

# MYCOBACTERIAL INFECTIONS IN CAMELIDS – THE CURRENT SITUATION

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It was not so long ago that camelids were thought to be resistant to tuberculosis (Fowler, 2010), which is no longer true. However, they are not highly susceptible to tuberculosis which occurs in both Old World Camels (OWCs) and New World Camels (NWCs) and in recent years a serious concern has arisen in countries where NWCs are bred away from their countries of origin. In the UK for example, which has a strong camelid society, an increase of tuberculosis has been observed in some part of the country in NWCs. This increase in the UK is associated with badger tuberculosis. NWCs which are increasingly kept on pastures in close vicinity to cattle, a spillover has been reported from cattle as well from wildlife. Tb in NWCs has also been reported in many non-GB countries. Llamas and alpacas have been detected to suffer from mycobacteriosis in Spain, Switzerland and other countries of mainland Europe where they are mainly kept as companion animals (Rhodes *et al*, 2015).

Tuberculosis is rare in OWCs when kept under nomadic condition. The disease occurs, however more frequently when camels are kept in close quarters with other camels or cattle for example in Egypt or former Russia (Wernery *et al*, 2014). As OWCs normally roam freely in the desert during the day and as coprophagous animals, they may come into contact with faeces of infected antelopes as shown by Kinne *et al* (2006) who isolated *M. bovis* (antelope clade) from such a dromedary camel.

Also in camels, tuberculosis is a chronic debilitating disease. The clinical signs of tuberculosis in camelids vary widely, but in general progressive emaciation and weight loss are the main signs. Affected camelids may live for months or even years before succumbing to disease. It is also found that some infected camelids with extensive miliary tuberculosis lesions are clinically normal. The organs most frequently affected with the pathogen are the lungs, bronchial and mediastinal lymph nodes, pleura and liver.

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The tubercle bacilli are classified in two main complexes: *Mycobacterium* (M.) tuberculosis complex (MTC) and non-mycobacterium tuberculosis complex (NMTC). The “atypical” or “anonymous” or “non-tuberculosis” mycobacteria are grouped in the Runyon’s classification. These bacteria are widespread in pastures, soil and water. Camelid tuberculosis is caused by tubercle bacilli of both groups: *M. tuberculosis* complex (MTC): slow growing: *M. tuberculosis*, *M. bovis*, *M. microti*, *M. pinnipedii*; Runyon’s group (NMTC): *M. kansasii*, *M. aquae*, *M. fortuitum* and *M. smegmatis* and other which have not yet been identified (Wernery *et al*, 2014; Markey *et al*, 2013).

As the ante-mortem signs of tuberculosis are not very specific and therefore the ante-mortem diagnosis of tuberculosis in camelids is difficult. None of the tests currently available can diagnose tuberculosis in camelids with certainty, and none of the tests has been properly validated in these animal species. This refers to the classical tuberculin tests and also to serological tests. As the tuberculin skin test (TST) often gives non-specific reactions or is often negative when the animal reveals typical tuberculosis lesions at necropsy, a great number of serological tests have been developed since the 1980s for the diagnosis of tuberculosis. However, the official tuberculosis screening method for camelids traded internationally is still the tuberculin test, and this is also the only diagnostic test for tuberculosis currently recognised for use in live camelids worldwide.

Several researchers especially in the UK have used serological assays for the diagnosis of Tb in llamas and alpacas which are also funded by the British alpaca and llama industry to evaluate their efficacy. These include the interferon-gamma assay IFNy, the STAT-PAK®, the Dual Path Platform or DPP® from Chembio and 2 ELISAs from IDEXX and Enferplex™. So far, none of them have been properly validated in NWCs nor in OWCs. At CVRL we abandoned the tuberculin test due

to its low sensitivity and we regularly use the lateral flow test from Chembio which is a single immunochromatographic rapid test for the detection of antibodies to *M. tuberculosis* and *M. bovis*, mainly designed for elephants as there are no serological tests for camelids.

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