

NOCARDIOSIS IN A DROMEDARY CAMEL-CASE REPORT

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ABSTRACT

This case report investigated the occurrence of Nocardial mastitis in a dromedary camel, emphasising key aspects of etiology and pathogenesis. The female camel presented with chronic udder abscesses, haematuria, pyrexia and recumbency, underwent necropsy at the Central Veterinary Research Laboratory. Gross pathological findings revealed extensive abscesses and lesions in multiple organs, including the heart, lungs, liver, spleen, brain and kidneys. The udder exhibited suppurative mastitis with nodules and purulent milk. Notably, severe hepatic amyloidosis was observed in 80% of the hepatic tissue. Combining macroscopic and microscopic analyses, provided a comprehensive understanding of Nocardial mastitis in this dromedary camel. Bacterial isolation from collected specimens further contributed to clarifying the microbial involvement in this case.

Key words: Dromedary camel, gross-pathology, mastitis, nocardia

Nocardiosis is a non-contagious opportunistic pyogranulomatous disease of domestic animals, wildlife and people (Rawat *et al*, 2023). Infections in livestock, companion animals and people are rare, but have increased in the recent years (Merck, 2016). Infections are acquired through inhalation, traumatic percutaneous introduction of the organism through wounds, abrasions of the skin, ingestion or by the intra mammary route. In cattle and small ruminants and also camels, it is considered an organism of environmental origin, for example soil, organic material, water, compost vegetation and other environmental sources (Ayadi *et al*, 2016). It is a pleomorphic, non-motile non-capsulated, strict aerobic, gram-positive actinomycete which forms characteristic long or branching filaments with a tendency of producing rods and cocci. Many different Nocardia species exist, but the most important pathogenic species for animals and people are represented by the Nocardia asteroides complex (Rahmeh *et al*, 2022). Some pathogenic species of Nocardia exhibit partial acid-fast characteristics and this organism is characterised by thin, delicate branching filaments in bacillary forms. Nocardia is commonly found in the environment, thriving on dead or decaying organic material and has been isolated from diverse sources including soil, water, air, dust and the skin of healthy cows' udders. Systemic nocardiosis occurs through haematogenous dissemination, resulting in abscess formation in

various organs. The disease is characterised by a chronic, antimicrobial-resistant progression, leading to extensive granulomatous lesions in the mammary gland and eventual udder destruction. Herds with inadequate milking parlor management and poor hygiene conditions are particularly susceptible to Nocardial mastitis (Bättig *et al*, 1990; Aqib *et al*, 2022).

This case report describes systemic nocardiosis including mastitis in a dromedary camel, focusing on key aspects of etiology, pathogenesis and mastitis diagnosis.

Materials and Methods

A female dromedary camel in a fair to good body condition with no wound lesions was sent to the Central Veterinary Research Laboratory (CVRL), where a necropsy was performed. The female camel was presented with a history of chronic udder abscess in both rear quarters, haematuria, pyrexia and recumbency. The pre-necropsy inspection exhibited significant engorgement of the superficial epigastric vein additionally an inflamed, swollen and enlarged udder was observed which indicated suppurative mastitis. Both rear quarters revealed pendulous structures and blown-up teat shape (Ayadi, 2016) (Fig 1). To comprehensively analyse these pathological observations, the following specimens were collected during the necropsy for further analysis: lung tissue, liver tissue, intestinal tissue, kidney abscess, udder

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tissue and mammary gland and additional specimens like swabs from kidney and lung. Additionally exudate like pericardial fluid, abdominal fluid, milk and cyst were obtained as well.

Results

Upon necropsy a thorough examination of all visceral organs is essential, including the mammary gland. The gross pathological findings were observed and bacteriological and histological samples were obtained. The thoracic cavity had congested parietal pleura with some fibrin formation in the pleural cavity of the heart. A small white myocardial abscess was also observed in the right ventricle (Fig 2). The lungs showed hypostatic congested and oedematous lungs with multiple abscesses and cysts. Emphysema of the apical lungs was detected on the edge of the caudal lung (Fig 3). The abdominal cavity exhibited necrotic fat on the abdominal wall and the liver was pale, waxy with chestnut appearance (Fig 4). The spleen displayed severe congestion and

haemorrhages. Many small abscesses were present in the renal cortex, accompanied by multifocal lesions (Fig 5). Haematoma was seen in the uterine body with scattered dark brown lesions across the endometrium.

Upon dissecting of udder, huge amount of white pus was noticed deep in the gland cistern and the major milk ducts reaching up to the glandular complex with a lot of cutaneous material (Fig 6). Multiple nodules were dispersed throughout the udder parenchyma and purulent milk, appearing white to yellow with visible granules, in the mammary gland. Additionally, our investigation unveiled an abscess with pus, approximately 2 cm in diameter, located in the temporal lobe and midbrain of the cerebrum (Fig 7).

Histopathological changes were severe hepatic amyloidosis with 80% of the tissue occupied by amyloid-deposits (Fig 8). Linking the previous observations of our investigations, the subsequent step involved the bacterial isolation of the microorganisms



Fig 1. Pendulous udder quarters and blown-up teats shape.



Fig 2. Myocardial abscess with white pus formation.



Fig 3. Caseous abscesses in the lung.

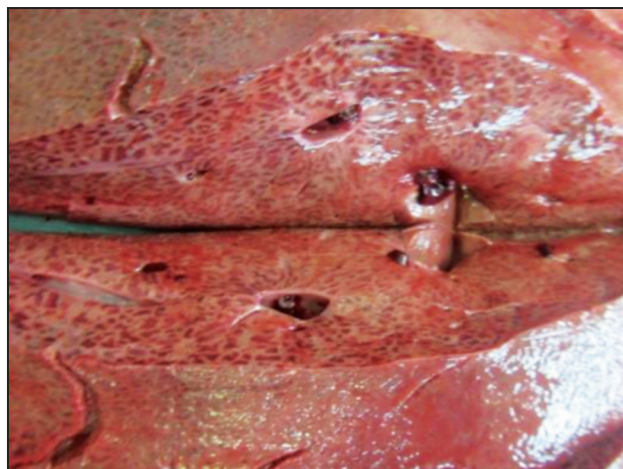


Fig 4. Waxy chestnut liver.

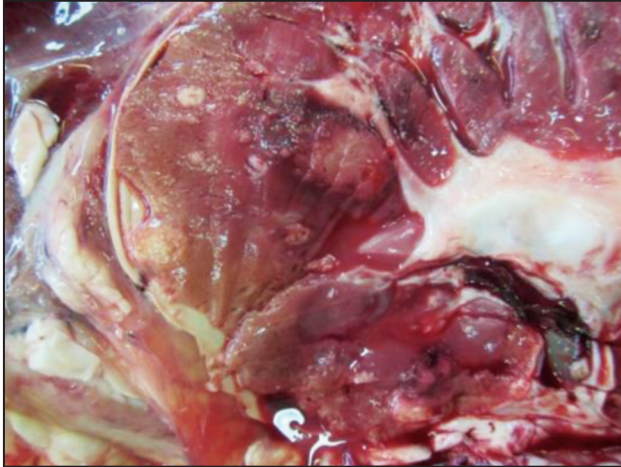


Fig 5. Renal abscess formation.



Fig 6. Pyogranulomatous mastitis with white cutaneous material and pus in the gland cistern and the ducts.



Fig 7. Brain abscess.

from the collected specimens, as outlined in Table 1. This integrative approach, spanning macroscopic and microscopic analyses, allows for a more comprehensive understanding of the pathology and microbial involvement in the identified case of *Nocardia* isolation in dromedary camels.

Discussion

We report here a generalised *Nocardia* infection in a lactating dromedary camel resulting in multiple abscesses, including those in brain and udder. *Nocardia* is an agent of mastitis of environment origin and is predominantly caused by soil contamination of the teats. From the udder, the pathogen most probably spread through haematogenous dissemination to all other organs producing multiple abscesses. Nocardial mastitis is generally described as a chronic infection and is usually refractory to antimicrobial therapy. The disease can be avoided with antibiotic. However, in this case no information was received if the camel was treated and if so with which antibiotics. Blood sheep agar and sabouraud

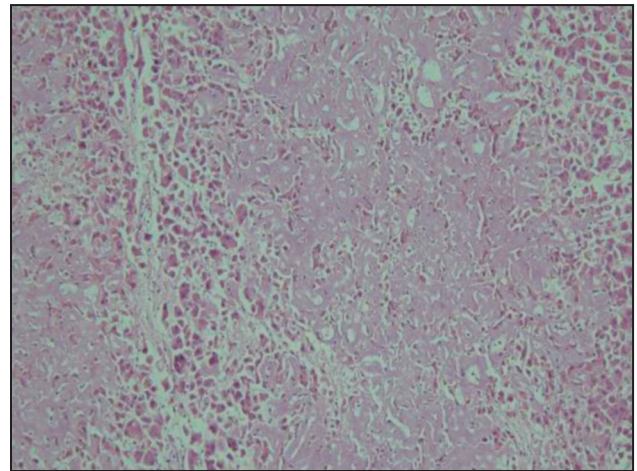


Fig 8. Severe hepatic amyloidosis with 80% of the tissue occupied by amyloid-deposits (HE, 10X objective).

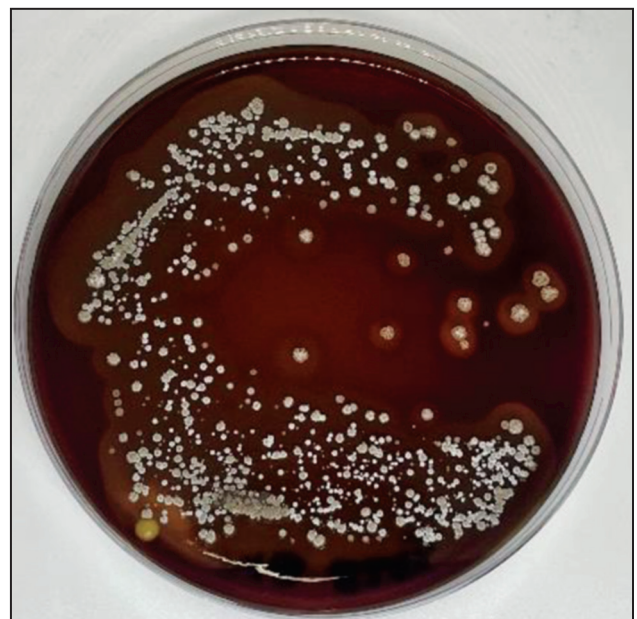


Fig 9. *Nocardia* colonies growing on the blood agar.

Table 1. Summary of the microorganisms that were isolated from the collected specimens.

Samples collected	<i>E. coli</i>	<i>Cl. perfringens</i>	<i>Nocardia</i> sp	<i>Corynebacterium jeikeium</i>	<i>Enterococcus faecalis</i>
Lung	+	N/A	N/A	N/A	N/A
Liver	+	N/A	N/A	N/A	N/A
Intestine	N/A	++++	N/A	N/A	N/A
kidney abscess	+++	N/A	+++	N/A	N/A
Udder	++++	N/A	+++	+++	N/A
Mammary gland	+	N/A	+++	N/A	++++
Swab (lung)	++++	N/A	++++	N/A	N/A
Swab (kidney)	+++	N/A	+++	N/A	N/A
Pericardial fluid	++++	N/A	N/A	N/A	N/A
Abdominal fluid	++++	N/A	N/A	N/A	N/A
Milk	+	N/A	+++	++	+++
Cyst	++++	N/A	N/A	N/A	N/A

plates were incubated with the specimen of all organs and incubated aerobically at 37°C for up to 7 days. The colonies growing on the blood sheep agar after 3 days were white and powdery in appearance and firmly adherent to the medium (Fig 9). Gram-stained smears from colonies showed gram-positive branching filaments that broke up into rods with age. In comparison to *Streptomyces* and *Actinomyces*, the *Nocardia asteroides* bacteria stained red with modified Ziehl-Neelsen.

Infusion technique, proper sanitation of hands, teats, wearing gloves and the use of single use treatment devices is a highly effective prevention. Nocardiosis in camels has not been clearly described or rare and this is the first report.

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