Cutaneous Lesions In An Outbreak Of Bovine Tuberculosis In Fallow Deer (Dama dama)

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Keywords
Bovine tuberculosis, fallow deer, cutaneous lesions

Introduction
Bovine Tuberculosis (TB) is the most contagious type of TB, able to infect most mammals. It is one of the most important infectious diseases that infect members of the deer family which are particularly sensitive to infection.

Materials and Methods
The authors describe a case of generalised cutaneous lesions which were occurred in a fallow deer reared in captivity in a park in the Peloritani mountains (Sicily) in 2012.

Results
A range of lesions was seen, most of which differed from classical bovine tuberculosis in that pus was almost white-yellowish, liquid, fibrous encapsulation was not thickened and well defined and calcification was rare. Cutaneous lesions distributed on the whole body were observed. They were the result of the subcutaneous abscesses burrowing visible at the gross examination as alopecic areas.

Discussion/Conclusions
This is a rare report of skin lesions in fallow deer. Probably it is correlated to the high infectious pressure of the interesting areas (Peloritani Mountains). These areas are usually associated with high TB infection rates. Moreover all the animals belonged to the same group and they were all infected. According to the authors further investigations are required.

Detection Of Mycobacterium bovis Infection In A Capybara (Hydrochoerus hydrochaeris)

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The capybara (Hydrochoerus hydrochaeris) is the largest rodent in the world, and is widely distributed throughout Central and South America. It’s an animal of economic interest due to the pleasant flavor of its meat and higher protein content in comparison to beef and pork meat. Its hunting is prohibited by law in Brazil, thus authorised capybara breeding is necessary to supply the market. During surveillance in an exotic meat abattoir, pyogranulomatous lesions were observed in both lungs of a capybara. Tissue
samples were treated with 1-hexadecylpyridinium chloride (HPC) at 1.5%, inoculated into Stonebrink and Löwenstein-Jensen media and incubated at 37°C. After 19 days, acid-fast bacilli were isolated. Through multiplex PCR diagnostic methods and Spoligotyping, the isolates were classified as member of Mycobacterium tuberculosis complex, and identified as M. bovis SB1961. There are few cases of natural mycobacteria infections in rodents, including M. bovis infection, which was reported in captive capybaras from zoos in the Czech Republic and Switzerland. However, in this case, there are issues concerning public health, since its meat is destined for human consumption, and the leather, hair and fat, for commercial purposes. Capybara is a semi-aquatic animal with highly social behaviour, which facilitates the tuberculosis transmission. Therefore, legislation focusing sanitary control of this species is required.

Detection and Identification Of Mycobacterium bovis Infection In Two Captive Llamas (Lama glama) in Brazil

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Outbreaks of tuberculosis caused by Mycobacterium bovis and M. microti in farmed South American camelids, such as alpacas (Lama pacos) and llamas (L. glama), have been reported in The Netherlands, Spain, Ireland and Great Britain. In a zoological garden in Brazil, from a group of nine captive llamas, six animals died in less than six months. Only two were sent to post-mortem examinations. Previously they exhibited prostration, dyspnea, anorexia and progressive emaciation. At necropsy, both animals were cachectic. In the thoracic cavity, turbid thick fluid and whitish caseous 0.5-1 cm nodules were observed. Lungs were diffusely consolidated with multiple caseous 0.5-5 cm nodules. Tracheas were red-coloured with whitish caseous 0.2 cm nodules associated with erosion. Tracheobronchial and mediastinal lymph nodes were whitish and caseous. One animal showed pericardial pronounced thickening with fibrin deposition and multiple caseous 0.5 cm nodules, and whitish-yellow firm 0.1-0.5 cm nodules in liver, spleen, pancreas and kidneys. Microscopically, all lesions revealed extensive caseous necrosis areas with discrete mineralisation, and inflammatory cell infiltration. Acid-fast bacilli were seen by the Ziehl-Neelsen staining. For bacteriological exams, lung samples were treated with 1-hexadecylpyridinium chloride (HPC) at 1.5%, inoculated into Stonebrink and Löwenstein-Jensen media and incubated at 37°C. After 21 days, acid-fast bacilli were isolated. Through multiplex PCR diagnostic methods, the isolates were identified as M. bovis. The infection probably occurred due to contact with other infected animals or humans, since they lived in a zoo and were kept among camels, cervids, capybaras, brown capuchins and zebras.

Seasonal and Gender Differences In The Ranging Behaviour Of European Badgers Meles meles L.

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Key words
European badger, ranging behaviour, satellite tracking, social groups, territoriality
Knowledge of the movement patterns of animals is crucial for understanding the epidemiology and potential transmission routes of diseases they carry. As European badgers *Meles meles* L. are wildlife vectors of bovine tuberculosis, their ranging behaviour can have a significant economic impact on cattle farmers. The current information on territory use and ranging behaviour of badgers is largely based on bait-marking of social groups and radio-telemetry of individuals over relatively short periods of time.

In this three-year study, using collars fitted with GPS (Global Positioning System) units, the positions of badgers were recorded up to eight times a night. Analysis of these data revealed a detailed picture of the ranging behaviour of the study animals.

The ranging behaviour of the European badgers in County Wicklow, Ireland, varied enormously throughout the year. Badgers had very small ranges in winter and much larger ranges in summer. Generally, males had larger home ranges than females, but there were seasonal and age-related variations to this trend. Both sexes made excursions outside their “regular” home ranges throughout the year. While individuals of the same social group shared large parts of their home ranges, they also used considerable areas which other members of their group did not use. In addition the area used by any one badger changed markedly from year to year.

The ranging behaviour of the individuals and social groups in our study demonstrated plasticity and porosity in contrast to the classic notion of a territory as an area shared and defended by the social group.

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**Molecular Characterisation Of *Mycobacterium bovis* Isolated In Wild Boars and Cattle From An Italian Pasture Between 2002 and 2013**

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**Keywords**

*M. bovis*, Molecular typing, wild boars

**Introduction**

Bovine tuberculosis (bTB) in wild animals is a serious problem in many parts of the world. Between 2002 and 2013, *Mycobacterium bovis* was isolated from wild boars and from cattle that shared the same pasture in Marche region, central Italy. Two different cattle herds were involved in bTB outbreaks: the first occurred in 2005 and the second in 2013, respectively. With the aim to investigate the role played by wild boars in this area, since 2005 we have started a surveillance activity that led us finding infected wild boars in the environmental studied.

**Materials and methods**

In the last ten years, samples with suspected lesions from hunted wild boars were collected at slaughterhouse. Lymph nodes, mainly from head and thorax, were processed for histological and culture examination. Cattle positive to skin test or at post mortem inspection were submitted to culture isolation for diagnostic confirmation of bTB. All isolates were typed by spoligotyping and analysis of 12 variable number tandem repeat (VNTR) loci (ETR A-E, 2163a, 2163b, 4052, 1895, 3155, 3232 and 2996) at National Reference Centre for Bovine Tuberculosis.

**Results**

Overall, 29 *M. bovis* were isolated, 16 from wild boars and 13 from cattle belonging to bTB outbreaks. All isolates were characterised by Spoligotype SB0120 and VNTR type 3.3.5.3.10.4.4.4.3.6.5. Discussion and conclusion. The finding of a single cluster in the same area between cattle and wild boars confirmed the existence of wildlife-livestock interaction and its potential role in the bTB epidemiology.
Use Of Rapid Serological Assays For Detection Of M. bovis In Free-Ranging African Lions (Panthera leo)

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**Key words**
Lions, Mycobacterium bovis, Panthera leo, serological assays, STAT-PAK

**Introduction**
Tuberculosis has been a growing concern in the free-ranging lion population in Kruger National Park since its initial discovery in 1995. The impact of tuberculosis on lions requires accurate methods of detection.

**Aim**
To evaluate the use of commercially available serological assays for detection of M. bovis infection in lions.

**Materials and Methods**
Blood was collected from 146 free-ranging immobilised lions in Kruger National Park (KNP). Tracheal lavage was performed to obtain samples for mycobacterial culture using an adapted field technique. Blood and tissue samples were obtained from a cohort of 20 necropsied lions. Blood samples (n=112 lions) were obtained from a TB-uninfected lion population for comparison. For all lions, sera were tested in the ElephantTB STAT-PAK (Chembio Diagnostic Systems, Inc.) according to manufacturer’s instructions. Serological test results from KNP lions were compared to mycobacterial culture results.

**Results**
Tracheal lavage sample cultures confirmed M. bovis infection in 7 of 146 lions tested. Four of the seven culture-positive animals (57.1%) were seropositive using the STAT-PAK test. An additional 15 tracheal culture-negative lions reacted positive on STAT-PAK (15/139= 10.8%). Results were comparable to those from necropsied lions with 57% (8/14) of M. bovis-infected lions having a positive reaction in STAT-PAK tests, and 100% (0/6) seronegative results in TB-negative lions. Five weak-positive and 1 positive STAT-PAK results were found among the 112 lions tested from the TB-free population (94.6% specificity).

**Conclusion**
M. bovis-infected lions can develop humoral responses that are detectable by the ElephantTB STAT-PAK serological assay. This rapid test may provide a practical adjunct method for screening lion populations.

Determination Of Tissue Persistence Of Mycobacterium bovis BCG In Texas-Origin Feral Swine Orally Vaccinated With Mycobacterium bovis BCG

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Poster Abstracts
A Gene Expression Assay For The Detection Of *Mycobacterium bovis* Infection In African Lions (*Panthera leo*)

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**Keywords**
African lion, diagnosis, qRT-PCR, tuberculosis

**Background**
*Mycobacterium bovis*, the aetiological agent of bovine tuberculosis (BTB), has become established in numerous wildlife hosts in South Africa including African lions (*Panthera leo*). Further understanding of this disease in lions and the possible control thereof will require a practical and sensitive test for *M. bovis*-infection in this species.
Translating Theory Into Practice: Targeted Tuberculosis Control In Meerkats Of The Kalahari

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Keywords
Targeted Disease Control, Vaccination, Tuberculosis, Wildlife, Meerkats

Introduction
Tuberculosis (TB) is a worldwide problem affecting humans, livestock, and wildlife. Often a minority of individuals are responsible for the majority of transmission. Targeting management at these ‘superspreader’ individuals is an attractive proposition. This project aims to trial a targeted intervention strategy for TB control in meerkats, a social mammal species.

Materials and methods
A population of 250 wild meerkats has been studied at the Kalahari Meerkat Project in South Africa’s Northern Cape for twenty years. Endemic tuberculosis in this population, has lead to losses of both individuals and entire social groups. Previous work undertaken here has shown a TB infection risk imbalance between individuals due to differences in social behaviours. This study aims to prospectively investigate epidemiological impacts of targeting BCG vaccinations against key individuals. It is proposed to compare vaccination strategies across multiple groups: (1) all pups (2) male pups only (3) dominant individuals only and (4) random selection of individuals. Observations of individuals and regular diagnostic testing will be carried out, in order to confirm selected individuals’ predicted behaviours, and track infection transmission.

Results
Over 100 individuals’ culture and DPP results are pending, and will be used to inform study structure. We welcome delegates’ comments on study design and aims.

Discussion/Conclusion
Through this empirical field trial greater understanding of the role of superspreading individuals in transmitting infection within populations will be gained, as well as the potential utility for targeted...
Role Of The Badger (*Meles meles*) In The Multi-host System Of TB In French Infected Area.

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France is bTB-free but the infection has re-occurred in cattle and has also been detected in wildlife, notably in badgers in some regions such as Côte d’Or. In the British Isles, the badger is known to act as maintenance host and thus hamper efforts that are made to control the infection in livestock.

In order to improve knowledge on the role that the badger may play in the *M. bovis* multi-host system of Côte d’Or and to assess the risk of transmission between badger and cattle, we carried out a study in this French infected area. The active bTB surveillance program, implemented since 2009 in the badger population, provided the prevalence. The ability to shed *M. bovis* was evaluated by using new PCR methods on badger excreta. To estimate the population density, we censused active setts and used camera trapping to assess the mean group size on three 100 km² areas. Finally, the level of contact between badgers and cattle was studied by using GPS tracking data of ten individuals.

All these results suggested that the badger population of Côte d’Or may spillback *M. bovis* to cattle. Nevertheless, it is difficult to assert if it can maintain the infection solely. Further investigations are needed to assess to which extent the infection is clustered within groups and between groups. However, these results are valuable to target effective measures aiming to mitigate the risk of transmission of TB between badgers and cattle.

SYLVATUB: A Bovine Tuberculosis Surveillance Network In Wildlife In France

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**Keywords**

Bovine tuberculosis, epidemiological surveillance, wildlife

France is officially free of bovine tuberculosis (TB) according to EU standards. However, new cases were recently detected in cattle in several geographical areas and investigations led to the detection of infection of wild ungulates and badgers at proximity.

In this context, the French Ministry in charge of agriculture and the main institutions involved in wildlife health launched in September 2011 a national surveillance program for TB in free-ranging wildlife, named Sylvatub. The main goal of the program is to detect and to monitor TB infection in wildlife. It relies on a combination of passive and active surveillance protocols which are applied according to the estimated risk levels in each department or area of the country. Passive surveillance is based on (i) detailed pathological game inspection, (ii) the monitoring of dead or dying animals (SAGIR network), and (iii) TB detection of vaccination against TB in a wild mammal species.
Co-infections may enhance the effects produced by a single pathogen in infected animals. It has been shown that tuberculosis in humans may be driven by the presence of other pathogens such as parasites or viruses. The aim of this study was to investigate the relationship between tuberculosis and other pathogens in wild boar, as yet unexplored. Specifically, we assessed the role of common concomitant infections in the severity of tuberculosis infection in wild boar from mid-western Spain.

The occurrence of Mycobacterium spp. infections was evaluated in 165 hunted wild boar. The presence of tuberculosis lesions affecting only one anatomic location (cervical lymph nodes), or more severe patterns affecting more than one location (mainly cervical lymph nodes and lungs), was also assessed in infected animals. In addition, the existence of contacts with other pathogens such as porcine circovirus type 2 (PCV2), Aujeszky’s disease virus (ADV), swine influenza virus, porcine reproductive and respiratory syndrome virus, Mycoplasma hyopneumoniae, Actinobacillus pleuropneumoniae, Haemophilus parasuis and Metastrongylus spp., was assessed. Whether concomitant pathogens drive disease severity was examined using a Partial Least Squares regression approach.

Results showed that previous contact with PCV2, ADV and infection by Metastrongyulus spp., enhanced tuberculosis severity. Since specific pathogens seem to alter the development of tuberculosis, measures against these concomitant pathogens such as vaccination or deworming, might be useful in tuberculosis control programmes in the wild boar. However, given the unexpected consequences of altering any community of organisms, further research should evaluate the impact of such measures under controlled conditions.