feeding behaviour and condition of the camel in a significant way. In severe cases parenteral treatment with ivermectin is efficient, but expensive.

2. Acute Pneumonia

Clinical & Epidemiological Features:

- Cases seen mostly in immuno-incompetent (calves) or immuno-compromised (*T. evansi*, PPR) individuals often as a sequel to acute respiratory infection; infection progresses from upper to lower respiratory tract: bronchitis → bronchopneumonia; manifested as painful coughing, increasing dullness and accelerated/laboured breathing.
- Affects all age groups but more common in calves and weaners.
- Poor physical condition especially when combined with climatic stress (sudden drop in temperatures, wet and chilly conditions at onset of rains), Pox, also PPR, chronic *Trypanosoma evansi* infection and high worm burden all predispose camels to bacterial pneumonia.

Treatment:

Pneumonia can progress fast to reach a fatal state. Affected camels should be treated early with:

- Penicillin-streptomycin (once daily for 3 to 5 days)

or

- Amoxicillin long-acting (every second day)

or

- 20% Oxytetracycline long-acting (repeat on fourth day).

There are no pneumonia vaccines for camels. Avoidance of the predisposing factors listed is important.

Aspiration Pneumonia

Accidental introduction of fluid into the lungs (incorrect drenching with dewormer or rehydration fluid) can cause sudden severe inflammation of the lung. Often very difficult to treat.

3. Chronic Pneumonia

Clinical & epidemiological features:

- Individual cases mostly seen in old animals.
- Characterized by painful chronic cough and progressive loss of condition.
- Specific causes include Tuberculosis, which is not common in camels kept under extensive management but can become a problem where animals are kept under crowded conditions; Tuberculosis is a dangerous zoonosis.
- *Corynebacteria* have occasionally been found in lesions of the respiratory tract of camels.
- *Burkholderia pseudomallei* ("Meloidosis") causes chronic Pneumonia, which presents itself as a wasting disease in camels; the pathogen occurs in the tropics & subtropics but has so far not been reported from Africa; Melioidosis is a dangerous zoonosis with extremely high fatality rates in humans!
- Chronic Pneumonia may occasionally present as a long-standing respiratory infection in younger animals as a result of untreated / inefficiently treated acute Pneumonia.

Treatment:

Chronic lung disease is resistant to antibiotic treatment. Transient improvements seen during treatment are followed by relapse after the end of the antibiotic. Both, Tuberculosis and Melioidosis cannot be treated and are very difficult if not impossible to confirm in the live animal. Old camels with chronic lung disease should be killed (or slaughtered) under controlled conditions (presence of a veterinarian, taking precautions to avoid exposure of humans). If suspicious lung lesions are seen the carcass must be immediately destroyed. Samples should be taken to a laboratory for confirmation.

**MODULE 4
HANDOUT 2
LEAD SYMPTOM: SICK CALF**

**DISEASES COVERED:
TICK PARALYSIS
DIARRHOEA IN SUCKLING CAMEL CALVES
LACK OF COLOSTRUM & MECONIUM RETENTION
PERI-ARTHRICULAR ABSCESSSES & NAVEL ILL**

Brief on Diseases Listed under Module 4

Tick Paralysis

Epidemiology:

The disease occurs in suckling calves. First symptoms are seen about one week after the ticks (nymphs) have attached. Especially *Hyalomma* nymphs ("white ticks" attached mainly to the skin under the long hair in front of the hump) inject a salivary toxin into the blood while feeding. Older camels are normally immune against tick toxin.

Clinical Symptoms:

The toxin causes hind leg paresis, fast breathing, sweating, ataxia and rapid death. Death can occur within a few hours(!) - otherwise within 1-2 days.

Treatment:

Manual removal of the ticks is followed by fast improvement of the clinical condition and full recovery. Time is of the essence! Do not treat sick calves with acaricide, rather start removing ticks immediately. Supportive therapy (Cortisone, Vitamin B) can help.

Prevention:

Apart from the risk of tick paralysis, heavy infestation of calves with ticks causes general weakness, anaemia, multiple skin abscesses and stunted growth. Advise owner on need to reduce tick burden in the herd. Spray at least the calves against ticks (Knapsack).

Diarrhoea in Suckling Calves

Diarrhoea

Diarrhoea is the main cause of pre-weaning losses in camel calves and affects especially animals aged from birth up to 12 weeks of age. It has been studied in different camel keeping regions and some of the intestinal pathogens common in domestic ruminants have also been identified in camel calves. *Salmonella* spp. have been found in all camel populations studied and are very significant pathogens, causing diarrhoea and Septicaemia in camel calves. In addition *Isospora orlovi*, a pathogen of carnivores, birds, pigs and humans, also plays an important role in diarrhoea of suckling camel calves.

The intestinal pathogens described in camel calves include:

- Salmonella
- *E. coli* (incl. Capsular type K99)
- *Klebsiella pneumoniae*
- (Clostridia - sporadic cases in weaners)
- Rota and Corona virus
- Coccidia – play only a minor role in suckling calves, but can cause diarrhoea in older calves, weaners and adults
- Isospora

Clinical & Epidemiological Features:

- Diarrhoea occurs most frequently in camel calves 1 - 10 weeks old.
- Initial symptoms include frequent passage of loose faeces (watery, bloody, pasty, with pieces of mucosa, sometimes also smelly), followed by very little if any passage of faeces and constant pressing; soiled hind legs.
- Dehydration symptoms, which rapidly intensify over time, are: complete inappetence, dullness, weakness, eyes sink deep into the socket, cold nose, cold skin surface, raised skin fold does not slide back, inability to stand → death due to dehydration.
- Dehydrated calves that cannot stand up any more are about to die.

Treatment:

- Pastoralists normally withhold or severely limit milk intake of diarrheic calves which aggravates the calf's condition severely.
- The most important treatment measure regardless of the cause of diarrhoea is replacement of lost fluid and electrolytes (oral rehydration, see below); oral rehydration treatment is only successful if the diarrheic calf can still stand and suckle!

- If available, repeated i.v. or s.c. administration of electrolyte-glucose solutions can be attempted in severely dehydrated recumbent calves, but most will still die.
- Antibiotic therapy targeting the infectious agent is indicated for bacterial Septicaemia (esp. for Salmonella) but has little effect on intestinal infections, which are mostly self limiting; antibiotic sensitivity tests are useful in providing guidance on the best choice of drugs, esp. for Salmonella.
- Sulphonamide-TMP combinations, often used orally for diarrhoea treatment, are contraindicated in dehydrated calves.
- Coccidial infections are self-limiting, anti-coccidial drugs have not been tested specifically for camels; most have no effect on; one coccidiostatic (Salinomycin) is extremely toxic for camels.

Where ready-made rehydration salt mixes are not available the following rehydration formula can be used:

- Mix 5 tablespoons of sugar and 1 tablespoon of salt with 2 litres of clean water (boil water and let it cool down before mixing); instead of 5 tablespoons sugar one can also use 5 tablespoons of honey.
- In addition, pulverised charcoal (to absorb and remove toxins from the intestine) can be added to the rehydration fluid: 2 handfuls of charcoal powder per litre, passed through a sieve before giving it to the calf.

Oral rehydration protocol

- A 30 kg calf needs minimum 3 litres of oral rehydration fluid per day (minimum 1 litre for 10 kg body weight per day). Rehydration fluid must be given orally in small portions at the rate of max. 0.5 litre at a time.
- Rehydration fluid should be given for 5 days.
- Milk may be withheld for the first 24 hours but not for longer than 36 hours; from the second day on small amounts of milk should be fed.
- Keeping calves in the shade slows down dehydration.

Prevention:

- Diarrhoea treatment is a race against time, to prevent camel calves from entering into severe dehydration camel owners must be educated to start oral rehydration treatment as soon as diarrhoea symptoms have been observed.
- Camel calves are born into an environment contaminated with faecal organisms and coccidia / Isospora; the immune status of the calf and the level of contamination with pathogens decide on the outcome of inevitable oral infections in suckling calves.
- Ensure early suckling after birth for optimum transfer of maternal colostral antibodies.
- Minimise environmental exposure of the newborn (frequent relocation of the camel enclosure, clean calving area, separate fresh enclosure for the dam and her newborn).
- Oral application of crushed raw eggs: chicken eggs contain acid-fast Immunoglobulin-Y; chicken sharing the same environment with camels will have antibodies to faecal organisms present in camel enclosures, which can confer some protection.

Lack of Colostrum & Meconium retention

As in ruminants, camel calves are not immune-competent at birth and depend on transfer of colostral antibodies to acquire passive immunity as a protection during their first weeks of life.

Clinical & Epidemiological Features:

- Some pastoralist communities believe that excess colostrum causes diarrhoea; in consequence they restrict or delay colostrum intake by the newborn calf; this causes low absorption of maternal colostral antibodies or even complete failure of antibody transfer between the dam and the newborn.
- Low immunoglobulin levels in newborn camel calves predispose them to fatal infections with opportunistic pathogens present in the environment.
- Colostrum also acts as a mild laxative and stimulates the passage of the first faeces (meconium), hence lack or absence of colostrum can lead to meconium retention.

Prevention / Treatment:

- Educate camel owners on the absolute need to let newborn calves suckle as early as possible after birth for optimum transfer of maternal colostral antibodies
- Colostral antibodies are still absorbed by the newborn on day two postpartum, albeit at lower efficiency; giving colostrum late is better than giving no colostrum at all.
- Colostrum from other camels that have calved at roughly the same time can be used for the newborn in cases where its' own mother gives no milk, dies or rejects the calf.
- Rectal application of liquid paraffin can assist with passage of the first faeces.

Peri-arthric Abscesses & Navel ill

Clinical & Epidemiological Features:

- Suckling camel calves can develop small external abscesses around the joints where the skin is rubbing on the soil when they are lying down because they have not yet developed hard skin pads like adult camels.
- These abscesses around the joints can become chronic and can spread to the joint capsule, the inside of the joint, tendons and muscles - resulting in inability of the calf to stand and suckle.
- Peria-arthric abscesses appear at three to eight weeks of age and resolve in most cases; some progress and increase in severity and are still present in camel calves up to nine months old.
- If untreated the condition can cause severe stunting and sometimes death.
- Infections of the umbilical cord leading to omphalogen ascending infections (omphalophlebitis, 'navel ill') are by far less common in newborn camel calves as compared to newborns of other livestock species.

Prevention / Treatment:

- In cases where the process is not self limiting and where the abscess capsule is soft, make an incision with a clean scalpel at a low point to allow the pus to drain out.
- Flush with hydrogen peroxide (3%), iodine or gentian violet and repeat flushing for several days.
- In severe cases, especially in calves with multiple abscesses around the joints, treat with penicillin-streptomycin (daily injection for 5 days).
- For navel ill the prophylaxis and treatment are the same as in other livestock.

MODULE 5

HANDOUT 1

LEAD SYMPTOM: CENTRAL NERVOUS PROBLEMS

DISEASES COVERED:

RABIES

VIRAL AND BACTERIAL MENINGITIS

***CAPPARIS TOMENTOSA* POISONING**

CENTRAL NERVOUS FORM OF TRYPANOSOMOSIS

Brief on Diseases Listed under Module 5

Central Nervous Problems

Knowledge on CNS disease of camels is very limited. It can be expected that some CNS infections known from other livestock also affect camels. - Taking as complete a case history as possible is extremely important for CNS disease. Clinical symptoms vary as the disease progresses and only very few clinical signs may be observed during the visit.

Rabies

Epidemiology:

Rabies virus can infect all warm blooded vertebrates and is transmitted via infective saliva. Camels contract Rabies virus when they are bitten by rabid stray dogs or rabid predators (e.g. hyena); they can also become infected through bites from a rabid camel within the herd.

Clinical Symptoms & Diagnosis:

'Silent Fury' is uncommon in camels who mostly exhibit the 'Raging Fury'. The symptoms listed below are not all seen in individual cases.

After an incubation period from 3 weeks to 6 months (can be longer!) the signs seen in 'Raging Fury' are:

- Initial restlessness, stops feeding and drinking (lasts 1-2 days)
- Excitative stage - biting, snapping, itching, self-mutilation, hypersexual behaviour in bulls (this stage lasts 1 -3 days)
- Paralytic stage – hypersalivation, tremor, almost constant attempts to yawn, lateral recumbency with flailing legs (lasts up to two days)
- Death within 7 (possibly up to 10) days

In cases of 'Silent Fury' the only clinical signs are weakness, trembling, sternal recumbency and death. Rabies cases cannot be differentiated from meningitis on clinical grounds and may go unnoticed. This puts the owner, the public and the examining vet at an extreme risk unless the head/brain is taken to a laboratory after post-mortem to be examined for Rabies (identification of Negri bodies in the Ammon's horn).

Note: in camels, Negri bodies may sometimes only be present in the medulla oblongata

→ always include the neck/spinal cord samples for laboratory investigation!!!

Abnormal objects found in the Rumen at post-mortem can be an indication of Rabies.

Treatment:

There is no treatment and no spontaneous recovery. A rabid camel must be killed (not slaughtered)! without exposing humans to infection risk and without destroying the brain/skull. Repeatedly vaccinate all in contact livestock and humans against Rabies (follow vaccine manufacturers instructions for post-exposure vaccination)! Rabies virus is excreted by the infected animal several days before first clinical symptoms appear. Also vaccinate livestock and humans who were in contact with the rabid camel during the week before it fell sick.

Prevention:

Vaccination. Unless followed up by a booster injection, one single vaccination only protects for under one year.

Viral and Bacterial Meningitis

Epidemiology and Clinical Symptoms:

Listeria have been isolated in New World camelids fed on silage but not from camels. No specific viral or bacterial meningitis pathogens have been confirmed in camels. Clinical cases of meningitis are seen sporadically in camels in the field. Depending on the part of the brain affected such cases can present as unilateral or partial paralysis and normally result in recumbency.

It is of imminent importance to conclusively differentiate and confirm any form of CNS disease from Rabies! The clinical picture of 'Silent Fury' and other bacterial/viral meningitis can look exactly the same.

Treatment Attempt:

High doses of penicillin-streptomycin or other antibiotics can be injected daily for 5 days.

Hydatid Cysts

Cysts of the *Echinococcus granulosus* tapeworm of dogs and other carnivores are found regularly in the organs of camels (esp. in the liver and lung), including in the brain. In relation to the localisation of the cyst in the brain a commonly seen symptom is circling movement (“turning sickness”).

Bacterial abscesses, including Tuberculosis, localised in the brain may cause a similar clinical picture.

There is no efficient treatment for Hydatid cysts. Tapeworm cysts found at slaughter or during post-mortem are a major public health hazard and must be burned or buried to disrupt the tapeworm transmission cycle.

Taenia multiceps cysts (*Coenurus cerebralis*) can occasionally be found in the brains of camels causing dizziness and staggering.

Capparis Tomentosa Poisoning

Epidemiology:

Under very dry conditions livestock may have to be grazed in areas normally not browsed by camels. The most common toxic plant found in such areas of East Africa is the *Capparis tomentosa* tree, which contains poison in its’ fruits, flowers and leaves. Apart from severe drought situations, older camels normally avoid this tree, but young camels may ingest the fruits when they are in season.

Clinical Symptoms:

These include sideways bending of the neck, difficulty in walking, paralysis and emaciation in prolonged cases.

Note:

Many other plant poisonings are known locally by experienced camel pastoralists.

Treatment:

Stop camels from feeding on the tree. Various traditional treatments are applied by camel pastoralists. There is no clear information on the efficacy of general anti- poisoning treatment.

Prevention:

Advise camel owners to avoid grazing in areas where the tree is known to occur. In case such areas have to be used for grazing during dry season or during drought the herdsman must prevent camels from feeding on this tree. If herdsman are negligent or inexperienced whole groups of camels, especially subadults and weaners, can die from plant poisoning.

Wry Neck

This is a clinically similar syndrome of unclear aetiology, which is commonly found in camels in East Africa. It is not related to feeding on any specific plant and causes only isolated cases. Most likely it is related to physical trauma. The typical clinical picture includes:

- Twisted neck, often double bent (S-shape)
- Only severely with feeding in severely affected cases
- Camels may recover spontaneously, even overnight!

Traditionally it is treated by branding of the neck. Unconfirmed reports indicate that vitamin B injection or bakers yeast given as an oral drench have a beneficial effect.

Central Nervous Trypanosomosis

Epidemiology:

Following infection with *Trypanosoma evansi* camels frequently develop a chronic state that can last for years. In chronically infected camels parasites evade the immune system by hiding in the meninges. A compromised general immune status due to poor physical condition and stress (e.g. long distance trekking) can trigger a relapse with occult *T. evansi* infection suddenly manifesting itself as central nervous disease.

Clinical symptoms & diagnosis:

Blindness is perhaps the most commonly seen sign of central nervous *T. evansi* infection. Other symptoms include severe dullness, circling movement, trembling, unusual aggressiveness (like Rabies!), aimless running and sudden collapse. Death occurs within a few weeks.

Trypanosoma evansi can be seen in the buffy-coat of centrifuged EDTA blood samples. But a negative result of the blood analysis does not rule out presence of trypanosome in the brain.

Treatment:

The only trypanocidal drug for use in camels that can cross the blood-brain - barrier and reach therapeutic concentrations in the meninges is melarsomine (Cymelarsan®) injected i.m. at 0.25 mg/kg. Cure rates in camels exhibiting central nervous symptoms are low.

Prevention:

Early treatment of suspected cases and chemoprophylaxis with quinapyramine (Triquin®) during periods with high risk of transmission can prevent establishment of *T. evansi* in the brain.

Module 5: Central Nervous symptoms

Handout 2

Herdsman: "My camel/s is/are behaving abnormally."

	Herd 1	Herd 2	Herd 3	Herd 4
Q	Are all camels in your herd affected?			
A	One bull is sick	One camel is sick	Three weaner are behaving abnormally	One adult camel is affected
Q	When did the problem start?			
A	Two days ago	Five days ago	Over a week ago.	One week ago
Q	Are animals still feeding normally?			
A	No, not feeding	No, not feeding	Trying to feed.	Feeding very little and cannot see
Q	What other disease signs did you see?			
A	Bull is trying to mate other camels. And he doesn't drink any water	Camel is "one sided"	Only poor feeding	Other female camels are losing condition rapidly
E	Clinical examination!			
F	Camel in good condition but very aggressive and irritated. At times absent minded	Camel in good condition but has severe coordination problems and is recumbent	Camels in relatively good condition but have a bent neck and problem in walking	Camel in very poor condition, hump almost gone and is blind on both eyes
Q	Have any of your camels died since the disease outbreak?			
A	No	No	One weaner died	One adult died last month
D	What is your clinical diagnosis			
D	<u>Rabies</u>	<u>Meningitis</u>	<u>Plant poisoning</u>	<u>Trypanosomosis</u>
D	What main observations support your clinical diagnosis?			
D	Aggressive behavior and water phobia	Problem in coordination only one animal affected	Several animals affected, incoordination in walking, bent neck	Blindness and poor condition
D	Additional examination / diagnostic tests			
D	Inquire about contact between rabied animal and carnivore or other animals in the herd	Post mortem might give a clue	Inquire about poisonous plants in the area e.g. <i>Capparis tomentosa</i>	Blood sample (haematocrit / PCV, microscopic detection of the parasite) though difficult at this stage
T	What therapy do you recommend?			
D	Camel should be killed. Head send to laboratory for analysis. Whole herd should be vaccinated against rabies. Animals that were in contact or bitten should be observed carefully	Is difficult to treat but antibiotic treatment (e.g. with oxytetracycline 20% LA or penicillin & streptomycin over 5 days) and injection with vitamin B complex	Camels should move to different pasture immediately to avoid poisoning with plant	Only trypanocide that passes the blood-brain barrier is Cymerlarsan®

Q = Question; A = Answer; E = Examination; F= Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control

C	What control measures do you recommend?		
C	Vaccination of the whole herd in areas where rabies is a big problem.		Avoid known areas with poisonous plants Treat whole herd with quinapyramide (e.g. Triquin®) at least twice a year to prevent infection. Use pour-on or spray with acaricides

Q = Question; A = Answer; E = Examination; F= Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control



Photo: Diolo
 Photo 1: Camel with terminal signs of rabies (yawning and paralysis).



Photo: Diolo
 Photo 2: Camel with *Capparis tomentosa* poisoning, difficulties in getting up, stiff walking, stiffly joints swollen and emaciation

MODULE 6

HANDOUT 1

LEAD SYMPTOM: ACUTE DEATH IN ADULT CAMELS

DISEASES COVERED:

ANTHRAX

ACUTE TRYPANOSOMOSIS

HAEMORRHAGIC SEPTICAEMIA

CAMEL SUDDEN DEATH SYNDROME

SNAKEBITES

Dead Adult Camel

Apart from Anthrax, the veterinary knowledge on confirmed causes of acute deaths in adult camels is virtually non-existent. This puts the veterinarian in a rather difficult situation when faced with disease outbreaks in the field involving deaths of valuable adult camels. Taking no action at all is not an option. Pragmatic decisions have succeeded in curbing outbreaks of unclear aetiology in the past.

Anthrax

Epidemiology:

Bacillus anthracis is the cause of a soil-born infection that leads to peracute and acute disease in camels. Typically infections occur when camels are grazed in seasonally dry flood plains or when they have to feed on very short grass stubbles during drought. The infection is transmitted via spores that are released from cadavers of animals that died of Anthrax. Anthrax spores are extremely resistant and can survive for decades in the environment. Anthrax contaminated high risk pastures are often well known to pastoralists. Following unusual rain and heavy flooding new pastures can become contaminated when Anthrax cadavers or spores are carried by the water into hitherto clean areas.

Anthrax is a very dangerous zoonosis. Humans become infected when they slaughter or dissect Anthrax infected camels. Anthrax spores survive cooking; humans regularly die after eating Anthrax contaminated meat.

Clinical Symptoms:

In the peracute form sudden death is often the only symptom seen in camels.

The acute form can show any of the following signs:

- Fast, laboured breathing
- Trembling
- Colic & bloat
- Painful swelling on throat & on base of the neck, swelling of other body parts
- Most camels die within 2 to 4 days
- Tar - like un-clotted blood visible on body orifices

Diagnosis:

Blood smears and a ligated ear are the easiest and safest to collect and to transport to the laboratory. – Anthrax spores only form after the inside of the dead carcass comes into contact with oxygen. To protect yourself and others against Anthrax infection and to prevent pasture contamination don't perform post mortem when suspecting Anthrax!

Treatment:

High doses of penicillin if given immediately after the first clinical signs can be successful. Normally such treatment comes too late in the field but can be used to protect clinically healthy camels at risk.

Very early intravenous treatment of Anthrax infected humans with high doses of penicillin is life saving in many cases.

Prevention:

The best prophylaxis is to vaccinate camels annually against Anthrax before moving them into or through Anthrax risk areas.

If camels are not vaccinated provide antibiotic coverage for the whole herd with Penicillin G and move camels out of the Anthrax infected pasture immediately after the first case has occurred.- To prevent contamination of the pastures and water with Anthrax spores burying the dead camel deep underground or burning it completely is the safest disposal method. Often this is not feasible in remote locations. Anthrax cadavers, if not cut or ripped open, decontaminate themselves rapidly during decomposition. Guard dead camel against dogs and other scavengers for at least two days.

Meat from dead camels must not be consumed by humans, not even if well cooked.

Acute Trypanosomosis

Epidemiology:

Occasionally camels are kept near or even inside Tse-Tse fly infested zones (e.g. entering riverine Tse-Tse fly belt for watering). Tse-Tse - transmitted *Trypanosoma brucei*, *congolense*, *vivax* and *simiae* have all been shown to cause acute deaths in camels. In East Africa certain strains of *T. vivax* cause an acute haemorrhagic syndrome—Translocation of Tse-Tse - transmitted trypanosomes via migrating infected cattle and short distance mechanical transmission can occasionally occur outside Tse-Tse infested areas.

Clinical Symptoms:

Acute febrile disease leading to death within few days. Sometimes haemorrhages in the skin and visible mucous membranes.

Diagnosis:

Internal bleeding with petechiae of serosa membranes is typically present at post mortem. Collect blood smear and EDTA blood for confirmation of the parasite.

Treatment:

Treat with trypanocide licensed for use in camels (see Module 1)..

Prevention:

Move animals through Tse-Tse fly infested zones during the night when Tse-Tse flies are inactive. Apply chemoprophylaxis (trypanocide) and topical repellent or insecticide.

Haemorrhagic Septicaemia (HS)

Epidemiology and Clinical Symptoms:

In camels the term 'Haemorrhagic Septicaemia' is used for at least two different clinical syndromes.

Swollen Glands

This syndrome is endemic to certain areas. Typical signs are swollen lymph nodes, especially those of head and neck. Camels are extremely dull, reluctant to move, develop breathing problems and may die after 3-5 days. Recovery is very slow. This form occurs regularly in certain areas and herds and affects mainly weaners and sub-adults.

Acute Camel HS

This syndrome resembles clinical HS in cattle. Sporadic outbreaks occur suddenly in herds that may not have experienced the disease for many years. Reportedly the disease-free intervals can last as long as 7 to 10 years. From the onset of clinical symptoms there are acute and severe breathing problems; camels lie down with their necks stretched out gasping for air. They are unable to stand up and die within less than 24 hours. Sometimes the intestine is also affected, resulting in bloody or dark faeces. Epistaxis has also been reported. Some outbreaks appear to be triggered by sudden climatic changes (abrupt transition to chilly and wet weather). The disease affects mainly adults in good body condition. At post-mortem there are massive haemorrhages in the lungs and/or intestines.

For both syndromes there are indications that direct contact, esp. sharing of watering points, play a role in transmission.

Treatment:

Identification of the infectious agent is still lacking for both syndromes. Swollen Glands and HS do not respond well to antibiotic treatment. But immediate antibiotic coverage for clinically healthy camels at risk has repeatedly curbed HS outbreaks in camels.

Prevention:

Avoid contact with HS affected herds during outbreaks. So far there is no evidence that HS vaccine for cattle also protects camels.

“Camel Sudden Death” Syndrome

Epidemiology:

The least understood of all acute deaths in adult camels. Between end 2005 and 2007 a protracted outbreak of what was then named 'Camel Sudden Death' moved slowly through the lowlands of Northeast, East and South Ethiopia, the whole of Somalia and North Kenya. The disease syndrome was clearly new to the whole region and has not reoccurred since—Sporadic deaths occurred in affected herds over a very limited period of time and then stopped.

Clinical symptoms:

Sudden collapse of animals in best conditions, affecting the heaviest animals in the herd include: prime breeding bulls, heavily pregnant and lactating females. No clinical symptoms in thin and young camels. 'Sudden Death' camels exhibited very sudden difficulty in breathing, collapse, peracute oedema with white froth in the nostrils and death within 1-4 hours after the collapse. There were no warning symptoms before and in contact camels remained perfectly healthy. There also were no obvious or consistent post-mortem changes, but sub-epicardial bleeding was observed in several cases.

Treatment:

None.

Prevention:

The cardiovascular system seemed to be involved with heavier and metabolically stressed camels being most at risk. The following recommendations were applied during the outbreak

- Avoid contact with affected herds.
- Avoid stressing pregnant and lactating animals on long treks.
- Avoid sudden intake of large amounts of salt and/or water.

Snakebites do occasionally kill adult camels. Look for bite-marks. Sometimes the herdsman may have seen a snake close to his camels.

Module 6: Death in Adult Camels

Handout 2

Herdsman: "My camel died suddenly."

	Herd 1	Herd 2	Herd 3	Herd 4
Q	How long was your camel sick before it died?			
A	Two days	About a week	Just one day	Just a few hours
Q	Have any other camels died in your herd recently?			
A	No	No	Yes, two died in the last three days	No
Q	Have your camels been browsing in this area for a long time?			
A	We moved here because of drought	About one month now	About six weeks now	Yes
Q	Have you been with your camels here before?			
A	Yes	No, it is our first time.	Yes	Yes
Q	Have you ever seen such a case before?			
A	Yes	No	Yes but a very long time ago	No
E	Clinical examination / observation!			
F	Camel in good body condition. Unclotted blood oozing from nostrils	Camel in good body condition. Bleeding in eyes, visible in the mucosa	Camel in good body condition. Pasty dark faeces but small amount	Camel in good body condition. Foamy froth in nostrils
Q	Have you observed anything else in the camels or in the area before the camel died?			
A	Camel had a swollen neck	There are Tse tse flies in this area	It rained heavily about a week ago and it was cold	No
D	What is your clinical diagnosis			
D	<u>Could be Anthrax</u>	<u>Could be acute form of Trypanosomosis</u>	<u>Could be Haemorrhagic Disease Syndrome or other?</u>	<u>Could be Camel Sudden Death or other?</u>
D	What main observations support your clinical diagnosis?			
D	Un-clotted blood and mentioning of swollen neck	Bleeding in eye/mucosa but difficult	Several animals affected. Rain	No clinical signs beforehand
D	Additional examination / diagnostic tests			
D	Blood smear. DO NOT OPEN THE CARCASS!!!	Blood smear	Blood smear	Post mortem examination only showing lung oedema and haemorrhages in endocard
T	What therapy/control measures do you recommend?			
D	None. Only safe disposal of the carcass	Inject whole herd with quinapyramide (e.g. Triquin®) and move from the area	Treat affected animals with oxytetracycline 20% LA	Not known

Q = Question; A = Answer; E = Examination; F= Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control

DD	What else could cause sudden death in an adult camel?
DD	Snake bites can also cause sudden death in adult camels

Q = Question; A = Answer; E = Examination; F= Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control



Photo: Dioli

Photo 1: Cattle that died of Anthrax, classic un-clotted blood oozing from nose



Photo: Dioli
Photo 2: Camel dying of Haemorrhagic Disease Syndrome



Photo: Dioli
Photo 3: Tarry faeces found in camels with Haemorrhagic Disease Syndrome



Photo: Dioli
Photo 2: Camel dying of Haemorrhagic Disease Syndrome



Photo: Dioli
Photo 3: Tarry faeces found in camels with Haemorrhagic Disease Syndrome



Photo: VSF Germany
Photo 6: Camel with nasal froth just before collapsing and dying



Photo: VSF Suisse
Photo 7: Bloody froth found in a camel that died from Camel Sudden Death Syndrome

MODULE 7

HANDOUT 1

LEAD SYMPTOM: SKIN PROBLEM

DISEASES COVERED:

RINGWORM

MANGE

CONTAGIOUS SKIN NECROSIS

LYMPHNODE ABSCESSSES

Brief on Diseases Listed under Module 5 Skin Problems

Camel skin is thinner than the skin of bovines and prone to micro-trauma and infections. The sensitivity of the camel skin and the importance of skin disease as a debilitating factor in camels compares in some respect to equines. With camels still playing a significant role as baggage animals, healthy skin is a necessity for their use in transport.

Ringworm

This fungal skin disease presents as typical circular, expanding and later confluent bold patches. Chalky crusts can be seen on older lesions. There is no itchiness. It is seen mostly in suckling calves and also in weaners. In 90% of cases *Trichophyton verrucosum* can be isolated as the causative agent. Other species of *Trichophyton* and *Microsporum* also occur in camels. Unless calves are in extremely poor condition the infection is self limiting and there is no need for anti-fungal treatment. Low vitamin-A content of camel milk seems to be a predisposing factor. Wet and unhygienic conditions can aggravate the clinical course of this normally harmless disease.

Mange

Epidemiology:

Camel mange is specific to camels and is caused by *Sarcoptes scabiei* var. *cameli*. Very exceptionally, transmission of camel mange to humans has been reported. The disease is spread via close contact and also through contaminated objects, including trees on which camels like to rub or via contaminated night enclosures. The mite lives in the skin but can survive for some time in dead skin scabs shed by affected camels, especially under wet conditions with little sunshine. Mange is more severe in the rainy season.

Clinical Symptoms:

The earliest and most persistent clinical symptom is severe itching, especially in the morning. The almost permanent itching is not seen in other skin diseases and results in shorter feeding hours and gradual loss of condition in affected camels. Some animals may show almost normal skin, but there is always severe itching, which is much more intensive than normally observed grooming behaviour. Boldness begins mostly on the head (dorsum of the nose) and spreads from there to other parts of the body. After several months formation of skin scabs and thickening of the skin follow (hyperkeratosis: skin develops folds and looks like elephant skin). The mange has now entered its' chronic stage and is very difficult to treat.

In East African camels mange can be present in an extremely mild form over prolonged periods, the only clinical signs being boldness and itching.

Sporadic cases of typical "mangy" looking camels with hyperkeratosis in otherwise mange-free herds must not necessarily be infected by mange mites but may be suffering from auto-immune problems and/or chronic deficiency.

Treatment:

A single treatment does not eradicate disease from the herd because it only kills adult mites, while mite eggs in the skin hatch within a week. Therefore the treatment of choice is a double s.c. injection of 1% ivermectin. Two doses must be given 8 days apart (note that this treatment interval is specific for camels and is shorter than the interval recommended by the manufacturer for cattle). Sometimes three treatments at 8 days' interval may be necessary (very costly!). Ivermectin does not penetrate into dead skin scabs. In between the two ivermectin injections, it is important to first wash all camels with a detergent and in particular rub off all dead skin scabs (with a brush); then an acaricide must be applied on the skin, best done by spraying manually with a knapsack. After washing and acaricide treatment, move camels to a clean fresh enclosure/environment. In cases where ivermectin is too costly, the following treatment protocol is also efficient if carried out meticulously:

1. Washing with detergent (+ brushing of dead skin);
2. Spraying twice (better three times!) with acaricide at eight days' interval and moving camels to new clean boma after the first spraying. Spraying must be done thoroughly such that the whole skin surface is reached by the acaricide, including the head and the inside of the ears.

Note that any calves born in between two treatments must also be injected twice and treated with acaricide, the same as for adult camels. One single untreated calf can act as a source of slow re-infection for the whole herd; despite spending a lot of money on treatments, there will be a relapse with the mange spreading again throughout the herd within 4–8 weeks.

Note: Because of its' very long drug withdrawal period, ivermectin should not be used in lactating camels. If lactating camels are to be treated against mange, washing and 3 x acaricide spraying should be applied (observe milk withdrawal period for acaricide).

Prevention:

Once in the herd, mange is very difficult and very costly to eradicate. A major problem is sharing of grazing and water points with camel herds of uncertain mange status and also introduction of mange by clean looking but infected camels from other herds. When introducing new camels into a clean herd, inject them twice with ivermectin at 8 days' interval, before allowing them to mix with the clean camels.

Contagious Skin Necrosis

Epidemiology:

This skin disease of camels was initially thought to be a specific infection. But there is strong evidence that the underlying cause is rather a prolonged mineral deficiency. Skin lesions become rapidly super-infected by ubiquitous pathogens (esp. Streptococci and Staphylococci).

Clinical Symptoms:

Contagious Skin Necrosis begins as a painful swelling of circumscribed areas of skin, followed by localised alopecia and hardening of the skin starting from the centre of the affected area. Subsequently dry scabs evolve, starting again from the centre of the lesion. After 7 -14 days a sharp demarcation between dead and living skin begins. If pressure is applied on the centre of the lesion a clear discharge appears along its margins, which rapidly becomes purulent. The central portion then separates and sloughs away. The subcutis is not affected. Lesions can be located anywhere on the body, but are more common on the neck, shoulders, flanks and hind quarters. The condition can persist for months. After healing, a star - shaped scar remains.

Treatment:

Feed ad lib quality salt/minerals containing ample NaCl to camels and/or move camels to salty pastures/salty springs. Salt from natural salt pans can be short in NaCl.

Clean affected skin area and apply iodine. In severe cases, penicillin-streptomycin can be injected daily for 5 days.

Prevention:

Ensure that camels have regular access to quality mineral salt containing NaCl, salty pasture and/or salty water sources. Move herd to new pasture when first cases occur.

Dermatophilus congolensis is sometimes confounded with Contagious Skin Necrosis in the literature. In the East African region Dermatophilosis (also called "cutaneous streptothricosis") of camels is a seasonal skin problem that occurs in relation to humid warm conditions. It presents as an exsudative, pustular (initial small nodules) dermatitis characterised by formation of crusty scabs that occur especially in skin areas covered by long hair. Dermatophilosis normally resolves after rains subside. *Dermatophilus* can also be isolated from the skin of the hind quarters of female camels kept wet by urinating.

Lymphnode Abscesses

Epidemiology:

Following micro-trauma (acacia thorns, tick bites) the camel skin easily develops abscesses. Swelling and abscessation of Ln. cervicalis superficialis, which is very prominent in camels, is seen frequently in healthy camels. The most common bacteria present in purulent lymphnodes of camels are *Staphylococcus aureus* and *Streptococcus agalactiae*. Both organisms are occasionally isolated from non-purulent lymphnodes.

Corynebacterium pseudotuberculosis, the specific infectious agent of Pseudotuberculosis (or 'Caseous Lymphadenitis') also affects camels. In camels the distinction between true Caseous Lymphadenitis and multiple abscessation of cutaneous lymphnodes due to other bacteria remains vague.

Clinical Symptoms:

Swelling of cutaneous superficial lymph nodes, with pus accumulation. The affected area is first warm, swollen and painful; later the hard swelling becomes softer and there is no heat or pain; after 3 - 4 weeks, some abscesses burst and discharge pus. Chronic fistula are quite common and are a source of contamination in camel enclosures.

Note:

Lymphnode abscesses can also be located in the mammary gland and in internal organs. Chronic abscesses in internal organs of adult camels (incl. the lung) are due to *Corynebacteria* and cause chronic progressive loss of condition.

Treatment:

For cutaneous abscesses normal abscess treatment applies: incision - draining out the pus - flushing with hydrogen peroxide (3%), with iodine or with gentian violet. Antibiotic treatment is not indicated for skin abscesses. In severe cases (immuno-compromised camels) the underlying causes should be treated (*T. evansi*, nutritional deficiency).

Internal abscesses are well encapsulated and do not respond to antibiotic treatment.

Prevention:

Educate camel owners on early treatment of wounds and small skin injuries to prevent formation of abscesses. Chronic fistulated abscesses must be treated to minimize contamination of the environment, especially the camel night enclosures. Do not open and drain abscesses inside the enclosure.

Module 7: Skin problems

Handout 2

Herdsmen: "My camel/s has/have skin problems."

	Herd 1	Herd 2	Herd 3	Herd 4	Herd 5
Q	Are all camels in your herd affected?				
A	Only suckling calves are sick	Almost the whole herd is sick	Only a few camels are affected	Some younger adults are affected	Some adults are sick
Q	When did the problem start?				
A	More than three weeks ago	About two weeks ago	More than six months	About a month ago	Not sure, but cases are increasing
Q	Are the animals still feeding/suckling?				
A	Yes, calves still suckling	Yes herd is feeding normally	Feeding normally, but losing condition	Feeding normally	Feeding normally
E	Clinical examination / observation!				
F	Patches without hair visible. Calves in good condition	Dull coats. Animals scratching frequently	Dull coat, animals in poor condition	Camels in good condition, some abnormal areas visible	Swollen Lymphnodes visible
E	Clinical examination of the skin!				
F	Confluent bold patches. Dry, chalky scabs found on some	Skin rough, frequent scratching visible, skin irritated	Some large bold areas, skin wrinkled and hyperkeratosis	Sharp demarcated lesions. Some with irregular edges and pus, some with scabs only. Skin rough	Lymphnodes enlarged
Q	Have any of your camels died?				
A	One calf died from diarrhoea	No	No	No	No
D	What is your clinical diagnosis				
D	<u>Ringworm</u>	<u>Acute Mange</u>	<u>Chronic Mange</u>	<u>Contagious Skin Necrosis</u>	<u>Lymphnode abscess/ Lymphadenitis</u>
D	What main observations support your clinical diagnosis?				
D	Only calves affected, and confluent bold patches	Most of the herd affected. Frequent scratching and rough skin	Poor condition of affected ones. Typical clinical signs (Hyperkeratosis, wrinkly skin, bold areas)	Only few camels affected. Typical clinical signs (demarcated lesions, with pus at times)	Typical clinical signs
D	Additional examination / diagnostic tests				
D	No	Skin scrapings for microscopic examination of mange mites	Skin scrapings for microscopic examination of mange mites	Bacteriological swab can be taken. Identification of bacteria and antibiotic sensitivity testing	Bacteriological swab can be taken. Identification of bacteria and antibiotic sensitivity testing

Q = Question; A = Answer; E = Examination; F= Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control

T		What therapy do you recommend?				
D	If calves are in poor condition, supportive treatment with vitamin ADE	Ivermectin 1% injection, second after 8 days	Chronic mange difficult to treat. Ivermectin 1% can be tried. Culling is better as chronically infected camel can infect other animals	Supplement with quality salt. Spray infected areas with blue spray	Abscess treatment.	
C		What control measures do you recommend?				
C		Ensure newly bought camels are clean. Treat with ivermectin 2% twice	Cull chronically infected animal. Most to different pasture	Regular supplementation with salt		

Q = Question; A = Answer; E = Examination; F= Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control



Photo: Dioli

Photo 1: Classic itching and scratching in herds with mange

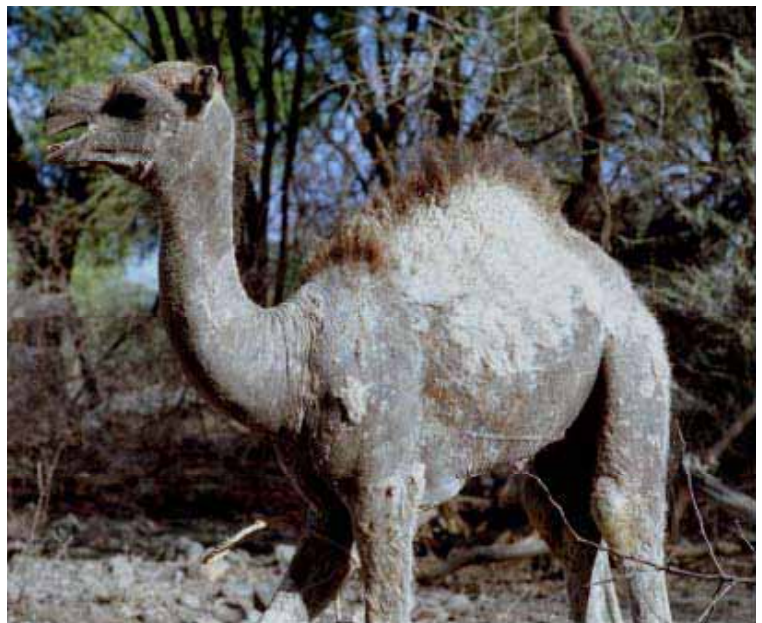


Photo: Dioli

Photo 2: Camel calf with generalized acute mange

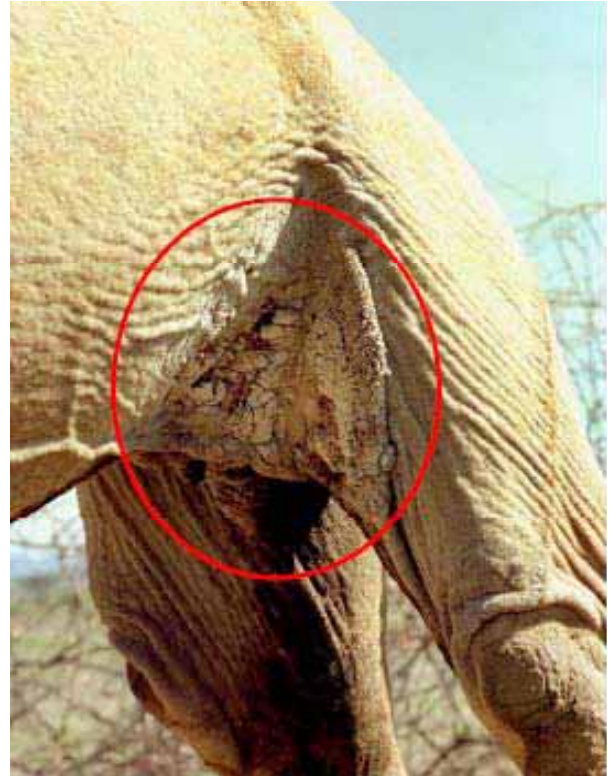


Photo: Dioli

Photo 3&4: Camel with chronic mange, hyperkeratosis and wrinkled skin visible



Photo: Dioli

Photo 5: Camel with ringworm



Photo: Dioli

Photo 6: Contagious skin necrosis on the neck of an adult camel

MODULE 8

HANDOUT 1

LEAD SYMPTOM: ABORTION

DISEASES COVERED:

BRUCELLOSIS

RIFT VALLEY FEVER

ABORTION DUE TO TRYPANOSOMOSIS

**OTHER ABORTION CAUSES (CAMEL POX, Q-FEVER,
CHLAMYDOPHILA, SALMONELLA)**

Abortions

Brucellosis and *Trypanosoma evansi* are major causes of abortion in camels. Rift Valley Fever, Q-Fever, Chlamydia, Salmonellosis and *Equine Herpes Virus* (EHV-1) have all been shown to occur in camels. Other infectious causes of abortion in livestock are likely to also affect camels. - Taking appropriate biosafety measures when sampling abortion cases is extremely important.

Brucellosis

Epidemiology:

Brucella abortus and *Br. melitensis* can both infect camels. They are mostly transmitted via night enclosures and pasture contaminated by the fluids, foetus and placenta expelled during and after abortion and at birth. After abortion, the vast majority of *Brucella* - infected female camels conceive and calve again normally but remain infected. Permanent *Brucella* infection localises itself in the endometrium, udder and associated lymphnodes. At each calving permanently infected camels excrete large numbers of *Brucella* with the placenta, in their lochial discharge and also in their milk and urine. Such carrier camels represent a constant source of infection for clean camels. *Brucella* can occasionally also be transmitted by infected bulls at mating (= venereal infection), but this transmission route only plays a very minor role. Camels normally isolate themselves from the rest of the herd when they are about to give birth. This behaviour reduces transmission rates within camel herds. Camels often become infected by *Brucella* from abortion outbreaks in other livestock (sheep, goats, cattle). Sudden exposure of a group of pregnant camels to a *Brucella* contaminated environment can cause small abortion storms. Brucellosis is a very important zoonosis; humans become infected via direct contact when infected camels abort or give birth and also through consumption of raw milk. For humans *Brucella melitensis* is the most virulent.

Clinical symptoms:

Abortion is the only symptom seen in infected females and occurs during the last third of the gestation. Unlike in cattle, retained placenta is very uncommon after abortion in camels.

Infected camel bulls can show Orchitis (may be only unilateral), epididymitis and infertility, which may be only temporary.

Another symptom indicative of brucellosis is a non-suppurative synovitis (hygromatous swellings) affecting mostly one single joint on the limb.

Diagnosis:

Blood samples are the easiest and safest to collect and to transport. Serological tests for Brucellosis like Rose Bengal can also be used for camels. In cases where a first blood sample taken immediately after abortion is negative, a second one should be collected and tested 2-4 weeks later.

Note:

The standard Brucella Milk-Ring-test does not work on camel milk.

Treatment:

There is no treatment.

Prevention:

Similar to the practice in cattle, the best prophylaxis is to vaccinate camel heifers with *Brucella* vaccine (Buck19 or Rev1) before they reach breeding age (e.g. at weaning). There is no information as to how long camels are protected after a single vaccination.

Rift Valley Fever (RVF)

Epidemiology:

RVF is caused by an arbovirus transmitted by *Aedes*, *Culex* and other mosquito species. Mechanical transmission by biting flies is also possible, but plays only a minor role. Sheep, goats and camels are the domestic livestock species most affected by RVF and camels are the best host indicator system for RVF. In arid and semi-arid areas RVF outbreaks occur at long intervals and are triggered by extraordinary heavy rainfall and flooding. In between outbreaks the infection remains cryptic with trans-ovarial transmission of RVF virus among *Aedes* and *Culex*.

RVF is a very dangerous zoonosis. Humans get infected when slaughtering viraemic animals, carrying out post-mortems on animals that died during viraemia or being exposed to abortion fluids and materials.

Clinical Symptoms:

RVF abortion rates in camels can reach 100%! Abortions occur at any stage of pregnancy. Apart from mass abortions there is increased neonatal mortality. In older camel calves cases of severe febrile disease with jaundice can occur. Apart from abortions adult camels do not show signs of disease.

In humans RVF mostly produces an influenza like disease, but fatal haemorrhagic cases do occur.

Diagnosis:

The combination of abnormally intense rainfall/flooding, an extraordinary high number of pregnant camels aborting within a very short period and mass abortions also occurring in sheep and goats kept in the same area should be regarded as highly suspicious of RVF. Serum samples from animals with and without abortions plus EDTA blood samples should be submitted to the laboratory when suspecting RVF do not carry out any field post-mortems!

Treatment:

There is no treatment.

Prevention:

Vaccination with the new Clone13 RVF vaccine, which unlike older vaccines does not cause abortions in pregnant sheep. Clone13 is yet to be tested in pregnant camels.

Topical application of insecticides during RVF outbreaks reduces the risk of infections considerably.

Warning

RVF is an extremely dangerous zoonosis - biosafety rules when dealing with RVF infected livestock:

- Avoid direct contact with body fluids of sick or dead animals.
- Do not slaughter or dissect animals during RVF outbreaks.
- Wear gloves and mask (or any other device to avoid direct contact e.g. plastic bags) when handling sick or dead animals, particularly when assisting at birth, burying placenta or fetus.
- Wash your hands with disinfectant or soap immediately after contact with any animal body fluid.
- Animal products are infectious and must be well cooked before consumption (esp. milk).
- During RVF outbreaks people should protect themselves against mosquito bites by using covering clothes, repellents, bed nets and insecticides.
- People with fever for more than 48 hours must urgently seek medical advice.

Trypanosoma evansi

Epidemiology and Clinical Symptoms:

Trypanosoma evansi is transmitted mechanically by blood-sucking flies. Transmission rates are higher during rainy season and in areas with more insect vectors. Most transmissions are short distance (within the herd, at watering points). Abortions occur within 5–60 days after infection at any state of pregnancy. Aborting animals are otherwise healthy. Camels infected chronically with *T. evansi* pose a serious infection risk to pregnant females of the same herd. (See also Module 1)

Treatment:

There is no treatment.

Prevention:

Chemoprophylaxis with trypanocides during periods with increased transmission risk (rainy season) and when moving animals during high risk zones.

Other causes of abortion

Epidemiology:

Other causes of abortions in camels include Camel Pox, Q-Fever, Chlamydophila and Salmonella. Apart from Camel Pox (see Module 2), there is no information about the camel specific epidemiology of these pathogens. Infection occurs via contact with abortion materials and contaminated environments. Salmonella are very common in camel herds and antibodies to *Coxiella burnetii* (Q-Fever) and to *Chlamydophila abortus* (former *Chlamydia psittaci*) have been found in camels. Ticks play a role in maintenance of Q-Fever infection.

Clinical Symptoms:

Chlamydophila abortus causes abortion towards end of the pregnancy.

Coxiella burnetii causes sporadic abortions.

Camel Pox outbreaks frequently cause abortions.

Salmonella dublin can cause sporadic abortions.

Treatment:

None.

Prevention:

The only vaccine validated for camels is Camel Pox vaccine. Vaccines against *Chlamydia*, *Coxiella* and *Salmonella* are available for other livestock species.

Module 8: Abortion

Herdsman: "My camel/s has/have aborted."

	Herd 1	Herd 2	Herd 3
Q	How many camels have aborted?		
A	One first calving heifer and two females	About six camels. It might be seven but I did not see the foetus of the last one	Two camels
Q	How many adult female camels do you have and how many were pregnant before the abortion started?		
A	I have about 60 female camels and 12 were pregnant		
Q	When did the abortion begin and did you have abortions before?		
A	About two days ago and there was no abortion before that	It started about a week ago is still ongoing. Before I did not have a problem with abortion	One aborted yesterday another one two months ago
Q	At what stage of pregnancy did your camel abort?		
A	About 6 to 7 months	Not sure, they were all at different stages	One was about to give birth, one was three months
E	Clinical examination / observation		
F	No retained placenta Camels in good condition		
Q	Have you observed anything else abnormal?		
A	No	No, but today 2 more camels aborted	No
D	What is your clinical diagnosis		
DD	<u>Could be Brucellosis or other</u>	<u>Could be Rift Valley fever</u>	<u>Could be caused by Trypanosomosis</u>
D	What main observations support your clinical diagnosis?		
D	Difficult	Massive abortion at various stages of pregnancy. Confirm if very wet conditions (during heavy rains)	Confirm if camels are regular treated with quinapyramide
D	Additional examination / diagnostic tests		
D	Submit blood sample of affected animals and others to laboratory. If possible submit also foetus or placenta to laboratory – NOTE: Follow biosafety measures (RVF and Brucellosis are zoonosis!!!) transport chilled and in tightly closed containers		
C	What therapy/control measures do you recommend?		
C	If possible affected animals should be separated from herd. Calving should take place in a different enclosure. Be careful when handling dead foetus and placenta and ensure proper disposal (bury or burn). Remind the herdsman that Brucellosis and RVF are zoonosis and can affect humans!		

Q = Question; A = Answer; E = Examination; F= Findings; D= Diagnosis; DD= Differential Diagnosis; T= Treatment; C= Control

Module 9: Clinical Examination of the Camel

HANDOUT 9/1

Introduction:

Keep in mind that:

- The camel is not a very good clinical patient
- It has the ability to vary within physiological parameters without being sick
- Example “fever”: physiological range for rectal temperature from 34°C to 42°C
- Example “weight loss”: a normally hydrated camel of ~370 kg BW weighed 260 kg after 21 days without water intake (was it sick?)
- Dehydrated camel also has significantly lower breathing rate

STEP 1:

After interviewing the herdsman about the camel, especially its’ feeding behaviour and general activity level, it is time for clinical examination.

As taught in university the clinical examination usually follows the pattern first adsppection then palpation. So look at the animal first before you go and touch it!

When entering the boma or seeing the animal with the herd outside in the pasture observe the camel first and compare it with the other camels in the herd. Through observation you can already note a lot of abnormalities. So take some time and just look at the herd.

As a “memory help” try and note the following and always compare with the other camels in the herd:

- General behaviour
 - Is the camel standing or lying down?
 - Is the camel feeding/ruminating?
 - Is the camel walking normally?
 - Is the camel showing any abnormal signs of behaviour (very dull, scratching, salivating, being aggressive, grunting, circling movement, problem with coordination of the movements / limbs,)?
- Body condition
 - Is the camel well fed or skinny?
 - Is the coat smooth, shiny, rough, dull?

STEP 2:

Start with the head and continue examining the body parts as they come:



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SANS FRONTIÈRES
SUISSE

