Wollo University School of Veterinary Medicine

Camel Health

Chapter 4. EXAMINATION IN CAMELS

Criteria can be helpful in interpreting whether an animal is healthy or diseased

Probably 99% of camels are maintained under primitive management by pastoralists/nomads mainly in remote areas where regular health care centers or proper diagnostic facilities are not available.

Under the circumstances, assessment of an animal whether it is healthy or diseased simply on the basis of its appearance might be confusing.

Temporary loss of body weight and condition is normal in dehydrated animals, in camel bulls during the rutting season, in lactating females and in animals which are overworked.

Cont'd

A gradual but permanent decline in live weight can be due to old age of the animal.

In young animals a prolonged weight loss is always an indication of a chronic generalized disease.

In the process of interpreting signs of disease, it is essential to develop a proper diagnostic routine. This should include an evaluation of the animal's environment, particularly the supply of forage and water.

General information on the health history of the herd and that of the individual animal need to be ascertained before a general inspection and clinical examination is undertaken.

Cont'd

Most part of an animal's health status is reflected by general body condition, appearance, conformation, posture and behaviour.

For example, hollow flanks, a retracted abdomen and a shrunken hump may indicate a severe systemic illness, but might also be the result of a prolonged dehydration, which is quickly reversed when the animal can drink its fill of 100 to 120 litres of water.

Difficulties which are commonly expected in deciding what disease a sick camel has

- The animal may show only some of the signs of the disease.
- The same disease may produce somewhat different signs in different animals.
- Different diseases may produce the same signs.
- A camel may be suffering from more than one disease and the signs may mask or reinforce each other.
- Camels are generally placid animals, they often do not show much distress, even if seriously ill.
- Thus the diagnosis gets complicated, especially if the camel suffers from a general, systemic illness that affects its whole body and not one particular organ.

Some of commonly observed disease signs

Signs of weakness, dullness, tiredness, lack of appetite, lying down at unusual times, fever and rapid heart beat can be caused by many different types of diseases.

When these signs are present, check for other more specific signs that will help you to determine the disease and correct treatment.

Experience helps a great deal in arriving at the correct diagnosis.

Often a major sign is accompanied by several others; taken together, they give you an idea about the disease.

Cont'd

Signs of Fever: High body temperature, fast pulse, sweating, standing with head down and still, dull, watery eyes, off rumination.

Signs of Dehydration: Pinch a fold of skin and let it go; it returns slowly to its normal position.

Signs of Anaemia (**loss or lack of blood**): mucus membrane inside mouth and nose is pale or whitish, conjunctiva pale.

Cont'd

Signs of Pain: Neck erect and stiff, sometimes quickly lowering and raising the neck, watery eyes, sitting uneasily, shifting body around, grunting when breathing or ruminating.

Certain signs can be seen in normal animals as well as indicate diseased conditions e.g. shrunken hump in females suckling a calf, can also be a sign in mange, trypanosomiasis, internal parasites, teeth problems and chronic stomach and gut diseases.

Grinding of teeth and foam in mouth are normal after eating salt or in male camels during the rut.

Parameters to be considered during clinical examination of camels

- **Rectal temperature** (morning, evening)
- **Respiration** (Frequency, Quality)
- **Pulse** (Frequency, Quality)
- **Mucous membranes** (pale, pink, red, haemorrhagic)
- **Palpable lymph nodes**
- **Stomach motility**
- **Faeces** (Consistency, pellets shaped or unshaped, colour, visible parasites)
- **Urine** (Quantity, Color)
- **Discharges** from Eyes, Nostrils, Mouth and Vagina (quantity, colour, consistency)

Restraining Methods in camels

From among the various restraining methods, which one to use depends on

The type of treatment

The camel's training and temperament and

Its relationship with its handler.

Physical methods

A well trained camel needs to be restrained only by holding its head rope or nose-peg.

Restrain a small camel by holding its upper and lower lips with both hands and turning its head to one side.

Cont’d

If the camel is somewhat trained and the handler is an experienced person, this should suffice when giving an injection.

If necessary a second person can hold the camel by its ears. The same method can be used with a large camel if it is in a sitting position.

Hold the camel’s lower jaw with a rope running behind the front teeth. Hold the rope in your hands; do not tie it to a tree or post, as a sudden movement can break the camel’s jaw.

Cont’d

Make the camel stand on three legs by tying one of its fetlocks to its foreleg with a rope.

To restrain a violent animal, tie a rope around its neck and have two people hold the ends, one on each side of the animal.

Make sure the camel does not suffocate.

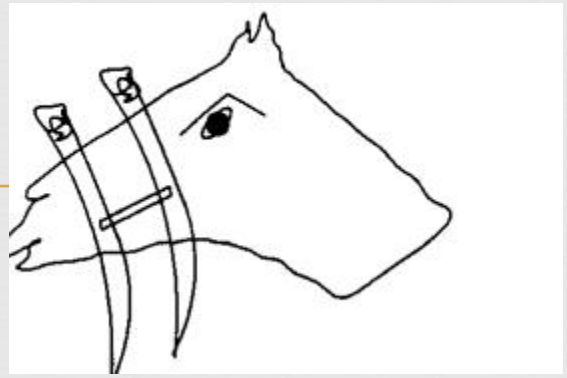
Cont'd

If the treatment is painful, make the camel lie down by tying one of its fetlocks to its foreleg. Then pull either the other front leg or both hind legs forward with a rope around the fetlocks.

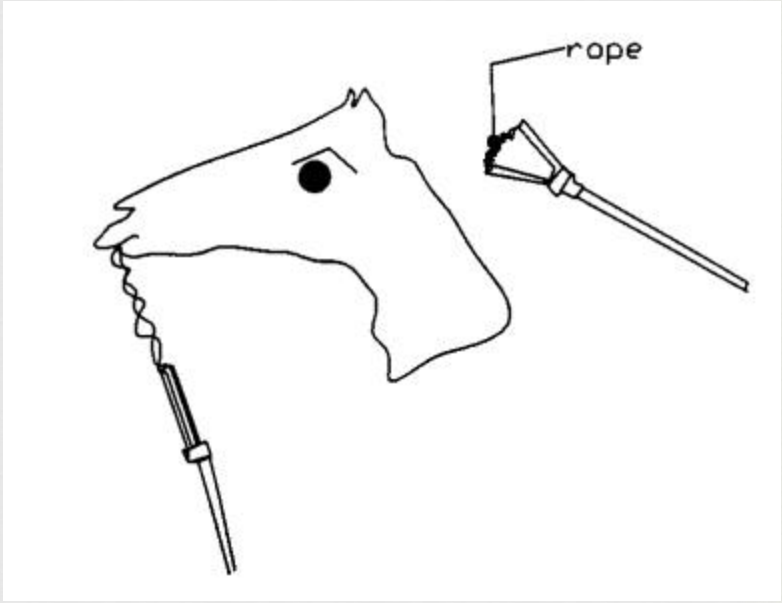
Tie both front legs together with a rope passing over its neck. To make the animal completely immobile, also tie the hind legs together. Bend the neck to the side by pulling on the head-rope.

It is also possible to immobilize a camel by injecting it with a sedative

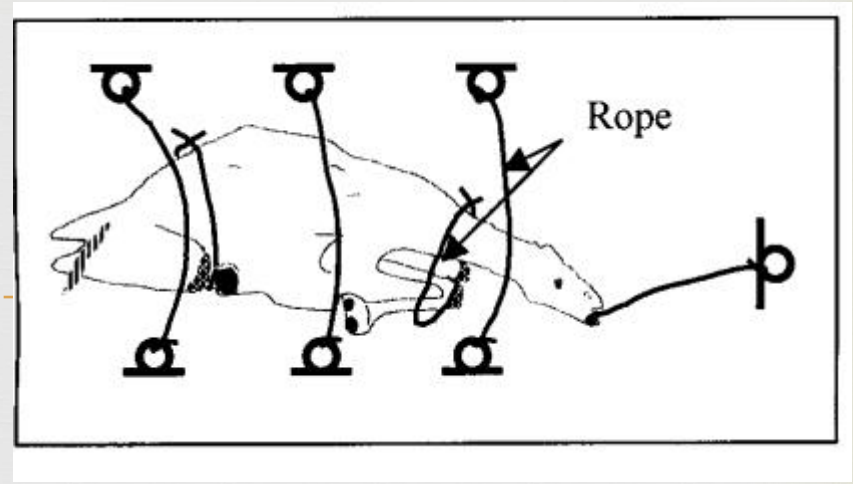
Using muzzles



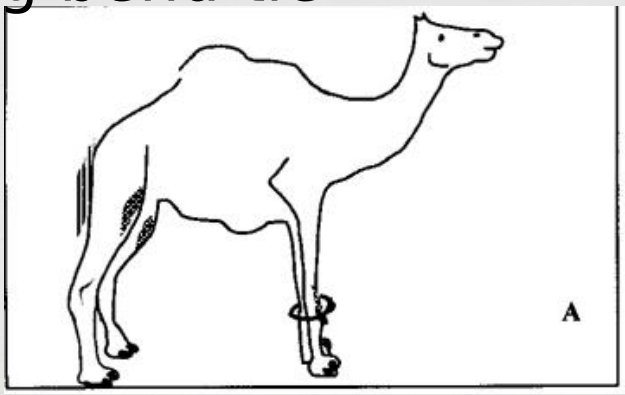
Camel holder

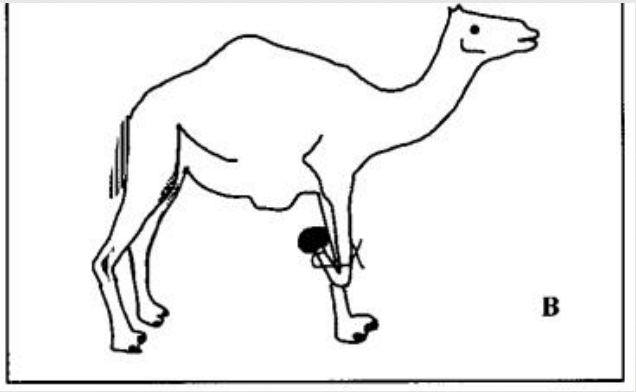


Camel crush



Restraining camels in standing position (forleg ring tie and foreleg bend tie



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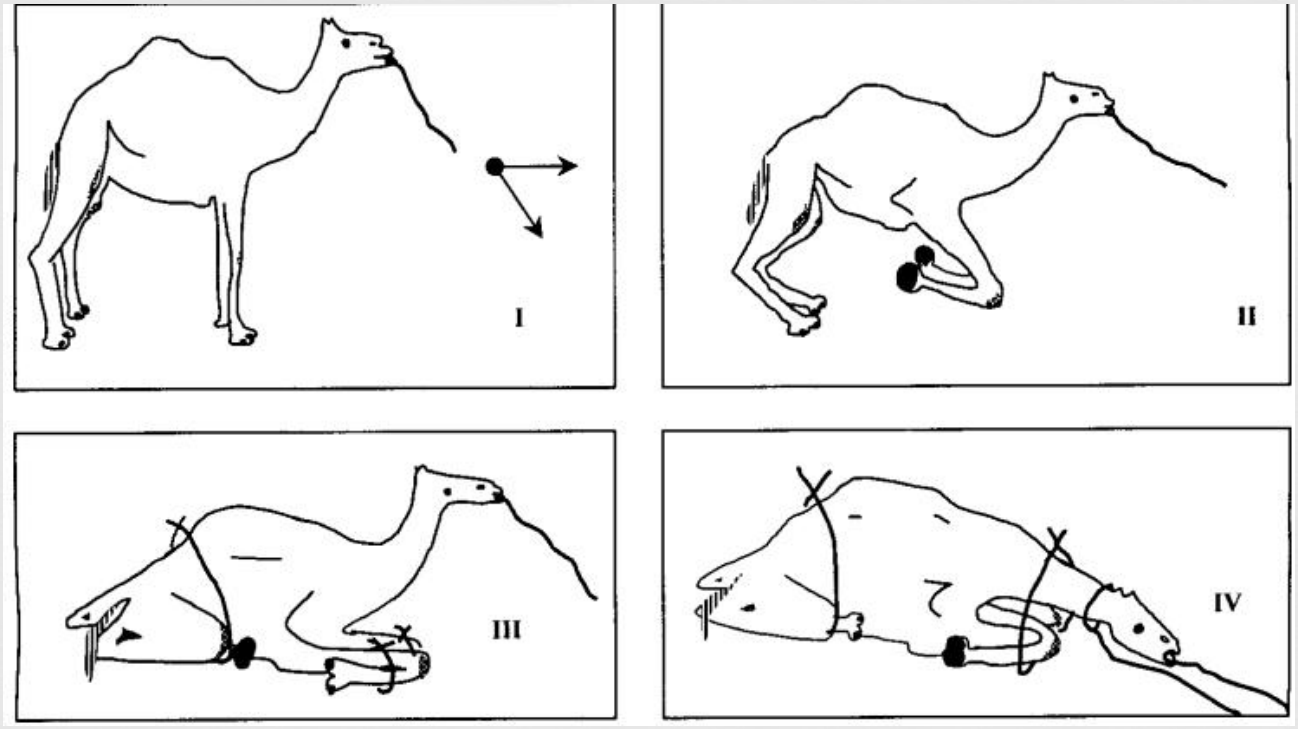
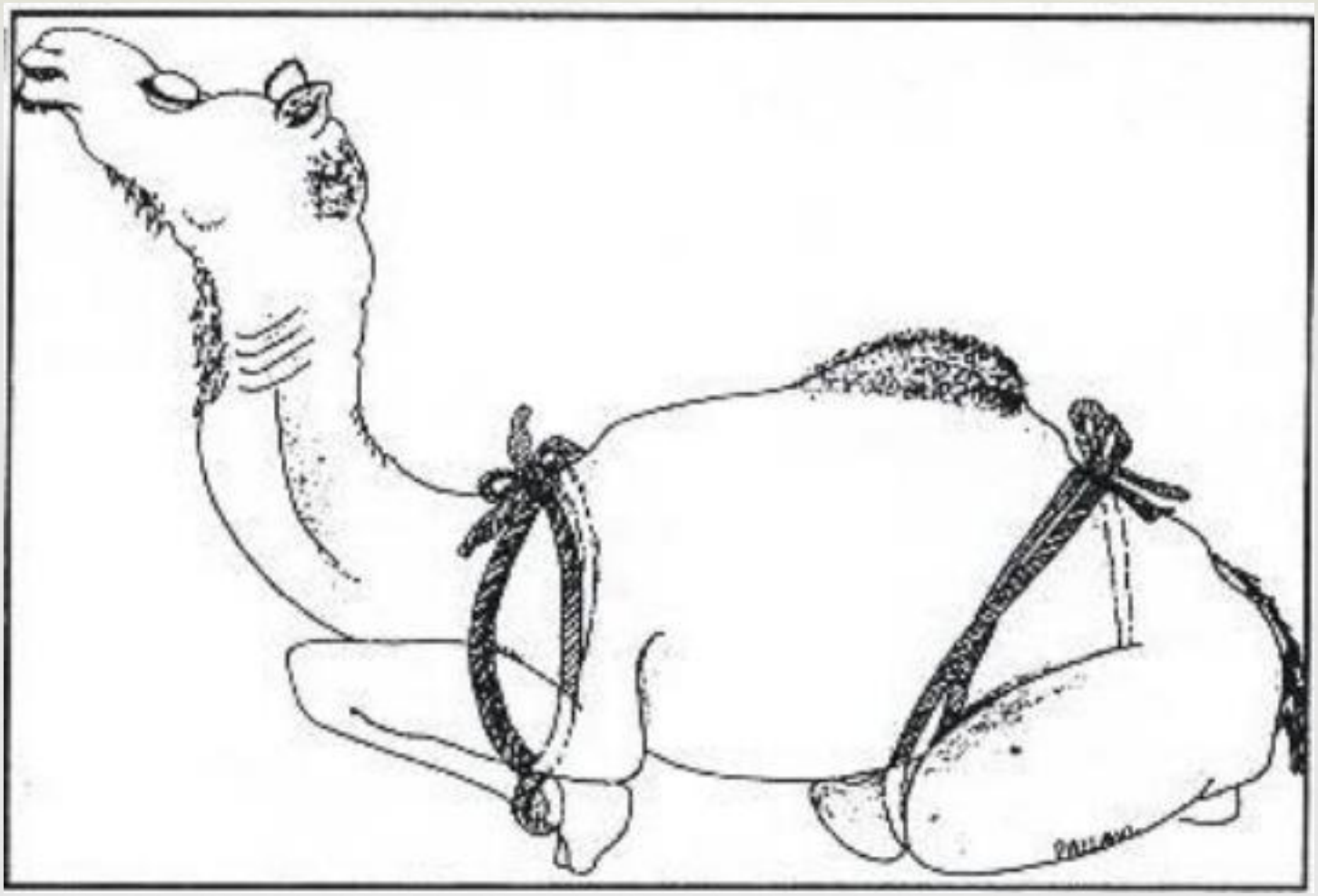
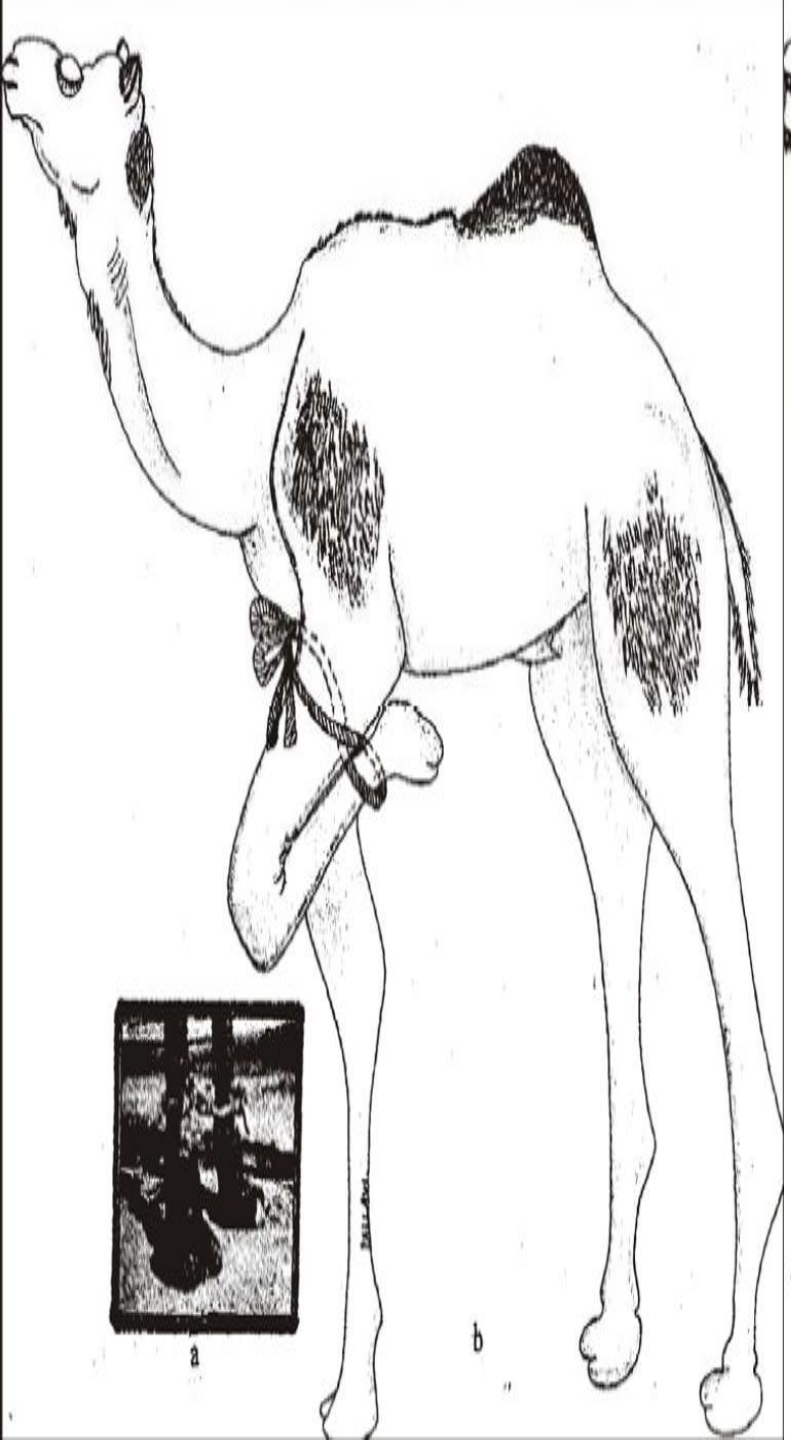
Restraining camels in sternal recumbency





Restraining camel in sitting position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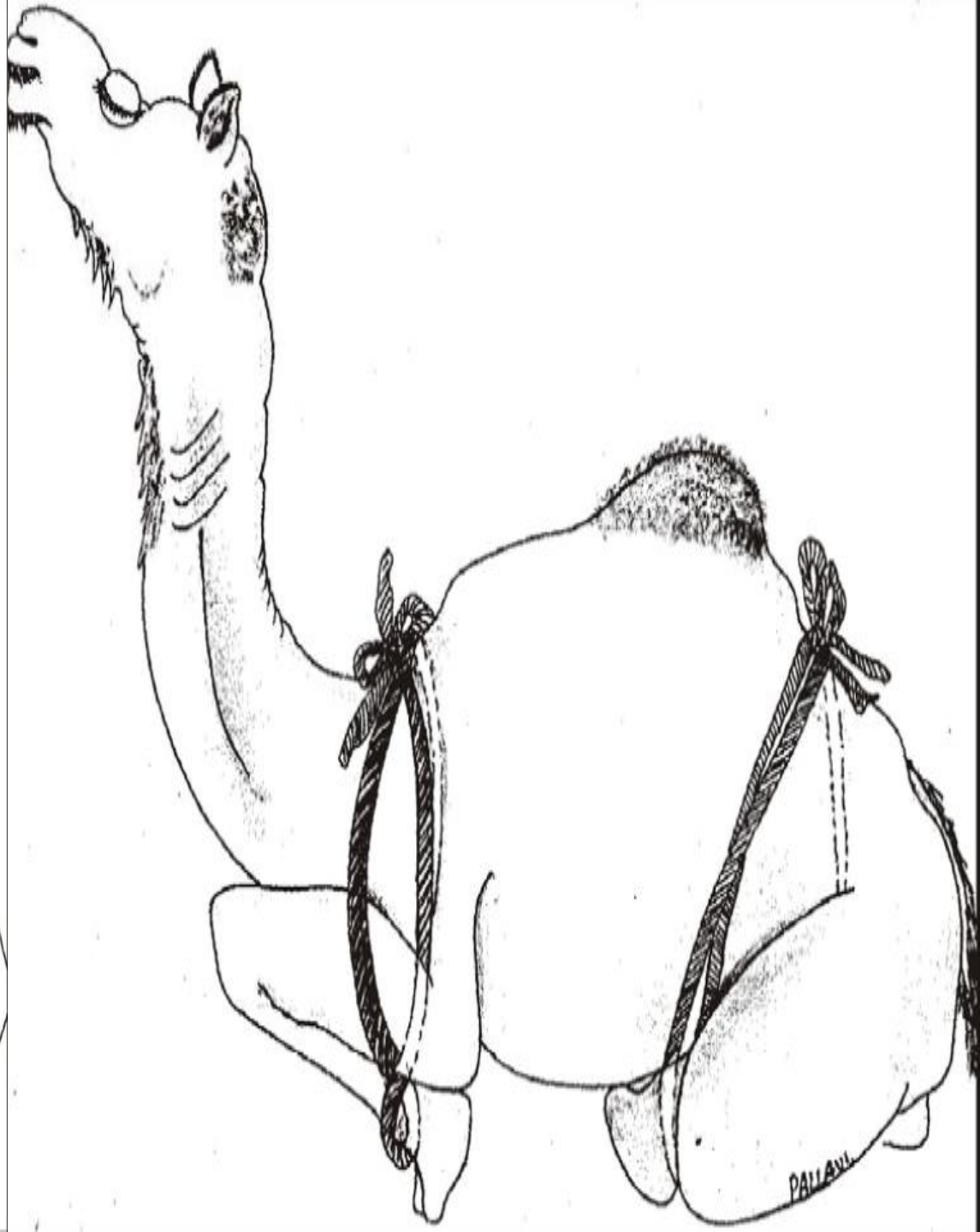
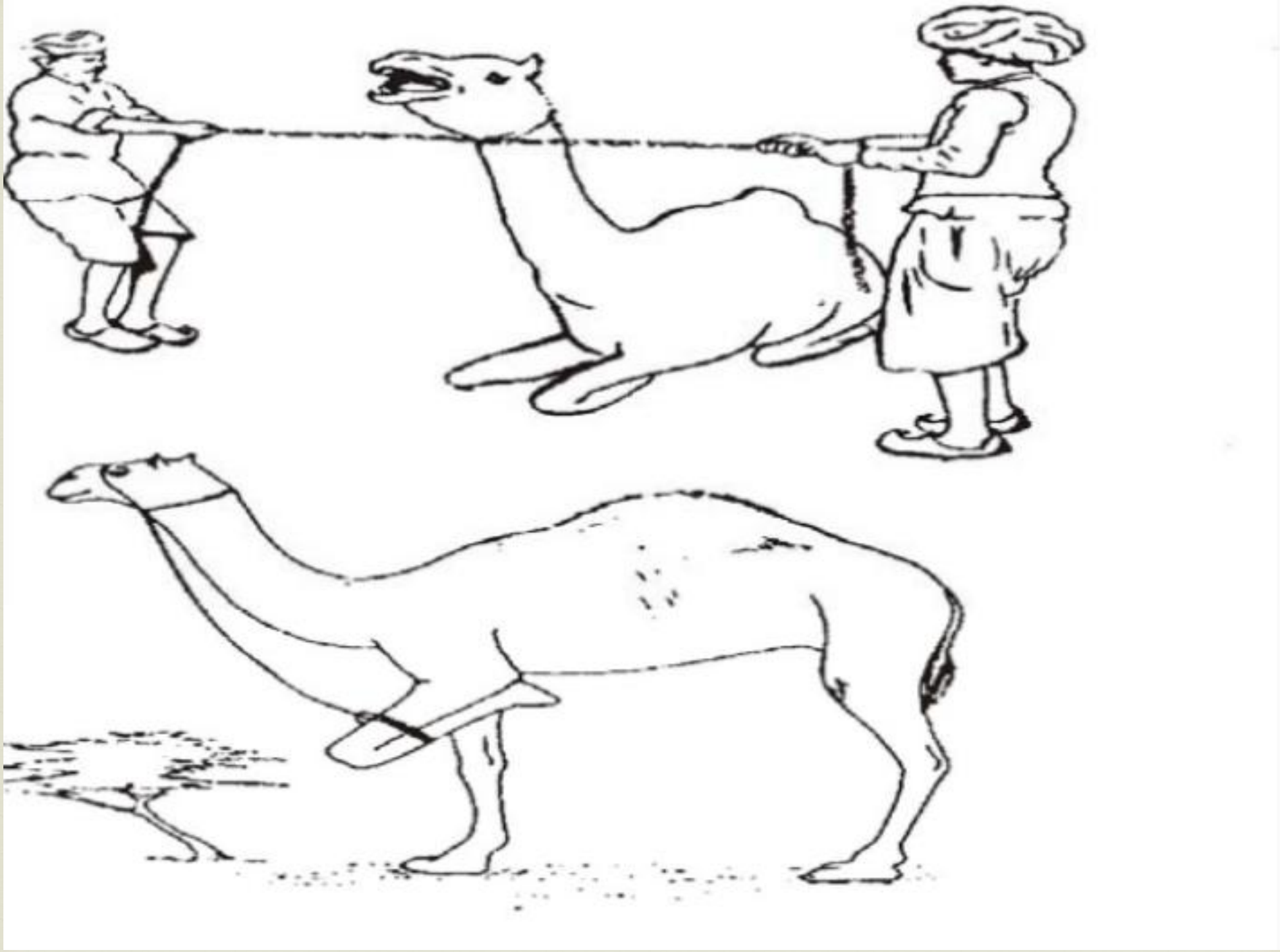




Chemical methods (Anaesthesia)

Types of anaesthesia : There are three types of anaesthesia

General Anaesthesia:

It makes the animal lose consciousness and stops it from feeling pain anywhere in the body.

Regional Anaesthesia:

It stops pain in a part of the body, while the animal stays conscious.

It is used for surgical procedures in the genital area such as prolapse of the vagina or uterus.

We can do it by injecting a local anaesthetic into the spinal cord.

Local Anaesthesia:

It stops pain only in the area where it is injected.

It is used for suturing wounds and for minor operations.

Drugs commonly used and their dosage for sedating and immobilizing camels

Name	Dosage (mg/kg body weight)	Application	Effect
Xylazine	0.25 – 0.50	IM	Sedation 30-60 minutes
	1.0 – 2.0	IM	Anaesthesia 90 minutes
Yohimbine	0.125 – 0.25	IM	Antidote
Propionyl-promazin	0.2 – 0.5	IM	Sedation 2-4 hours
Ketamine	5.5	IM	Sedation 20 minutes
Thiopentone	10.35 ± 0.64	IM	Anaesthesia 30 minutes

Epidural Anaesthesia:

It is used for surgery in the genital area e.g. for prolapse of the vagina or uterus.

Move the camel's tail up and down and feel where the rigid backbone ends and the tail (which can be moved) begins. The gap between these bones is where to give the injection.

Clip the hair, clean and disinfect the skin.

Insert a 20 gauge 4 cm needle at right angle to the tail. The needle must go between the bones into the spinal canal.

Slowly inject 2 to 5 ml of lignocaine. This will stop pain in the genital area for about 2 hours.

Epidural anaesthesia should be given only by an experienced person.

Local Anaesthesia: Use lignocaine hydrochloride (Lidocaine)

Normal values for physiological parameters in resting adult camels

Temperature : 35.5 – 41.0℃

- Morning : 35.5 – 37.5℃
- Evening : 39.0 – 41.0℃

Respiration : 5 – 12/min.

Pulse : 35 – 50/min.

Besides pathological conditions a variety of environmental and host factors including age, sex, ambient temperature and watering, stress and physical work out have an effect on these parameters.

Body Temperature:

Camels show a marked diurnal fluctuation of body temperature.

High temperatures during the morning are indicative of fever.

Accompanying symptoms are hyperlacrimation, increased respiratory and pulse rate, loss of appetite, dull and depressed appearance, decreased urine production and later rapid weight loss.

Pulse Rate:

Intermittent irregular pulse is not uncommon in camels and is not always a sign of illness.

In adult camels pulse rate can be best checked in sternal position.

Several arteries including the *posterior tibial*, *middle sacral* and the *femoral artery* are equally accessible.

Matted hair and dirt crusts on the hind legs make pulse detection difficult when using the *posterior tibial artery*.

Attempting to use the *femoral artery* requires patience since the animal might object to the presence of a hand there.

In young and immature camels the tail artery is the most convenient.

Respiration Rate:

- Camels are obligate nasal breathers of a pronounced abdominal respiratory type.
- Respiratory rate is best established by watching flank movements from a distance or by thoracic or tracheal auscultation using a stethoscope.
- Laboured breathing, coughing and snoring are always indicative of respiratory diseases.
- Coughing occurs more often during the night or after resting when the animal rises.
- Nasal and/or ocular discharge is frequently seen in the case of fever, local irritation and inflammation due to parasite infestation, frontal sinus infection, ocular diseases and upper respiratory diseases.

some clue about the systemic infection in the camel

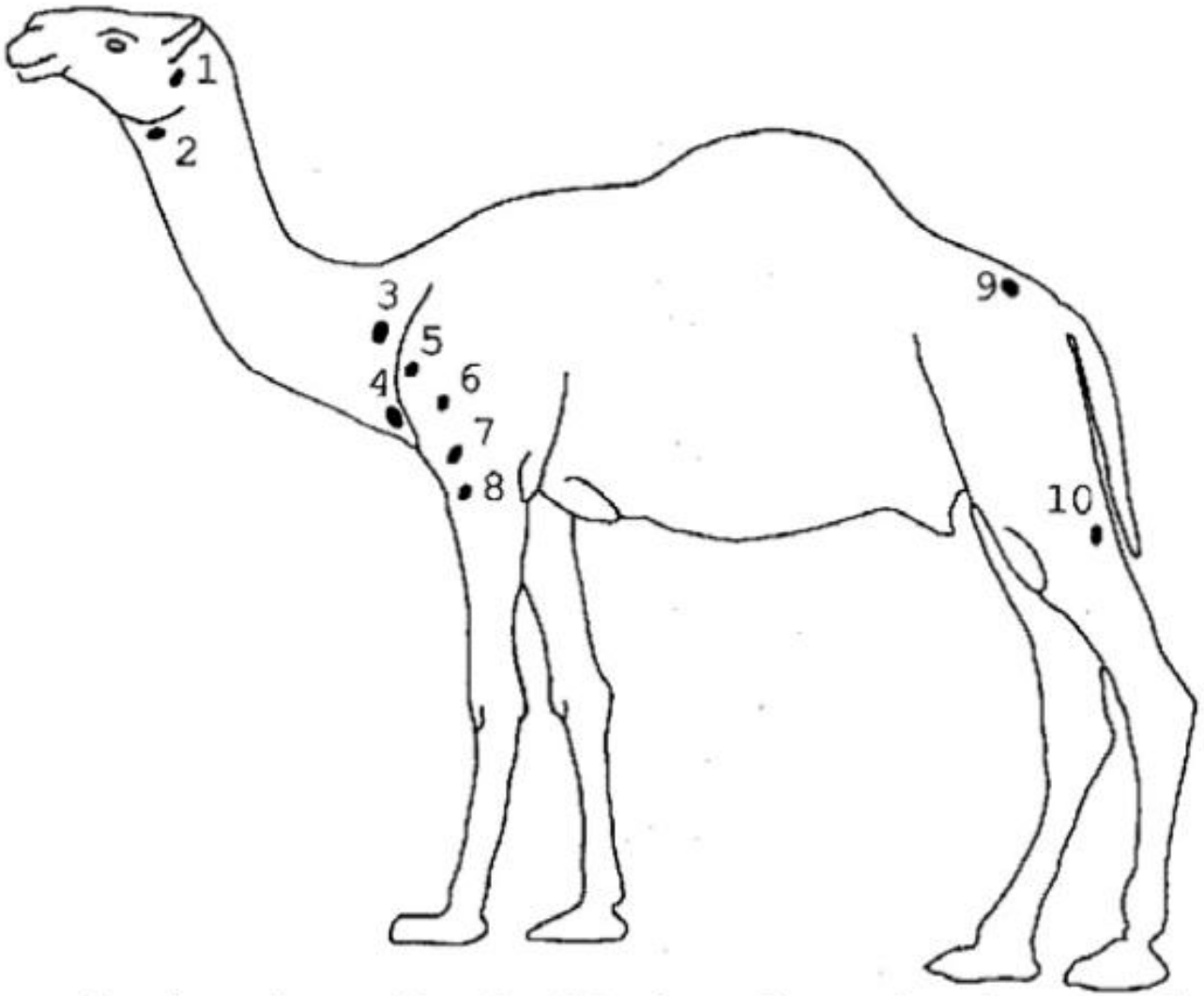
Palpation of peripheral lymph nodes can lead to the detection of infection in camel.

Temporary swelling of peripheral lymph nodes is most commonly due to localized or systemic infections.

The site of infection and peripheral lymph node reaction correspond. In systemic diseases all lymph nodes may be affected. The swollen lymph nodes may be tender to touch, hot and the overlying skin oedematous and reddened.

Increased sensitivity to touch and warmth is indicative of active infection.

In the process of healing, large lymph nodes do regress



Schematic drawing of palpable lymph nodes in camels: 1 preparotid, 2 pharyngeal, 3 prescapular, 4 inferior cervical, 5+6 external thoracic, 7 pectoral, 8 cubital, 9 ileo-pelvic, 10 superficial

Source: Schwartz and Dioli (1992).

Abdominal examination and rectal palpation

Abdominal Examination:

Stomach motility in camels is different from that of true ruminants, consisting of a total of 12 contractions per cycle.

About 2 to 3 audible contractions per minute can be noted when auscultated on the left flank.

Rectal Palpation:

Rectal palpation should be done in sternal recumbency.

In camels the rectum is quite tight and fragile. Preferably the examiner should have small hands and use sufficient lubrication to reduce risk of rectal perforation.

Bladder, large intestines, left kidney and the female genital tract can be palpated.

Reliable pregnancy confirmation is possible from the late second month of pregnancy onwards.

Salivation, urination and defaecation, guidance for the process of diagnosis

Salivation:

Excessive salivation in camels is unusual. Increase in salivation is suggestive of plant poisoning, snake bite, facial paralysis and central nervous disorders such as rabies.

Urination:

Camels frequently urinate and defecate especially after rising.

Daily output of urine ranges between 0.5 to 5.0 littres, depending to a large extent on the camel's status of hydration or dehydration.

The colour is usually light yellow but can turn dark yellow during dehydration.

In bull camels during rutting season, excessive salivation is an essential part of the mating behavior.

Faeces:

Faeces are usually well-formed pellets of light to dark brown colour.

In the early rainy season, faeces may take a light green colour, become less well formed or even take a liquid consistency, depending on the water content of the available forage.

During prolonged water deprivation, faecal water content may drop to approximately 30%.

Faeces are best sampled by free catch, which is not too cumbersome since camels tend to drop some pellets every few minutes. Grab sampling from the rectum is also easy.

Cont'd

Urine collection likewise is best attempted by free catch. Female camels can be catheterized, but their urethral opening is small and a suburethral diverticulum just in front of urethral opening makes insertion of a catheter quite difficult.

Male camels cannot be catheterized due to the presence of a urethral recess at the ischiatic arch.

Clinical Aspect:

Body fluids and excretions such as saliva, urine and faeces can change in colour, volume, frequency of excretion, consistency and smell, which often points to specific disorders.

Cont'd

A dark reddish to dark brown discoloration of urine indicates the presence of blood, myoglobin or haemoglobin. This is a serious clinical finding, just like a black and tarry appearance of the faeces caused by cloted blood.

The claim by many East African pastoralists that they can diagnose acute phases of trypanosomiasis by the smell of the animal's urine, was found fairly accurate by the scientists working in that area.

Blood collection from the camel

Usual convenient sites for blood collection from camel are the jugular vein, the medial metacarpal vein and the dorsal metatarsal vein.

Veins are either raised by digital pressure or using a tourniquet.

Camels have large oval shaped erythrocytes. These may rupture when blood is transferred from a syringe into a vacuum sampling container too rapidly with too much pressure on plunger, thus giving a faulty diagnosis.

Cont’d

Measurement of haematocrit values in camels is not as valid an indicator of the health status since the normal range is very large.

Haematocrit values ranging from 18 to 42 have been measured in the same animals within a time span of 10 days at various stages of mild dehydration.

Various methods and modes of administering drugs to camels

Oral application of drugs is done by drenching, through bolus or medicated feed.

Drenching and bolus administration are best accomplished with the animals seated, the head is then immobilized and tilted slightly backwards and the liquid medication poured onto the back of the tongue.

For ***subcutaneous injection*** the preferred site is just in front of the shoulder. This is one of the few sites on the camel's body with the skin loose enough to be grasped and lifted.

Cont'd

For ***intramuscular injection***, the usual sites are the neck and gluteal muscles.
A needle without syringe attached is inserted, which should be easily moveable underneath.
In suction no blood should appear in the hub of the needle.

If accidentally a blood vessel is hit, the needle needs to be repositioned.

The needle should be placed firmly and deeply into the muscles. The syringe is then attached and the drug injected.

After injection the needle still attached to the syringe is withdrawn.

Cont'd

For ***intravenous injections***, jugular vein is considered the most common and convenient site.

Camels have a very large jugular vein, which can be easily raised by palm pressure in the cervical groove. For raising the vein, a tourniquet can be applied near the base of the neck.

When the needle has been inserted, the pressure is released or the tourniquet loosened and the drug is injected slowly and steadily.

Cont'd

Caution is advised for restraining rutting bulls for blood sampling or intravenous drug administration, since there is a high risk that they injure their dulaa by biting on it.

Simple digital pressure for a short period of time or the application of an antiseptic adhesive tape in case of blood leakage from the puncture will stop the bleeding.

Treatment

Generally dosing in camels is done by extrapolating the dose recommended for large animals.

But the adverse effects will be high and the withdrawal period will be long.

Chapter6: Skin Diseases

6.1. Camel pox

Camel pox is one of the most important viral diseases in East Africa.

It is caused by *Orthopox cameli.*

Its outbreaks mostly occur during early to middle periods of the rainy season.

The disease is highly contagious, from one animal to another, but scabs, contaminated tools, cloth, grazing areas and human beings also serve as fomites.

Cont’d

Camel pox is reported most often in young and immature camels.

The main clinical symptoms are characteristic skin lesions, papules appear around nostrils and lips.

These papules later on take the form of vesicles, which eventually rupture.

There is fever and anorexia; mandibular lymph nodes are often enlarged. Facial oedema is quite common at this stage.

Cont'd

Affected animals show high temperature, severe depression and anorexia. Vesicles develop all over the body.

The pox scabs become covered with a thick brown crust after some time.

Septicaemia, reduced feed intake and resultant general weakness can precipitate death of these animals.

Mortality in calves and immature camels is very high, especially under poor management conditions, but the effects of morbidity may be equally important because they cause heavy production losses, particularly in weight gain.

Cont'd

Severe secondary infections are common. In dry climates the disease cures itself. In wetter areas, the disease can be severe. The Lister strain of vaccinia virus applied by skin scarification has been successfully used to control a severe outbreak in Bahrain. Along with a vaccination programme, improved management strategies could diminish the prevalence of the diseases. Recovered animals show a stable and lifelong immunity, but there is no cross protection with other types of pox virus, including contagious ecthyma being clinically similar.

6.2. Contagious skin necrosis

Contagious skin necrosis and streptothricosis are identical.

Its associated with staphylococcus, corynebacteria spp. Or dietary salt deficiency.

Moderate spread of disease occurs in crowding, watering points etc.

The disease is characterized by single, flat ulcerative lesion.

Most commonly affected sites are the head, neck and shoulder region.

Painful swelling of small skin area mark the beginning of the disease.

Skin necrosis starts at the center and spreads out wards.

Cont'd

High humidity and the behavior of the female dromedaries during urination leading to chronic wetness of the hindquarters have been implicated in the spread of skin necrosis.

Due to secondary bacterial complication we will see purulent discharges from the site.

Due to intensive rubbing and scratching behavior fences, trees and holding pens become contaminated and facilitate the spread among the herd.

Healing is usually slow and takes 3–4 weeks

Treatment is usually by injecting of broad spectrum antibiotic systematically.

6.3. Dermatophilosis

Dermatophilosis is divided into a winter and summer type.

As in the horse, there are distinct differences between infections involving short or long hair.

Long hairs in the vicinity of the exudate become matted yielding the characteristic ‘paint-brush” affect.

The matted hair tufts can be easily detached leaving a wettish pink, hyperemic wound surface, these areas become covered with a suppurative exudate in cases of severe infection.

- Dermatophilosis of short-haired areas occurring on almost all areas of the body.
- The lesions ranged from nodules to thickened, raised areas covered with thick scabs.
- Upon removal of the scabs, a raw area with a serosanguinous exudate is exposed

Diagnosis

- The bacterium is comparatively easy to culture and grows well on sheep and ox blood agar.
- The plates should be incubated at 37°C for up to 5 days in a CO_2 atmosphere.
- **Gram-stained smears** of scab material show Gram-positive microorganisms arranged in rouleaux form.

Treatment and Control

Successful treatment of dermatophilosis with terramycin or procaine penicillin and streptomycin has been reported.
Infected dromedaries are treated twice with Terramycin LA intravenously.
The scabs are removed and the areas cleansed daily with an iodine solution for 7 days. The lesions should be fully healed within 4 weeks.
Shearing of badly affected areas with long hair is often an important additional method of further reducing the development of lesions.
Isolating clinically affected animals and controlling ectoparasites are methods used to break the infective cycle.

6.4. Contagious Ecthyma

Contagious ecthyma is caused by the *parapox virus*.

Both the one-humped and two-humped camels are prone to this disease.

Pox-like lesions are produced by the affected animals.

Modes of transmission are similar to those described under camel pox.

The virus is morphologically different from *orthopox* virus and can easily be identified by electron microscopy.

Clinical symptoms are similar to those caused by the *orthopox* virus, but a diagnosis based on these lesions can only be presumptive.

Cont'd

The main practical differences between camel pox and ecthyma are that the former disease is more severe and affects camels of all ages.

In immature camels the lesions are mainly found around the mouth and nostrils and occasionally on the eyelids.

The mandibular lymph nodes are enlarged.

Due to intensive pruritus animals spend a lot of time scratching and rubbing the affected area, resulting in haemorrhages and skin excoriations.

Both localized and generalized skin lesions have been observed.

Whether recovered animals have a lasting immunity is not clear, but according to field observations, recovered animals were not affected during new disease outbreaks.

6.5. Camel papillomatosis (wart)

Simultaneous outbreaks of contagious ecthyma and papillomatosis have been reported in camel herds mainly during rainy season.

Caused by papilloma virion.

Definite modes of transmission of the disease are inconclusive.

Morbidity rate is quite high.

Mortality in adult animals is nearly nil, but among affected calves mainly 6 to 18 months old under poor management and inclement weather, mortality rate might be high.

Cont'd

Recovered animals were not affected during new outbreak.

The zoonotic potential of the disease for human beings or other livestock is not clear.

In adult animals, the disease resembles bovine papillomatosis. Nodules are found mainly around head, neck, shoulder and udder.

These become persistent and may require surgical removal.

Cont'd

Proliferative localized or generalized skin lesions develop in immature animals.

These lesions are very itchy and affected animals resort to intensive scratching and rubbing, resulting into haemorrhages.

A high incidence of conjunctivitis with severe secondary bacterial infection has also been noticed. Other clinical findings include marked oedema of the head and swelling of the mandibular lymphnodes.

Chapter5. Systemic Diseases

5.1. Pasturellosis

- Haemorrhagic septicaemia (HS) also called pasteurellosis is a disease of bacterial origin.

Etiology

- The Pasteurella are small, Gram- negative rods or coccobacilli.
- They are non- motile, non-sporing and facultative anaerobes.
- They are oxidase-positive and catalase-positive.
- *Pasteurella multocida* is the usual causative agent.

Epidemiology and Clinical Signs

It is prevalent in buffaloes, cattle and camel.

Its outbreaks occur mainly during the rainy season and are commonly seen in low lying areas that have seasonal floods.

The disease is usually seen in adult animals, but all age groups can be affected.

Mortality can reach 50-80% among affected animals.

Mode of infection is believed to be by ingestion of contaminated feedstuff.

Cont'd

The bacteria are not particularly resistant and do not survive longer than 24 hours on pasture.

Clinical characteristics include high fever over 40°C, increased respiration and pulse rates and general depression.

In camels, localization chiefly to subcutaneous tissue results in hot painful swellings around the neck.

The mandibular lymph nodes and/or cervical lymph nodes are usually enlarged.

Necropsied dromedaries revealed hydrothorax, pneumonia, emphysema, hydropericardium and fibrinous pericarditis.

Signs of respiratory dispnoea such as dilated nostrils or open mouth breathing and cyanotic mucous membranes are seen.

In the majority of cases, haemorrhagic enteritis is present characterized by obvious clinical signs of acute abdominal pain and tarry faeces and coffee coloured urine.

Affected animals seldom recover and usually die in the next 24 to 48 hours.

On post-mortem the most obvious findings are generalized internal petechiation under the serosa of the intestines, the heart and the lymph nodes.

Haemorrhagic enteritis and lesions of early pneumonia may be present.

Differentiation from anthrax, blackleg and septicaemic salmonellasis is usually done by bacteriological examination.

Disease onset is acute.

The absence of bloody discharge from the natural body orifices and a normal appearing spleen on post-mortem can help differentiate HS from anthrax.

Since HS is an acute and quite often fatal disease, early treatment is essential.

Treat with antibiotics such as amoxycillin, tetracyclines or sulphonamides.

Give 110 mg/kg body weight of sulphadimidine by mouth each day for up to 4 days.

5.2. **Brucellosis**

Etiology

- Brucellosis is a contagious disease caused by the bacteria of the genus *Brucella*.
- Brucella bacteria are Gram-negative coccobacilli, which are non-motile and non-spore-forming.

Epidemiology and Clinical Signs

- Brucellosis is characterized by **abortion**, and to a lesser extent by **orchitis** and **infection of the accessory sex** glands in males.
- The disease has a worldwide distribution and affects cattle, pigs, sheep, goats, camelids, dogs, and occasionally horses.

Cont'd

In humans, the disease referred to as **undulant fever** or **Malta fever**.

Inflammation of the uterus lining with reddening, edema and necrotic foci in the uterus epithelium, as well as fibrosis of the endometrium and atrophy of the uterine glands are common findings.

The infection occurs via the mucous membranes or skin or by ingestion of contaminated foodstuffs, whereby the causative agent then enters via the upper gastrointestinal tract.

Cont'd

Infections through the mucosa of the respiratory tract or the eyes are also possible.

The spread of brucella during sexual activity plays a subordinate role.

Theoretically, all three known Brucella species can cause infection in camels. However, it is surmised that ***B. melitensis*** is widespread in Africa and the Middle East and *B. abortus* is widespread in the former USSR.

According to various researchers, brucellosis in breeding camelids occurs in all of the known forms, whereby **abortion** is its most obvious manifestation.

Cont'd

- Infections may also cause **still born calves**, **retained placenta** and **reduced milk yield** as is common in cattle and sheep.

Diagnosis

- Brucellosis is usually diagnosed in the laboratory by **culture** of blood, milk or tissue or **detection of antibodies** in sera.
- Brucella organisms can be recovered from the placenta, but more conveniently in pure culture from the stomach and lungs of aborted fetuses.
- Many authors regard the **CFT** as being the most **sensitive** and **specific** test for brucellosis. This is true for both acute and chronic infections.

Treatment and Control

For the eradication of brucellosis in animals, the ‘**test and slaughter**‘ and ‘**vaccination**‘ policy is recommended.

This method should be implemented when the disease is serologically and bacteriologically confirmed.

Seropositive animals should be slaughtered and the entire herd tested until all reactors are eliminated.

In Camelidae, as in other animals, this will be achieved when two to three successive tests are negative.

Cont'd

After this procedure, a vaccination program may then be implemented to protect the entire herd from re-infection.

The greatest danger comes from replacement animals.

Infected vaccinated animals remain a severe hazard to public health.

Both **inactivated** and **attenuated** Brucella vaccines have been used successfully in camels.

Dromedaries can be vaccinated with *B. abortus* strain *Buck 19* and with *B. melitensis* strain *Rev 1*.

5.3. **Anthrax**

- *Bacillus anthracis* causes anthrax in man and animals.
- Throughout the world there is a single uniform antigenic type, even though there are differences between local specific strains.
- Under natural conditions, the animals most frequently affected are the cow, sheep, goat, buffalo, horse, reindeer and elephant.
- Anthrax is an acute, septicemic disease, which can also affect camelids.
- Epidemics of anthrax tend to occur in association with marked **climatic or ecological** changes, such as **heavy rainfall**, **flooding or drought**.

Etiology

B. anthracis is an aerobic sporulating bacterium, which is a Gram-positive, non-motile, cylindrical rod.

Inside the host it forms a capsule, which can be demonstrated by special stains.

In organ smears the bacilli lie either singly or in short chains forming a so-called **bamboo-stick** form.

Spores develop only in the presence of oxygen at temperatures above 12°C.

B. anthracis grows on ordinary solid media and no hemolysis is produced on blood agar.

Under low magnification the colonies give the appearance of a **Medusa-like** head or a woman's curly hair.

Epidemiology and Clinical Signs

- Anthrax is a peracute disease characterized by septicemia and sudden death.

- The anthrax endospores can **survive for years** in the soil.
- Masses of vegetative bacilli are discharged from the body in the final stages of the disease and sporulate in and on the ground at temperatures of 20 – 32℃ .

- Soil can be contaminated for years by buried cadavers, which then serve as sources of infection, especially when the grazing animals bite off the pasture grass at ground level during periods of **food scarcity**.

Cont'd

The clinical signs of anthrax in dromedaries are similar to those in the cow i.e.

- Fever up to 42^0C,
- Extravasation of tar-like blood from the body orifices,
- Diarrhea
- Colic
- Bloat and severe cardiovascular and pulmonary disturbances.
- Some dromedaries develop painful swellings on the throat and neck.

Pathology

The principal lesions in septicemic anthrax in animals are hemorrhages, edema and necrosis.

In dromedaries, there is evidence of rapid post mortem decomposition of the carcass with oozing of bloodstained fluid from nose, mouth and anus.

Darkred, poorly clotted blood, petechiae and ecchymoses are observed throughout the carcass.

An enlarged pulpy **spleen**, which is the most characteristic feature at necropsy in ruminants, has also been described in camelids.

There is **no rigor mortis** and the **blood fails to clot**.

Spleenomegaly with black tarry pulp, generalized congestion and lung edema were also observed.

Diagnosis

B. anthracis is easily **cultured** from blood and tissues.

However, if anthrax is suspected one should avoid a necropsy to avoid contamination of the soil with spores.

A small quantity of blood is sufficient for the diagnosis.

A smear or a culture as well as a fluorescent antibody test (**FAT**) will confirm the diagnosis.

Prevention and Control

To prevent sporulation of *B. anthracis*, carcasses should not be opened.

They should be incinerated with the contaminated bedding.

After contact, equipment must be properly disinfected.

Anthrax vaccine has been used worldwide with great economic value to the livestock industry and to wildlife.

A single inoculation provides effective immunity for 9 months, but annual booster vaccinations are recommended.

6.4. **Mastitis**

- Inflammation of the udder occurs less frequently in the camelids than in other domesticated animals.
- There might be several reasons why mastitis is more **uncommon** in camelids than in other domesticated animal species used for milk production.

- The mammary glands of camels possess four quarters and one teat per quarter.

- Each teat has two streak canals that enter into separate teat and gland cisterns. Each teat is associated with a non-communicating double gland.

Cont'd

The streak canals are very narrow and a 1 mm tomcat catheter is required for penetration. This twin duct anatomy with its narrow streak canals might in some way protect against infection.

Milking camels are often fitted with **udder covers** to restrict suckling. These covers might reduce injuries to the teats and the udder and protect against gross contamination.

However, the more likely explanation why udder infections in camelids are less frequent lies in the **milk** itself. Several scientists have found substances in camel milk that inhibit the growth of pathogenic bacteria.

These inhibitors are proteins and have been described as lysozyme, immunoglobulins, lactoferrin and lactoperoxidase, which are already well characterized. These proteins have been shown to have higher concentrations or higher activity in camel milk.

Etiology

- There are divergent opinions as to which bacteria are potentially the primary causal organisms of infectious mastitis in the camel.
- *Streptococcus, Staphylococcus, Micrococcus, Aerobacter* and *E. coli* to be the main bacterial species causing mastitis.
- The following bacteria were considered secondary agents,
  - *Actinomyces* spp.,
  - *Pseudomonas aeruginosa*,
  - *Klebsiella pneumoniae*,
  - *Bacteroides* spp.,
  - *C. perfringens*

Pathology

Peracute, subacute and gangrenous mastitis with lymph node enlargement have been described in the camel.

Very little is known about the pathological alterations occurring during infection of the mammary gland.

The affected udders are often swollen, hard, reddened and painful to the animal on palpation.

In chronic mastitis, necrosis and abscessation might be observed with discharge of greenish pus.

In acute cases, the mammary secretions are watery, yellowish or blood tinged.

Treatment

When mastitis occurs, prompt attention is necessary to avoid severe damage to the mammary gland or even loss of the animal.

Mastitis treatment should be based on culture and sensitivity and the treating person must be fully aware of the anatomical particularities of the camelid's mammary gland.

Camelids should be restrained and then rolled on their sides with the hind legs roped back.

Ampiclox@, Orbenin LA@ and Mastalone@, which should be infused according to the manufacturers' recommendations.

6.5. Paratuberculosis

- This disease is characterized by persistent and progressive diarrhea, weight loss, debilitation and eventually death.
- The disease produces a chronic, contagious enteritis and affects cattle, sheep, goats, camels, farmed deer and other domestic and wild ruminants.

Etiology

- *Mycobacterium avium spp. paratuberculosis* is a non-motile, non-sporing,
- Aerobic and oxidative bacterium which does not take up dyes of the Gram stain because the cell wall is rich in lipids and mycotic acid.
- *M. avium spp. Paratuberculosis* is acid-fast and the best stain is Ziehl Neelsen.
- The disease can be diagnosed by the demonstration of the bacteria and by serological and allergic tests.

Epidemiology and Clinical Signs

- *M. avium spp. paratuberculosis* is shed in feaces and the organisms are found within macrophages of the intestinal mucosa and adjacent lymph nodes.
- A cell-mediated immune response appears to be involved in the pathogenesis of this disease.
- Not all infected animals become clinical cases, but they remain excretors of *M. avium spp. paratuberculosis*.
- Following oral infection, *M. avium spp. paratuberculosis* enters the lymphatics through the tonsils and the intestinal mucosa.
- Peyer's patches take up the microorganisms from the intestinal lumen and transport them through the intestinal mucosa.
- The incubation period is generally 18 to 24 months.

Pathology

- Paratuberculosis causes more pathological changes in Bactrian camels than in cattle.
- Lesions have been observed in the **ileum**, **cecum and colon**, although additionally inflammation of the **liver**, **spleen and lymph nodes** has also been reported.
- Infected animals die within 4 to 6 weeks after the initial occurrence of diarrhea.
- At necropsy, severe intestinal thickening and enlargement of the regional mesocolic lymph nodes.
- Histologically the lesions are characterized by a marked accumulation of macrophages in the mucosal layer that were laden with acid-fast bacilli.

Diagnosis

Paratuberculosis can be diagnosed by **culture, allergic and serological tests.**

Bacteriological culturing of feces is the most sensitive and specific test for *M. avium spp. paratuberculosis*, but it can require up to 16 weeks to obtain the results.

Biopsy specimens of intestinal mucosa and fecal smears stained by the ZN-stain usually yield characteristic clumps of *M. avium spp. paratuberculosis* organisms.

However, examination of feces will detect only about 25% of subclinical excretors.

Treatment and Control

- No satisfactory treatment of paratuberculosis is known.
- Control requires good sanitation and management.
- Suggested methods of eradication includes:

1. Clinically suspected camels should be isolated until the disease is confirmed. All infected camels should be slaughtered and carcasses properly disposed.

2. Where possible, camelid calves should be removed from their dams at birth and reared in a paratuberculosis free environment.

Cont'd

3. Appropriate sanitary measures should be applied to prevent contamination of food, water and soil; and ponds and ditches should be fenced off.

4. Newly purchased camels should be examined for paratuberculosis.

5. Vaccination should be considered.

- In many countries, vaccines are used in cattle, sheep and goats. The available vaccines are prepared from either a live or heat–killed strain of *M. avium spp. paratuberculosis*

6.6.Tuberculosis

Tuberculosis is a chronic contagious disease caused by mycobacteria, which affects many vertebrate animals and particularly manifests itself in lungs and lymph nodes.

The lesions are granulomas known as tubercles.

The lesions differ greatly according to the animal species infected and the species of mycobacteria involved.

The widespread outbreaks of *M. tuberculosis* are of considerable concern to public health officials, conservation agencies and veterinarians responsible for the health status of animals in zoos, animal parks and private herds.

Many strains have become resistant to medication.

The two most important members of the genus Mycobacterium are *M. tuberculosis* and *M. bovis*. Both have been isolated from camel.

Etiology

- The genus Mycobacterium of the family Mycobacteriaceae are acid-fast rods of various lengths, non-motile and non-sporulating.
- The genus Mycobacterium contains multiple species (about 50) with different pathogenicity.
- The atypical mycobacteria are widespread in pastures, soil and water. Some of them may infect animals.
- The most important mycobacterial species causing disease in livestock are:
  - *M. bovis* – occurs in many animal species including man
  - *M. avium* complex occur in poultry, wild birds, pigs, horses;
  - *M. avium* spp. paratuberculosis
  - *M. farcinogenes* which causes bovine farcy.

Epidemiology and Clinical Signs

- There are different modes of spread of tuberculosis between camelid herds.
- One is the introduction of an infected animal into a non-infected herd.
- The mode of transmission of tuberculosis is unknown in camelids, but it is presumed similar to that in cattle.
- In cattle it is mainly horizontal. It is believed that camelids suffering from pulmonary tuberculosis infect healthy animals via aerosols.
- The alimentary, congenital, venereal and cutaneous routes that may occur in cattle have not been described in camelids.

Cont'd

- Tuberculosis is rare among camels kept under nomadic conditions.
- The disease occurs more frequently when camels are kept in close quarters with other camels or in close contact with cattle.

Diagnosis

- The diagnosis of camelid tuberculosis in living animals faces many difficulties.
- None of the tests available can diagnose tuberculosis with certainty.
- Intradermal tuberculin testing, which is the classical diagnostic test, often gives non specific reactions in camelids.
- A definitive diagnosis of tuberculosis requires the culturing and specification of the organism.

Pathology

- The organs most frequently affected in the dromedary are the lungs, bronchial and mediastinal lymph nodes, pleura and liver. The trachea, kidney and spleen can also be affected.
- Miliary nodes on the surface of the lung and deep in the tissue have been observed. Tubercle bacilli have been isolated from these lesions.
- Histopathological lesions are pyogranulomas with dense centers containing caseous remnants of neutrophils surrounded by epitheloid macrophages with few giant cells.

Treatment and Control

In many countries tuberculosis is a reportable disease.

Positive animals must be slaughtered.

Permission was sometimes granted to treat valuable zoo camelids with isoniazid at a dose of 2.4mg/kg of pelleted feed, which was given adlibitum to Bactrian camels.

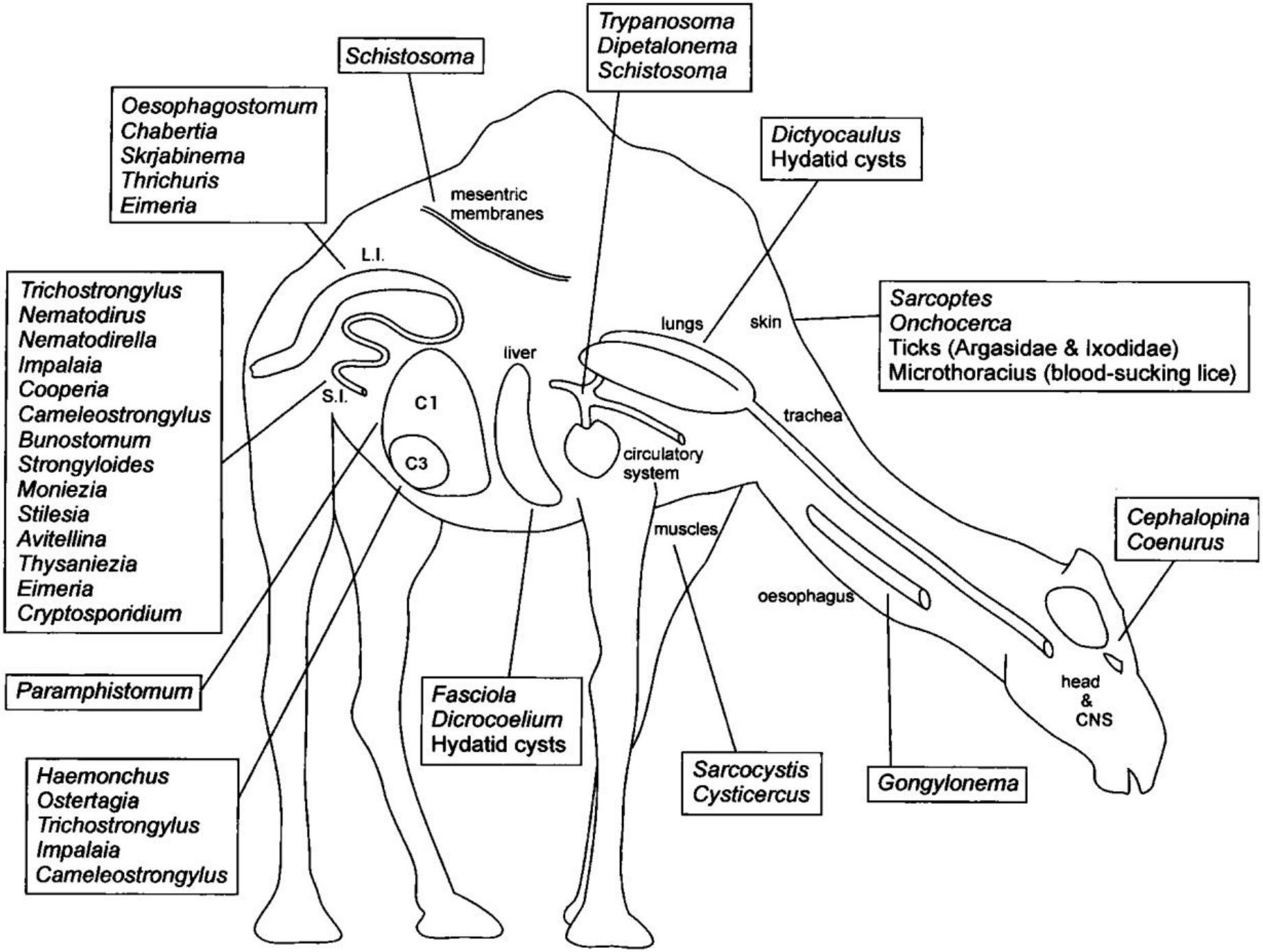
However, most probably due to an overdose, several camels died, exhibiting severe leukopenia and thrombocytopenia.

Infected properties, surfaces and utensils are disinfected with 3% formalin, 2% Lysol and 2.5% phenol.

Chapter 7. Parasitic Diseases

Parasitic infections may significantly limit the productivity of camelids and other livestock by causing a substantial reduction in the provision of milk, meat, wool and fibers, as well as transport.

Many conditions are of a subclinical nature.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Hydatid cysts
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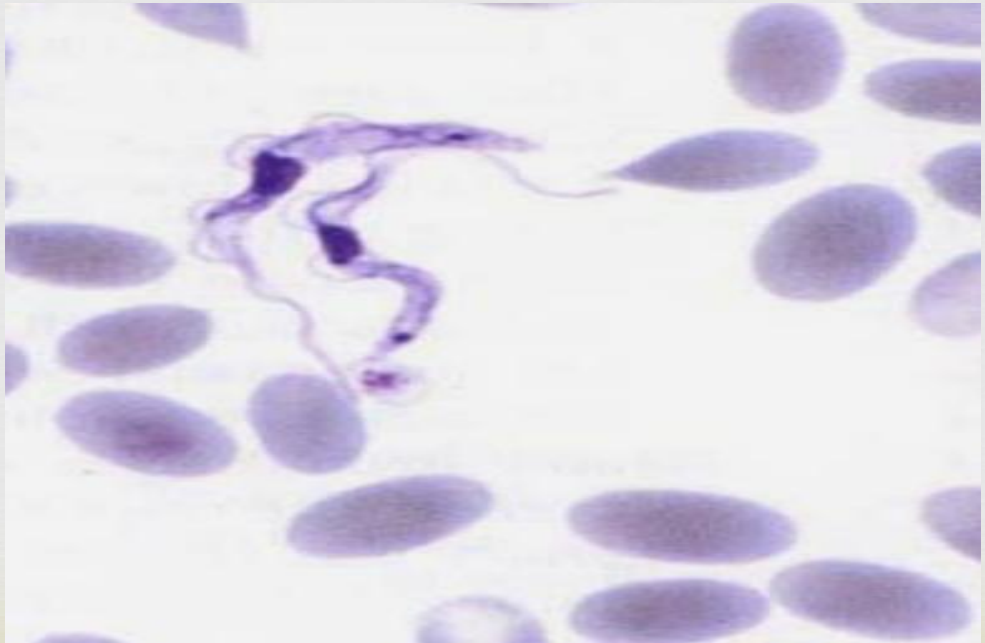
membranes
L.I.
Trichostrongylus
Nematodirus
Nematodirella
Impalaia
Cooperia
Cameleostrongylus
Bunostomum
Strongyloides
Moniezia
Stilesia
Avitellina
Thysaniezia
Eimeria
Cryptosporidium
lungs
skin
Sarcoptes
Onchocerca
Ticks (Argasidae & Ixodidae)
Microthoracius (blood-sucking lice)
liver
S.I.
C1
C3
trachea
circulatory
system
muscles
Cephalopina
Coenurus
oesophagus
head
&
CNS
Paramphistomum
Fasciola
Dicrocoelium
Hydatid cysts
Haemonchus
Ostertagia
Trichostrongylus
Impalaia
Cameleostrongylus
Sarcocystis
Cysticercus
Gongylonema

Protozoal Infections

Trypanosomosis

The most important protozoal disease of camels is trypanosomosis (named surra), caused by *Trypanosoma evansi*.

The parasite is widespread throughout tropical and subtropical areas.



Clinical Pathology

The anemia is **macrocytic** and **hemolytic**.

There is a decrease in erythrocytes and an increase in lymphocytes, eosinophils and monocytes.

The infection is also accompanied by progressive changes in the serum protein concentrations, a decrease in albumin, an increase in γ-globulins and a five-fold increase of IgM levels during the course of the infection.

Transmission

T. evansi is transmitted mechanically by blood-sucking flies.

Several biting or blood-sucking insects may serve as vectors.

Mechanical transmission by contaminated hypodermic needles is also a potential means of transmission.

The main vectors involved are **tabanids** and **Stomoxys**.

Other insects may also transmit the parasite, the efficacy of transmission depends on the interrupted feeding behavior of tabanids, i.e. on the interval between a fly feeding on an infected host and moving to a clean host.

Cont'd

- Other domesticated species like sheep and goats, which have only mild, subclinical infections and which often coexist with camels, might act as reservoirs.
- Surra has a marked seasonal pattern in some areas in association with wet conditions, e.g. the development of the biting fly populations after rain.

Clinical Signs

- Surra may be acute, subacute or chronic, with a mortality of up to 90%.
- Acute cases often show signs of recurrent fever accompanied by progressive anemia and poor general condition. Edema and paralysis may also develop.

Cont'd

Subacute infections occur with fever, edema, emaciation and high mortality.

The edema varies from plaques on the neck and flanks to edema of the muzzle, chest wall, sheath and scrotum and on the legs up to the knees and hocks.

Death may take a few days or months.

The chronic form of the disease leading to wasting and anemia is more common in camels.

It can cause abortion, premature birth and reduced milk production.

Treatment and Control

Only a few drugs, e.g. Cymelaman@, melarsomine, Triquin@ quinapyramine sulfate, quinapyramine chloride and isometamidium chloride.

As there are only very limited pharmacokinetic data available on camelids, drugs should be used with great caution.

This also applies to the use of vaccines.

They should undergo testing by regulatory agencies for safety and efficacy before they are used on camelids.

Coccidiosis

- They are important within the *Eimeriidae* and *Sarcocystidae* families.

- The Eimeriidae are mainly intracellular gut-dwelling parasites (gut-dwelling coccidia) of the intestinal epithelium where they undergo both asexual (schizogony) and sexual (gametogony) multiplication.

- They complete their life cycle (LC) in a single host, in contrast to the Sarcocystidae (tissue cyst-forming coccidia), which have a two-host LC and which form tissue cysts in the intermediate hosts.

Cont'd

The LC stages in both families ultimately result in the formation of oocysts, which are environmentally resistant forms that following sporulation may eventually infect susceptible new hosts.

Disease outbreaks characterized by enteritis are mostly associated with young animals living in crowded and wet conditions, after or during the rains.

When the infective stage, the oocyst, is ingested by a host following excystation the sporozoites are released usually penetrating the epithelial cells of the mucosa in the small intestine.

Clinical Signs

- Young animals suffer from hemorrhagic enteritis and diarrhea.
- The feces may be stained with blood and mucus.
- Animals with severe infections show signs of inappetence, dehydration, and progressive weight loss.
- Their coat is rough and hair loss may occur.
- Anemia is often seen and respiration may be rapid.
- Secondary bacterial infections may severely aggravate the disease and cause mortalities in young camels.

Pathology

Development stages of the parasites are found in the mucosa and laminapropria of the jejunum and ileum.

Histological sections show destruction and organization of the mucosa together with hemorrhages and infiltration of inflammatory cells (mainly eosinophils and macrophages).

Diagnosis

- Young animals are particularly prone to infection of coccidiae.
- Is based on clinical signs of diarrhea, dysentery and often the demonstration of very large numbers of oocysts in the feces (microscopic examination following flotation with e.g. salt or sugar solutions).

- Verification of suspected cases of coccidiosis depends on the demonstration of unsporulated oocysts either in smears prepared from fresh feces or by concentration methods involving flotation in saturated salt solutions.

- Identification is done by the morphology of the freshly excreted oocysts as well as the sporulated oocysts.

Cont’d

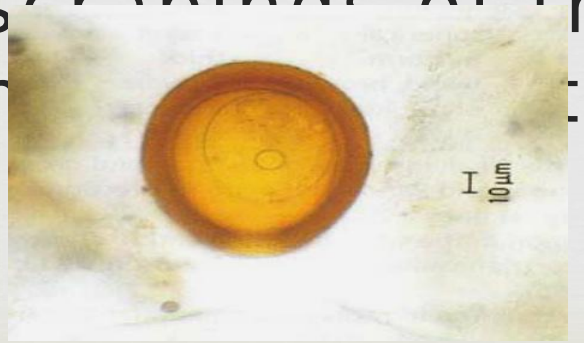
It is often necessary to sporulate the oocysts for species differentiation.

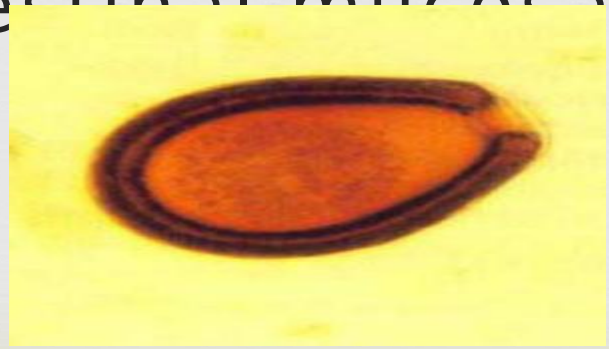
A direct smear of diarrheic feces examined under a microscope may reveal oocysts.

However, peracute and acute diseases may be exhibited before oocysts are excreted.

The morphology of the sporocysts are helpful in the diagnosis of species.

At necropsy, lesions in the intestine may be recognized and asexual stages may be seen in scrapings of the intestinal mucosa and on h tions.





Treatment

Coccidiosis is a self-limiting disease. Following the multiplication stages in the intestine, recovery is often spontaneous and occurs without any specific treatment.

With regard to OWC treatment; sulfadimidine, sulfadimethoxin 50mg/kg i.m. for 3 to 5 days is found to be effective.

Toxoplasmosis

Toxoplasmosis is caused by the cyst-forming coccidial parasite *Toxoplasma gondii*, an important worldwide zoonotic pathogen.

It is an intestinal coccidial parasite of cats, which become infected by ingesting toxoplasma infected animals, containing cysts of the organism.

The parasite in the intermediate hosts (which can be almost any mammalian species including man) may cause a severe disease.

Generally, Toxoplasma infections are subclinical, although in pregnant individuals the infection may cause abortion or congenital disease in the offspring.

Cont'd

T. gondii is one of the most common cat zoonoses.

Two separate stages of multiplication of *T . gondii* may be recognized.

The sexual cycle is only completed in the intestinal epithelium of felines (entero-epithelial phase).

This results in the development of oocysts, excreted in cat feces.

The oocysts are highly resistant when sporulated and can stay infective for a year or longer.

Cont'd

- As the infection proceeds, cysts within cells are formed containing hundreds of organisms named bradyzoites.
- These cyst formations are characteristic of the chronic infection.

Transmission

- Camels contract the infection by ingesting feed contaminated with oocysts.
- Cats given camel meat excreted oocysts of *Cystoisospora felis*, *C. rivoltu* and *T. gondii*.
- *C. felis* and *C. rivoltu* are coccidia of cats.

Cont'd

Housed camels had a much higher prevalence due to exposure to the final hosts (cats) than camels in the desert.

The presence of antibodies shown in camels is indicative of past or present infections with *T. gondii*.

Public Health Concern

- Consumption of undercooked camel meat may constitute a risk of infection to humans and should therefore be of public health concern.

Treatment and Control

The antimalarial drug pyrimethamine in combination with sulphadiazine is effective against tachyzoites.

In livestock, treatment of ovine toxoplasmosis with a combination of sulfamezathine and pyrimethamine proved successful.

There is no reported treatment of toxoplasmosis in camelids.

However, if the infection is diagnosed in a herd of camels, control measures should be employed.

Infestations with Ectoparasites

Camelids like other livestock are exposed to and affected by a range of ectoparasites, which may directly or indirectly cause a great diversity of health problems.

Some ectoparasites play a significant role in many disorders. For example, some biting insects are vectors of disease agents such as *T. evansi*, and the mite *Sarcoptes scabiei* is the cause of sarcoptic mange.

Both are regarded as the two most economically important diseases in camelids.

Sarcoptic Mange

- Sarcoptic mange occurs in more than 100 species of mammals including humans.
- The causative mite is *Sarcoptes scabiei*.
- The mite is thought to have a number of subspecies or variants, each designated according to which host it has been isolated from *S. scabiei* var. *hominis*, *S. scabiei var cameli* etc.
- However, the host-specificity is not complete and transmission from one host species to another may occur.
- The different isolates or subspecies are morphologically indistinguishable.

Morphology

- *Sarcoptes scabiei* belongs to the burrowing mites.
- It has an oval, ventrally flattened and dorsally convex tortoise-like body

Life Cycle

- The developmental cycle of *S. scabiei* consists of egg, larval, protonymphal and tritonymphal stages.
- The sarcoptic mites differ from most other mange mites; they inhabit the epidermis of the skin excavating tunnels in the outer cell layers.
- The mites burrow in the stratum corneum through the dead cell layers until they reach living cells in the stratum granulosum and stratum spinosum. Due to the continual outgrowth of the epidermis the burrows containing the mites and eggs are mostly found in the comeum.
- The mites are rarely found beneath the stratum germinativum.
- The fertilized female lays her eggs in tunnels. Her lifespan is about four weeks and the development time from egg to adult is about 12 to 16 days.
- The eggs are produced at a rate of three to four daily.
- The eggs hatch in 3–5 days and larvae with three pairs

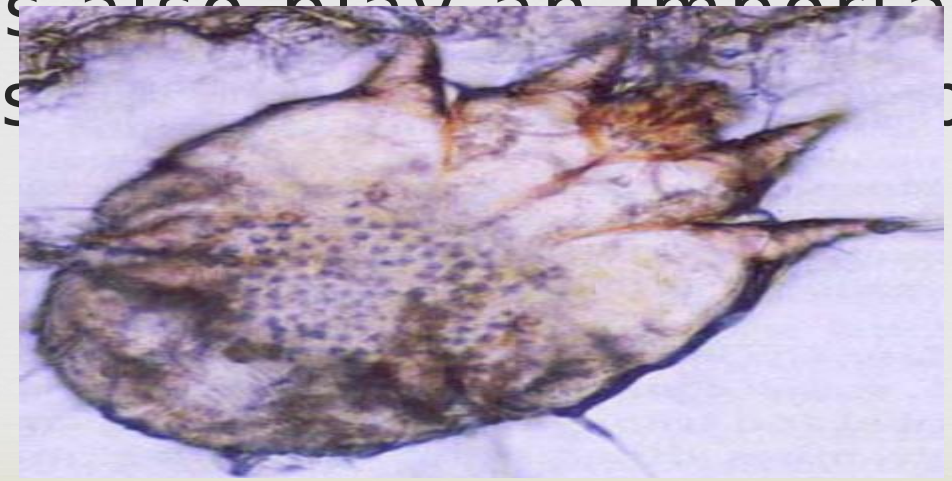
Epidemiology and Transmission

Infection is mainly through direct contact.

All three developmental stages (including the adults) are capable of migrating on the skin surface.

However, infection occurs when the mites become dislodged by their host scratching or rolling on the ground, whereby infection may take place indirectly.

Fomites also play an important part in the transmis[illegible]otic



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Mites can survive outside their host for several days and remain infective if the microclimate is sufficiently moist and cool.

During the dry season in the tropics, the mites most likely do not survive for long off the host.

S. scubiei of camels remained viable away from their host for 4 days.

S. scubiei isolated from naturally infected sheep and goats have been successfully transferred to domedaries.

The infection is regarded as highly contagious and

Cont’d

Sarcoptic Mange in Camelids is regarded as one of the most prevalent and serious camel diseases .

It is often ranked second in importance to all the disorders in dromedary camels , and second only to trypanosomosis.

It can generally be regarded as a chronic debilitating condition with high morbidity and low mortality.

The disease ‘sarna sarcoptica‘ was previously widespread in North American captive camelids where it appears to be decreasing, probably through routine deworming with ivermectin .

Cont'd

Any camelid regardless of sex and age may be affected by *S. scabiei* . However, some reports state that the infection is more prevalent in younger animals .

It is often cited that animals in poor condition are more prone to infection. However, this is controversial as others report that animals in very good condition can also become infected.

There are conflicting opinions regarding the seasonality of the disease.

Some authors describe a quiescent phase usually coinciding with winter, others finding a higher incidence in the winter.

Cont'd

- The disease also occurs worldwide in a wide range of wildlife species.

Clinical Signs

- The first signs of infection are small hyperemic papules often appearing on the medial aspect of the thighs or inguinal region, the head and neck, medial areas of the flanks, udder, and shoulder.
- In severe cases any part of the body may be affected.
- The lesions are often accompanied by intense pruritus with excoriation and secondary infections. The itching and rubbing causes alopecia.

- Hairless areas with serous exudation forming scabs follow the first acute signs and itching may increase, seriously disturbing the animals.
- The lesions spread and aggravate excoriation, alopecia, and crusting, resulting in more scabs.
- The latter may be rubbed away revealing a ‘red raw surface‘, erosions and wounds.
- Within a few weeks, the acute disease may develop to the chronic stage, which is the stage most often encountered in the field.
- Hyperkeratosis and proliferation of the dermis leads to the skin becoming thicker, fissured, and corrugated appearing like a dried cracked field of clay.
- The incubation period is believed to be around 2 to 3 weeks.

The earliest lesions are often unnoticed. Apart from the characteristic clinical signs of pruritus, alopecia and hyperkeratosis, demonstration of the mite is possible by taking deep skin scrapings from several affected areas.

proper and adequate numbers of skin scrapings from the individual mangy animal.

Care should be taken to scrape at least 1 cm^2 area of the mangy skin. In chronic lesions where the skin is thickened and corrugated, scrapings should be made in the ‘valley‘ areas .

The scrapings should be done by parallel strokes of a sharp scalpel blade at the margins of the mange lesions.

This is to be followed by taking deeper scrapings until capillary oozing occurs on the whole scraped surface. All scrapings, keratinous and epidermal material are collected and placed into a broad mouthed centrifuge tube.

The chances of making a correct diagnosis by skin biopsies are less likely because *S. scubiei* mites are rarely seen in biopsies.

In mange, varying degrees of superficial dermatitis, epidermal spongiosis, hyperplasia and hyperkeratosis may be observed.

Epidermal erosions and crusting are often seen due to self-trauma.

The scrapings should first be examined with a stereomicroscope or a magnifying glass to search for living mites that are stimulated into movement when the environmental temperature is above 18°C.

If no mites are observed, 100% potassium hydroxide (KOH) solution is added to each tube containing the skin scrapings, which are placed into a water bath of 37°C for a few hours until the material has disintegrated.

Adding 20mL of KOH solution to the skin material and placing the tube into boiling water for 30 minutes.

The sample is then centrifuged at 1500 rpm for 5 minutes.

The supernatant is discarded and one to two drops of glycerin are added to the sediment, which is then examined under a low power light microscope.

Cont'd

- The lesions of mange are most probably caused by hypersensitivity reactions, as has been shown in sarcoptic mange of humans and pigs.
- Only a few sarcoptic mites burrowing into the skin of the animal can provoke a generalized hypersensitivity reaction leading to the typical acute signs of mange in the host.
- Differential Diagnosis Several skin diseases may mimic sarcoptic mange. These are:

1. Ringworm;
2. *Dermatophilus congolensis*
3. Infestations with other ectoparasites
4. Staphylococcus aureus dermatitis;
5. Endocrinal dermatopathy;
6. Inhalant or food allergies ;
7. Irritant dermatitis associated with contact with abrasive surfaces when lying down

Zoonotic Potential

In Humans occasionally become infected with *S. scabiei* from camel, horse, pig, goat, sheep, chamois, ferret, fox and llama.

Direct transmission between the herders and their animals is most likely during milking, riding, and handling of animals.

Cross-infections by *S. scabiei* from animals to humans are called pseudoscabies, distinguished from true human scabies.

Humans infected by the itch mite *S. scabiei* from camels exhibit signs similar to those of classical scabies: pronounced intensive itching during the night.

Treatment and Control

- There are severala1 effective acaricides available today, organochlorines, organophosphorous compounds and synthetic pyrethrins.
- More recent drugs are applied parenterally as well as topically. Also effective against nematode infections are avermectins .
- When using acaricides as dip wash or sprays, it is essential that the whole animal be covered with the solution.
- Before acaricides are applied, such areas should preferably be washed with lukewarm water and soap to soften the scabs and keratinized material.
- In addition, the application of a 15% solution of salicylic acid, a keratolytic agent, is recommended.
- The salicylic acid solution is applied a few times at an interval of 2-3 days followed a day or two later by

Cont'd

The animals should be treated 3 times within an interval of 7 to 10 days, but sometimes 4 or more applications are needed until a cure is reached.

The topical application of acaricides is very laborious and difficult to carry out under nomadic conditions, but may more easily be applied in sedentary herds. The injectible ivermectin, doramectin have made the treatment of sarcoptic mange much easier.

The recommended ivermectin dose is 200 mg/kg given subcutaneously and repeated after 15 days. pruritus completely ceases after one week to 10 days following the second injection. Four weeks after the second injection all previously alopectic areas are covered with

Psoroptic Mange

- Psoroptic mange mites spend their entire life on the skin, feeding superficially.
- They reportedly infest camelids, but are less commonly found on camelids than *S. scubiei*.

Morphology

- Some of the features that distinguish Psoroptes from the other common non-burrowing mite. Chorioptes are the pointed mouthparts, the male's rounded abdominal tubercles, and the three jointed pedicels bearing funnel-shaped suckers on most of the legs.
- The female's third pair of legs end in bristles instead of suckers.

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Clinical Signs

- Common lesions consist of dry flakes in the ears. The ears may occasionally be filled with purulent discharge responsible for head shaking and poor coordination.
- Mites were also found in the perineum, nares, axillae, groin, neck and legs . The piercing and chewing mouthparts of the mite can severely damage the skin. This stimulates a local inflammatory reaction that exudes serous exudate. The exu- date coagulates forming a crust or scab.

Diagnosis

- Skin scrapings reveal the mites.
- A mite may be found in the center of the first papules seen. However, mites are usually found

Chorioptic Mange

The mange mite Chorioptes commonly infests cattle, sheep, goats and equines and, unlike *S. scubie*i, lives on the skin. Unlike Psoroptes sp., its mouthparts allow the mite to feed on scales and other skin debris.

Chorioptes sp. closely resembles Psoroptes sp., but has rounder mouthparts and tarsal cup-shaped suckers on short unsegmented pedicels.

Chorioptes sp. causes pruritic mange mostly seen on the neck, tail, udder and legs in cattle and on horses' legs below the knees and hocks.

Infestation with Chorioptes is most probably rare in camels.

Treatment

It has been shown that pourons may be used. Bayticol, Pour-on 1% (flumethrin), 1 mL/10 kg applied on Bactrian camels with psoroptic mange proved to be effective.

Five days after the single topical treatment was applied, no more living mites were found and the healing process of the skin lesions began a few days later.

Demodectic Mange

- The preferred site of the burrowing mite of the genus Demodex is at the hair follicles and sebaceous glands of the skin.
- It is a cigar-shaped, elongated 0.2 mm long mite.
- The thorax has four pairs of short stumpy legs.
- The LC is only partially known. It includes eggs (70-90pm x 19-25pm), one larval stage and two nymphal stages, and lasts 3 weeks.
- The mite is most probably transmitted from the dam to the offspring during nursing.

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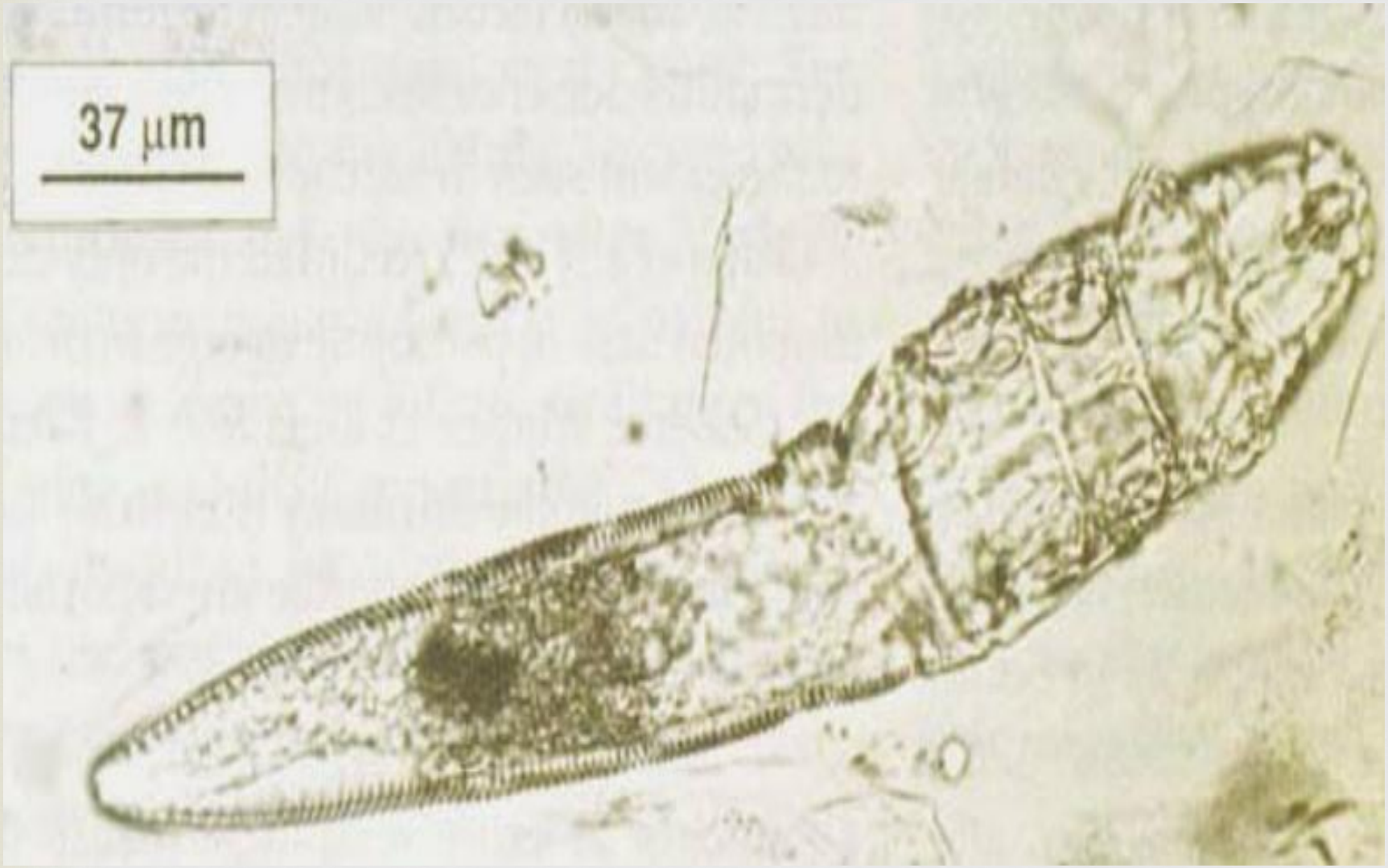

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Most of the species are named after their hosts, i.e. *D. canis*, *D. bovis* etc.

These follicular mites mainly live as commensals in the skin.

In some animals, these mites may cause mange, of particular severity in dogs. In bovines, the most significant sequela to infestation is the damage to the hide, causing economic loss.

There was no evidence of any secondary bacterial infection in the investigated camels, nor were there any significant histological changes other than distention of the hair follicles.

Tick infestation

Tick infestation is a common finding throughout the year.

Ticks commonly found on camels belong to the family Ixodidae, so called true ticks.

Female ticks deposit their eggs in sheltered spots. The newly hatched larvae, called seed ticks, wait on vegetation such as grass and scrubs for a suitable host.

After attachment they feed on blood and or lymph until they are fully engorged.

Cont'd

They detach after having engorged. Male ticks usually remain on the host longer than females.

Commonly found ticks on dromedaries are Hyalomma ssp, Rhipicephalus ssp and Amblyomma ssp.

These are two or three host ticks.

In three host ticks each developmental stage (larvae, nymph and imago) requires a new host after feeding.

These ticks are adapted to warm climate and their process of development is greatly influenced by ambient temperature.

Cont'd

- Inclement weather has a negative influence on hatching and moulting time.
- Immediately after the rainy season there is a marked seasonal decrease in tick burdens on camels.
- Apart from very heavy infestations average tick burden in dromedaries kept under nomadic conditions is around 50– 100 ticks per animal during the dry season.
- Long lasting grazing periods in areas heavily infested with seed ticks and temporary crowding at watering wells will facilitate spread and increase infestation rate.

Cont’d

Ticks from the genus Rhipicephalus and Hyalomma are known to be important disease vectors for domestic livestock.

The importance of tick transmitted pathogenic agents for dromedaries has not been thoroughly investigated.

However, outbreaks of hemorrhagic septicemia appear to be related to heavy Hyalomma dromedarii infestations.

The main harm caused by ticks and their developmental stages, especially nymphs, is through blood sucking.

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An adult female tick can remove 2 ml of blood, in heavily infested calves with nymphs the blood loss therefore can be marked and lead to anaemia.

Tick bites and subsequent attachment produce skin irritation and a localized allergic or inflmmatory skin response.

Secondary bacterial infection of these micro lesions is possible.

Heavily infested animals show general loss of productivity and body weight.

Amblyomma ssp. causes severe skin lesions due to very long mouthparts

Treatment and control:

Tick infestation can be easily appreciated but nymphs commonly hide in body regions with longer hair, like the withers, neck, shoulders, hump and ribs.

A thorough examination is necessary to diagnose tick infestation.

Heavily infested animals should be treated with pour-on acaricides or sprayed.

In adult animals, regular application of tick grease to common sites is recommended.

Cont’d

Immature animals especially suckling calves should be regularly treated in the first few months with pour on acaricide to reduce preweaning mortality due to heavy nymph infestation.

Altering management strategies by avoiding heavily tick infested grazing areas, overcrowding at watering holes and holding sites will also help to control tick infestations

Fly infestation

Fly infestation can present several problems in camel management.

According to their genus flies can cause **myaisis, transmit diseases, or produce simple disturbance** and **irritation** resulting in handling difficulties and significant loss of productivity.

Hippobosca camelina, a biting fly belonging to the group of camel flies is commonly found in the presence of camels.

They are not easily disturbed and cluster in the abdominal and inguinal region.

Cont’d

They can serve as a disease vector, the importance as a tryps vector is not fully assessed, but the significance as a disease vector is thought to be negligible, since it has been observed that the fly stays in close proximity to the camel and rarely leaves its chosen host.

Cephalopina titillator, a myiasis producing fly, is rarely observed, being rather short lived.

However the extremely common larval stages causing nasal myiasis demonstrate their continuous presence

The female deposits egg clusters on the nostrils, later the emerging larva migrate to the naso-pharynx and attach.

Cont'd

After completing their development the larvae are usually removed by sneezing.

Characteristic clinical findings in affected animals are occasionally bleeding from the nose, usually presence of nasal discharge due to swelling and infection of the upper respiratory tract and respiratory distress.

If larvae penetrate the ethmoturbinate bones fatalities may ensue.

Diagnosis is based on presence of neurological signs.

Rabies should be kept in mind as a differential diagnosis.

Drug treatment is seldom applied, but if necessary several injectable antiparasitic drugs seem to be effective.

Thank you