Infectious diseases of camels in the USSR

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Summary: The importance of the camel and the dromedary in arid areas is outlined and the main infectious diseases which have been studied at the Veterinary Institute in Alma-Ata (Kazakhstan) are described. The clinical picture of camel pox, contagious ecthyma, staphylococcosis, septic pneumonia and paratuberculosis is given, together with experience of these diseases in the USSR.

KEYWORDS: Camel diseases - Camel pox virus - Contagious ecthyma - Paratuberculosis - Pneumonia - Staphylococcus - USSR.

INTRODUCTION

Camels are used by mankind as a reliable resource for animal production and for transport. The world population of camels numbers some 10 million. Their population has risen slowly by 14-15% during the past 35 years, equivalent to 1-2% a year.

In the USSR there are 242,500 camels on all categories of farms, with roughly half (127,000) in Kazakhstan.

Camel breeding is one of the most profitable and suitable types of livestock breeding in the natural and climatic conditions of the Central Asian Republics and Kazakhstan. The keeping of camels is appropriate for the extensive deserts and semi-deserts of the south-eastern, southern and western regions of Kazakhstan, where the climate and food resources meet the needs of this irreplaceable animal.

It is well known that camels are more suited to the hot, dry climate of deserts and semi-deserts than any other domestic animal. Such territory covers 20 million km² of our planet, including 8 million km² of the Soviet Union. For every camel there is thus 2 km² of territory available, which indicates the extremely extensive nature of their distribution.

Mankind obtains from camels 1 million tonnes of meat, 1.2 million tonnes of excellent milk, at least 100,000 tonnes of excellent hair, and also treated hides. In the past, camels were used extensively for transport purposes in the difficult terrain of the deserts. They are still widely used for carrying goods and for a variety of expeditions in desert country.

With the growth in population and the rapid mechanisation of transport for agricultural production, the role of the camel in transport has fallen correspondingly.

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but it has not ceased altogether. It is still needed as a source of food (meat and milk) and raw materials (hair and hides), and this type of use is increasing. Camels are of benefit to human beings in the harsh life of deserts and semi-deserts. There is no doubt that camel breeding still has immense possibilities, in the USSR and in the world at large.

**SPECIFIC INFECTIOUS DISEASES OF CAMELS**

Camels are susceptible to many infectious diseases, some of which have been amply investigated because they affect all species of farm animals, such as anthrax, rabies, tuberculosis, brucellosis, pasteurellosis, necrobacteriosis (Fusobacterium necrophorum infection), pox and ringworm. They are also susceptible to some of the diseases which affect ruminants, such as foot and mouth disease, contagious bovine pleuropneumonia and malignant oedema, and some of those which affect equines, such as glanders, strangles and equine infectious encephalomyelitis. Like other farm animals, camels are also affected by diseases which are specific to the species, including plague, staphylococcosis, septic pneumonia, oral neoplasms, contagious diarrhoea, streptococcal abortion, contagious ecthyma, ulcerative stomatitis, and vaginitis. There has not been much research into the specific infectious diseases of camels, and some have not been investigated at all. We have undertaken research into the group of little-known diseases which have occurred in epidemic form during the past 26 years (since 1960), and which act as a brake on the development of camel breeding. These are (1) pox, (2) contagious ecthyma (referred to as ‘auzdyn’ in the Kazakh language), (3) staphylococcosis (‘ak-bas’ in Kazakh), (4) septic pneumonia (‘kara okpe’ in Kazakh and ‘kholdvart khaniad’ in Mongolian) and (5) paratuberculous enteritis (‘sychag-pychak’ in Kazakh). A whole range of other problems has also been noted for future investigation.

**Camel pox**

Pox in camels was recognised in the middle of the last century, being described first by Masson in 1840 in India, where it was known by the local population under the name ‘photohitur’. Later it was described by Leese (13), Cross (6) and Curasson (7).

In the USSR it was reported in 1893 by Vedernikov and Dobrosmyslov, who observed an outbreak in the Astrakhan and Ural governates. In the same year Dobrosmyslov also observed the disease in the Turgai region. Subsequent reports were prepared by Amanzhulov, Samarzev and Arbusov (2), Bauman (3), Ivanov (8), Semushkin (19), Vyshesluskii (24), Likhachev (14) and Vedernikov (22). These authors found that camels were susceptible to vaccinia virus. Borisovich and Orekhov (5) and Borisovich and Skalinskii (4) reported the existence of a specific camel pox virus. The virus belongs to the family Poxviridae, genus Orthopoxvirus (which includes poxviruses of many species of ungulates).

In a thesis entitled “Camel pox in Kazakhstan and some properties of its causal agent”, Sadykov (16) came to the conclusion that the local strains of poxvirus which he examined were specific for camels, and that cattle, sheep, goat, horse, pig, rabbit, Syrian hamster, guinea pig, white mouse, rat and fowl were not susceptible. Nevertheless, it was easy to passage the virus in chick embryos. Immunologically, camel
pox virus is closely related to vaccinia virus. This explains the authorisation given in 1973 for the use of vaccinia virus in the prophylactic immunisation of camels.

Camel pox is a contagious viral disease characterised by fever and a papular-pustular eruption on the skin and mucous membranes. Among farm animals, only camels are susceptible to this form of pox. The source of infection is an infected or a recovered camel, and also carcasses and animal by-products (hide, hair), contaminated feed and water, animal accommodations, pens and pastures. The incubation period is 3-14 days.

Camel pox takes two forms, localised and generalised. Camels aged two to four years most often develop the localised form, with lesions on the skin and mucous membranes of lips and nose. Young camels up to one year old and female camels in the final months of pregnancy are affected mainly by the generalised form. At first there is a rise in rectal temperature to 39-41°C, general depression, complete or partial refusal of food, dyspnoea, rapid pulse, hyperaemia of mucous membranes of the oral and nasal cavities, and conjunctivitis sometimes accompanied by corneal opacity. After 2 to 3 days, papules develop on the skin and mucous membranes, measuring 3-5 mm in diameter. The papules change into vesicles, then pustules, and they eventually burst. They leave flat, pale-pink scars. A pregnant camel may abort, and the aborted foetus may have a nodular-pustular eruption on the skin and mucous membranes. Diagnosis is based on clinical, epidemiological and pathological findings, and the results of laboratory tests. Affected camels and those suspected of being infected are segregated and treated, while those still healthy are moved to a different building or pasture, and vaccinated.

**Contagious ecthyma**

The study of camel pox by the Department of Epidemiology of Alma-Ata Zootechnical-Veterinary Institute revealed the existence of another disease like pox, referred to in the 1968 report of the Institute as “pox-like disease of camels”. It is widespread on camel-breeding farms of the Republic, being known among the local Kazakh population as ‘auzdyk’ (‘disease around the mouth’). Clinically this disease is very similar to contagious ecthyma of sheep and goats, and so by analogy it is called contagious ecthyma of camels. It was studied in detail by Tulepbaev (20) in a thesis entitled “Pox-like disease (auzdyk) of camels in Kazakhstan”.

The local inhabitants regarded the disease as non-contagious, explaining the mass occurrence in autumn, particularly affecting young camels, as being due to trauma of the skin of the lips resulting from the eating of prickly plants. This attitude was also prevalent among the veterinary personnel. Apparently the same disease was described by Borisovich and Orekhov (5) in Turkmenia, who referred to the need to distinguish camel pox from a non-infectious disease known as ‘yantakkuskan-bash’, caused by the eating of prickly plants (the name of the disease being the same in Turkmenian as in Kazakh).

Contagious ecthyma affects camels of all ages, particularly young stock in their first autumn of grazing, and also adult camels coming from disease-free herds. There is no doubt that the eating of prickly plants does damage the lips, opening the way for infection while grazing.

The disease spreads rapidly and within a short time may affect 70-80% of the grazing camels. In most cases the course is mild, and the animal recovers within
20-25 days. However, the skin lesions are sometimes very severe. Affected young camels are reluctant to eat. They lie down and rapidly lose condition, so that veterinary treatment is required, as in the case of localised necrobacteriosis. (In fact, before the viral nature of the disease was discovered, the condition was often diagnosed as necrobacteriosis). The main clinical signs of contagious ecthyma are swelling of the lips, cheeks, nasal skin and eyelids, with a slight rise in body temperature (38.5-39°C) and some depression. After 1-2 days small nodules the size of a millet grain develop on the inflamed areas of skin, rapidly changing to vesicles containing lymph which is clear at first, and then becomes turbid. When the vesicles rupture spontaneously, or as a result of being rubbed, the exudate contained in them becomes spread over the skin, leading to the formation of fissured crusts, through which an inflammatory exudate emerges and soon dries upon exposure to air. The formation of a greyish firm crust conceals inflamed skin. Microscopic examination of such crusts shows that they contain various sorts of bacteria. Investigations with electron microscopy by Roslyakov (15) showed that virions occurred singly and in groups, their structure resembling the virions of cowpox and ovine contagious ecthyma. However, more detailed examination showed that these virions differed in size and the number of twists from those of cowpox and ovine contagious ecthyma.

The viral nature of the disease has been demonstrated both by electron microscopy (presence of virions) and by the impossibility of reproducing the typical disease when virions are removed from a viral suspension by filtration.

Attempts to find a laboratory animal which is susceptible to camel contagious ecthyma virus have been unsuccessful, but infection has been established in pups (up to 3 months old) by applying viral suspension to scarified skin. However, the infection in dogs is invariably a mild dermatitis with lesions only slightly resembling those of camel pox. The lesions heal completely within 10-12 days. This test on pups may be used to detect the presence or absence of contagious ecthyma virus in specimens, since they are not susceptible to infection with vaccinia virus nor ovine contagious ecthyma virus. Precipitinogens of camel contagious ecthyma virus are detectable by the agar gel immunodiffusion test, using non-specific viral precipitins prepared in rabbits.

The virus is extremely resistant to environmental factors. On concentrates and coarse fodder stored under the usual conditions, it remains viable for 270-300 days, and in various soils, as well as in manure not subjected to biothermal treatment, it survives for up to 120 days. It is very resistant to various disinfectants, the most effective of which are caustic soda, phenol and potassium permanganate. In double concentrations, these can kill the virus in 10-20 minutes at 60°C. It is destroyed practically instantaneously in boiling water (96-98°C).

The virus is very resistant to the action of antibiotics. It takes two hours for penicillin and tetracycline in concentrations of 150-200 thousand units per ml to inactivate it, and 4 hours at a tetracycline concentration of 10,000 units/ml.

No specific immunoprophylaxis nor therapy has been developed. An antiseptic ointment is widely used for local treatment of skin lesions. To prevent the disease, camels must not be allowed to graze on prickly plants. The veterinary service should institute precautions suitable for an infectious viral disease.
Staphylococcosis

This disease is widespread throughout the Central Asian republics of the USSR, giving rise to various names in the different local languages. In Kazakhstan it is called 'ksaga' or 'ak bas', which means 'white head'. In Turkmenia it is called 'sychagpychak'. Semushkin (19) described it as 'contagious skin abscesses'. The aetiology of the disease remained obscure for a long time, until it was investigated by Sadykov and Dadabaev in 1960 (17). Information in the literature and the results of research may be summarised as follows. The disease spreads rapidly and affects 5-20% of a camel population, the mortality rate being 10-15%. Post-mortem examination of camels which have died recently reveals purulent lymphangitis. Clinically the disease is manifested by purulent inflammation of superficial lymph nodes, particularly those of the neck, prescapular and head regions. Body temperature of affected camels is increased by 0.5-1°C.

Microscopic examination of sections of purulent foci and parenchymatous organs reveals cocci isolated or in clumps (like bunches of grapes), and these can be isolated by sowing ordinary meat-peptone broth or agar and incubating for 1-2 days. Colonies on agar are white and rounded, and difficult to remove from the surface of the agar. In broth the bacterium forms flakes which settle to the bottom of the tube, while the supernatant fluid remains clear. The bacterium, which has been named Staphylococcus cameli, readily takes up aniline dyes and is Gram-positive. Antigen (extract of bacterial mass) gives a clear precipitation line in agar gel with blood serum from naturally infected camels and experimentally infected guinea pigs, which are susceptible to infection with the camel staphylococcus (although rabbits, hamsters and mice are insusceptible).

Six strains of the staphylococcus, obtained from camels which died from naturally acquired infection in Kazakhstan and the Tuva ASSR, have been studied. All strains had identical properties in various tests: plasma coagulase reaction, haemolysis reaction, dermatonecrotic test, pigment formation, fermentation of mannite, phage typing, catalase formation, carbohydrate medium with Andrade’s indicator, pathogenicity for camels and laboratory animals; and also similar survival in the environment, feed, soil and manure. They were not only identical in these tests, but also in tests conducted at the N.F. Gamal Institute of Epidemiology and Microbiology of the USSR Academy of Medical Sciences.

It should be noted that the staphylococcus grows in nutrient medium containing 10% sodium chloride. Out of many antibiotics and other chemotherapeutic agents, the most efficacious are biomycin (benzathine chlorotetracycline), monomycin and levomycetin (chloramphenicol). Antibiotic therapy is highly effective, curing 75-100% of cases if given sufficiently early. This disease may be accompanied by the formation of a huge abscess (of up to 500 ml capacity) requiring surgical intervention and local treatment. The pus is thick and whitish, resembling sour cream. Post-mortem examination reveals a purulent infection of the lymphatic system and septicaemia.

In addition to therapy, general precautionary measures should be implemented on infected farms and farms at risk, including the isolation and treatment of affected animals, disinfection of paddocks and buildings, and restricting trade in camels. All these measures should be implemented by the competent veterinary authorities.
Septic pneumonia

Septic pneumonia (contagious cough) is an infectious disease manifested by acute catarrhal inflammation of the mucous membranes of the upper respiratory tract and lungs, high fever, and general illness.

The causal agent is an encapsulated diplococcus which is particularly virulent for guinea pigs, and to a lesser extent for mice.

According to Semushkin (19), infectious pneumonia is known as 'kara-okpe' (black lung) in Kazakhstan and 'kholdvart khaniad' (contagious cough) in Mongolia.

Although this disease is widespread, it was not mentioned in the scientific literature until 1920 (by Amanzhulov, Arbuzov and Zhuravlev; 1). Since then other publications have appeared (23, 9, 10, 11, 12, 18).

Under our guidance Sakhai Oinakhbaev (18) prepared a thesis on this disease as it occurs in Mongolia. This thesis contains an extensive review of the literature (in the Library of the Alma-Ata Zootechnical-Veterinary Institute), which showed that this disease occurs wherever camels are kept. This has been brought about by the extensive use of camel transport. It is known (through a communication by G.K. Konakbaev) that in 1937 five thousand camels were moved from Mongolia into Kazakhstan, and that the disease broke out during this journey. The disease may have been spread by similar movements of camels and by means of expeditions. Various stressors, such as starvation, heavy work, prolonged and exhausting journeys, the bringing together of camels for veterinary intervention or for a census, shearing and the formation of herds can predispose camels to the infection. Such lowering of resistance worsens the epidemiological situation and aggravates the illness. Males seem to be affected more often than females, and the disease is most severe in males. Once the disease has become clinically evident, illness lasts for 1-2 months. The first sign is a rise in body temperature (40°C or more), a depressed state, sweating, hyperaemia of mucous membranes (conjunctiva and nose), and enlargement of lymph nodes, which are tender to the touch. Coughing becomes steadily worse, with quite prolonged attacks, and breathing becomes rapid and superficial. The general condition of the animal deteriorates considerably: it rises and moves with difficulty and has a poor appetite. Auscultation and percussion of the chest reveal pneumonia and exudative pleurisy.

Diagnosis is based on epidemiological features and clinical signs. Camels with contagious cough are treated with tetracycline, chlortetracycline, bicillin (benzathine penicillin), other penicillins or other antibiotics and sulphonamides. No method of vaccination or serum prophylaxis has been developed.

Paratuberculosis

This is widespread among camels in the Central Asian Republics and Kazakhstan. The disease has been studied periodically at our Institute since 1960, but without notable success. The information obtained about Mycobacterium paratuberculosis infection may be summarised as follows.

The existence of paratuberculosis of camels is well recognised, and it has been given the local name 'sychag-pychak'. It affects young camels between weaning and 2-4 years of age. Older animals are not usually affected, because they will have recovered from the disease earlier. Year after year such animals appear to be completely
healthy, and can be used in the normal way, including for heavy work. Young animals are affected more severely. The disease may affect considerable numbers of young stock. Clinically, it is manifested by progressive diarrhoea, becoming profuse and continuous (paralysis of the anal musculature). The animal rapidly becomes emaciated, has a poor appetite and increased thirst. In the early stages, the temperature is increased (40-40.5°C), but as the disease develops it falls to 36° or less, at which stage the animal can barely get to its feet. Death occurs when the animal is completely exhausted. When recovery occurs, it takes place slowly over a period of months, perhaps 6 months or more.

A comparison of the symptoms of paratuberculosis in camels and cattle reveals considerable similarities as far as diagnosis, pathological findings and control measures are concerned. The last-named include the removal of affected animals from the herd, with suitable organisation of feeding and watering so that healthy animals do not become infected. Methods for the differential diagnosis of paratuberculosis of camels are not altogether satisfactory, and properties of the causal agent have not yet been fully investigated. We still await answers to the problems of specific immunoprophylaxis and therapy, and in particular general disease control precautions.

Other diseases

We have observed various other diseases which are known by their clinical features, but are still of unknown aetiology. Among those described by Semushkin (19), the following are worth mentioning: vaginitis (called ‘myusgek’ and ‘terme’ in Kazakh), contagious skin necrosis, influenza, tick paralysis, oral neoplasms, pyosepticaemia of young camels, contagious diarrhoea, rheumatism, streptococcal abortion, endemic encephalomyelitis and ulcerative stomatitis.

We know little about such diseases, apart from unscientific opinions. It must be borne in mind that camels are subject to many parasitic and non-infectious diseases, also inadequately studied and requiring effective control measures. Thus camel diseases require support from veterinary science to fill a long-standing need. It would be desirable to create a centre for the study of diseases of camels.

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Résumé: Après un rappel de l'importance du chameau et du dromadaire dans les zones arides, les auteurs décrivent les principales maladies infectieuses qui ont été étudiées à l'Institut Vétérinaire d'Alma-Ata (Kazakhstan). La variole du chameau, l'ecthyma contagieuse, la staphylococcie, la pneumonie septique, la paratuberculose font l'objet de références bibliographiques russes et de descriptions cliniques.

MOTS-CLÉS : Ecthyma contagieuse - Maladies des chameaux - Paratuberculose - Pneumonie - Poxvirus du chameau - Staphylococcie - URSS.

Resumen: Luego de recordar la importancia del camello y del dromedario en las zonas áridas, los autores describen las principales enfermedades infecciosas que han sido estudiadas en el Instituto Veterinario de Alma-Ata (Kazakhstan). Se presentan referencias bibliográficas rusas y descripciones clínicas de la viruela del camello, la ectima contagiosa, la estafilococia, la neumonía séptica, la paratuberculosis.

PALABRAS CLAVE: Ectima contagiosa - Enfermedades de los camellos - Estafilococia - Neumonía - Paratuberculosis - Poxvirus del camello - URSS.

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