



## TUBERCULOSIS (Ungulates)

ANIMAL GROUP AFFECTED	TRANSMISSION	CLINICAL SIGNS	FATAL DISEASE?	TREATMENT	PREVENTION & CONTROL
Ungulates	Primarily aerogenous, also oral	Coughing, dyspnea, lymphadenopathy, wasting	Yes	Not recommended; sometimes treat endangered species. Streptomycin and isoniazid.	Strict quarantine and testing programs.

<p><b>Fact sheet compiled by</b>          Scott D. Fitzgerald, Diagnostic Center for Population and Animal Health, College of Veterinary Medicine, Michigan State University, East Lansing, Michigan, USA          Alexis Lécu, DVM. Paris Zoo</p>	<p><b>Last update</b>          April, 2009</p>
<p><b>Fact sheet reviewed by</b>          J. Sikarskie, College of Veterinary Medicine, Michigan State University, East Lansing, Michigan, USA          R. J. Montali, 6624 E. Wakefield Drive, Alexandria, Virginia, USA</p>	
<p><b>Susceptible animal groups</b>          All ungulates are susceptible : ruminants, camelids, tapirs, rhinoceros. Rarely described in equidae</p>	
<p><b>Causative organism</b>  <i>M.tuberculosis</i> complex, mainly <i>Mycobacterium bovis</i></p>	
<p><b>Zoonotic potential</b>          Yes. Individuals that have been in contact with TB-positive animals and personnel that work in quarantine facilities should be regularly monitored for tuberculosis by skin tests.</p>	
<p><b>Distribution</b>          Worldwide.</p>	
<p><b>Transmission</b>          Primarily airborne (direct contact), also oral by contaminated feed or pasture (feces, urine) and through milk in juvenile animals.</p>	
<p><b>Incubation period</b>          Several weeks for tuberculin to react after exposure to <i>Mycobacterium</i>; months to years for clinical signs.</p>	
<p><b>Clinical symptoms</b>          Asymptomatic for variable periods; may show skin tuberculin reaction or gamma interferon test positive. As disease progresses may develop coughing, labored respiration, enlarged peripheral lymph nodes, chronic wasting, lethargy, and death.</p>	
<p><b>Post mortem findings</b>          Enlarged lymph nodes of the head and neck, especially retropharyngeal lymph nodes and tonsils; disseminated nodules throughout the lung and pleura; less frequently involving abdominal lymph nodes and viscera. Lesions vary from firm, pale and partially mineralized caseous granulomas, to fluctuant abscesses with purulent centers. Microscopically, Langhan's giant cells, lymphocytes and macrophages are common, as is partial mineralization of necrotic debris; acid-fast bacilli may be rare to moderately common.</p>	
<p><b>Diagnosis</b>          1) Clinical signs, 2) Chest radiographs for advanced pulmonary cases, 3) Caudal tail-fold (bovids) or cervical skin (bovids and cervids), eyelid (rhino), inguinal (tapir) intradermal injection of 0.1 ml bovine PPD tuberculin(1 mg/ml, or 5000 tuberculin units), read and measure for swelling and induration at 72 hours; excellent results in bovidae, variable sensitivity and specificity in cervidae, 4) Gamma interferon ELISA is used in bovidae (Bovigam ®), similar test exists for cervidae (Cervigam ®) but is rarely available, 5) serological screening by detection of antibody against selected relevant antigen (like MBP70, ESAT6, CFP10,..) either by ELISA or by rapid flow test (TB STAT PAK ®). 6) Mycobacterial isolation and identification from clinical (lymph node aspiration, bronchial lavage,..) or necropsy materials (tracheo-bronchic LN) using specialized broths or BACTEC automated systems, 7) PCR highly sensitive and specific on clinical isolates, also used but less sensitive on formalin-fixed tissues, 8) Acid-fast staining of smears from caseous granulomas, 9) Histopathology of formalin-fixed tissues including acid-fast staining.</p>	



Remember that none of these antemortem tests can be 100% reliable used alone.

**Material required for laboratory analysis**

Clinical materials: exudates, discharges, lymph node biopsies. Necropsy materials: lymph nodes, lungs, other tissues exhibiting granulomas or abscesses; fresh for culture or PCR; fixed for histopathology.

**EU Reference Laboratory**

**VISAVET**

Laboratorio de vigilancia veterinaria, Facultad de Veterinaria, Universidad Complutense de Madrid

Avda. Puerta de Hierro, s/n. Ciudad Universitaria  
28040. Madrid  
Spain

**OIE Reference Laboratories**

- **Dr Bernardo Alonso**  
Gerencia de Laboratorios (GELAB) del Servicio Nacional de Sanidad y Calidad, Agroalimentaria (SENASA)  
Av. Alexander Fleming 1653, 1640 Martinez - Pcia de Buenos Aires  
ARGENTINA  
Tel: (54.11) 48.36.00.36 Fax: (54.11) 48.36.00.36  
Email: [balonso@senasa.gov.ar](mailto:balonso@senasa.gov.ar)  
Email: [dilab@inea.com.ar](mailto:dilab@inea.com.ar)
- **Mme María Laura Boschioli-Cara**  
AFSSA Alfort, Unité Zoonoses Bactériennes, Laboratoire d'études et de recherches en pathologie animale et zoonoses  
23 avenue du Général de Gaulle, 94706 Maisons-Alfort Cedex  
FRANCE  
Tel: (33 (0)1) 49.77.13.00 Fax: (33 (0)1) 49.77.13.44  
Email: [ml.boschioli@afssa.fr](mailto:ml.boschioli@afssa.fr)
- **Dr Debby V. Cousins**  
Australian Reference Laboratory for Bovine Tuberculosis, Agriculture Western Australia  
Locked Bag N° 4, Bentley Delivery Centre, Bentley WA 6983  
AUSTRALIA  
Tel: (61.8) 93.68.34.51 Fax: (61.8) 94.74.18.81  
Email: [dcousins@agric.wa.gov.au](mailto:dcousins@agric.wa.gov.au)
- **Prof. Glyn Hewinson**  
VLA Weybridge  
New Haw, Addlestone, Surrey KT15 3NB  
UNITED KINGDOM  
Tel: (44.1932) 34.11.11 Fax: (44.1932) 34.70.46  
Email: [r.g.hewinson@vla.defra.gsi.gov.uk](mailto:r.g.hewinson@vla.defra.gsi.gov.uk)

**Relevant diagnostic laboratories**

Many human medical laboratories can isolate *M. bovis* and *M. tuberculosis*.

**Treatment**

Not recommended except for valuable and endangered species; euthanasia of positive animals is recommended. If treatment is elected, strict isolation is mandatory. Combination therapy (usually 3 to 4) such as streptomycin, rifampin and isoniazid for months, followed by repeated cultures to confirm animal is not actively shedding organisms. Other therapeutic agents include ethambutol, ethionamide, kanamycin, ciprofloxacin, cycloserine, and capreomycin; *M. bovis* is resistant to pyrazinamide. Even after treatment is discontinued, animals should be regularly screened for shedding for the rest of their lifetime.

**Prevention and control in zoos**

Obtain animals from tuberculosis-free sources. Strict quarantine and multiple skin tests or cultures on all new stock prior to introduction. Annual testing of all animals. Strict quarantine of all animals that have been in contact with TB-positive animals; monitor status by multiple skin tests, or by crossing results from different testes (i.e. cellular mediated and serological). Strict quarantine of reactors; euthanasia of positive animals. May require depopulation of exhibit or herd if infection persists or spreads.

**Suggested disinfectant for housing facilities**

5% Phenol compounds, 1% sodium hypochlorite, formaldehyde, quaternary ammonium compounds or high concentration iodine compounds; use according to label directions for *M. bovis* or *M. tuberculosis*, requires removal of organic material and specific contact times on surfaces.



<b>Notification</b>
<b>Guarantees required under EU Legislation</b>
<b>Guarantees required by EAZA Zoos</b>
<b>Measures required under the Animal Disease Surveillance Plan</b>
<b>Measures required for introducing animals from non-approved sources</b>
<b>Measures to be taken in case of disease outbreak or positive laboratory findings</b>
<b>Conditions for restoring disease-free status after an outbreak</b>
<b>Contacts for further information</b>
<b>References</b> <ol style="list-style-type: none"><li>1. Anon. 2005. Bovine tuberculosis eradication: uniform methods and rules. United States Department of Agriculture, Animal and Plant Health Inspection Service, APHIS 91-45-011.</li><li>2. Artois, M., Loukiadis, E., Garin-Bastuji, B., Thorel, M.F., Hars, J. 2004. Infection des mammifères sauvages par <i>Mycobacterium bovis</i>, risques de transmission aux bovines domestiques. Bulletin Epidémiologique de l’AFFSA 13: 1-3</li><li>3. Clifton-Hadley, R. S., and J. W. Wilesmith. 1991. Tuberculosis in deer: a review. Vet. Rec. 129:5-12,.</li><li>4. Clifton-Hadley, R. S., Sauter-Louis, C. M., Lugton, I. W., Jackson, R., Durr, P. A., and J. W. Wilesmith. 2001. <i>Mycobacterium bovis</i> infections, In: Infectious Diseases of Wild Mammals (3<sup>rd</sup> ed.), E. S. Williams and I. K. Barker (eds.). pp. 340-361. Iowa State University Press, Ames, Iowa, USA.</li><li>5. Cook, R. A. 1992. Tuberculosis in cervidae: an informational guide for veterinarians of AAZPA accredited zoos In: Infectious Disease Guide AAZV.</li><li>6. EFSA Working Group. Scientific Report on “Tuberculosis testing in deer” – Question AFSA 2006-179. 2008. The EFSA Journal n°645 : 1-35.</li><li>7. Fitzgerald, S. D., Kaneene, J. B., Butler, K. L., Clarke, K. R., Fierke, J. S., Schmitt, S. M., Bruning-Fann, C. S., Mitchell, R. R., Berry, D. E., and J. B. Payeur. 2000. Comparison of postmortem techniques for the detection of <i>Mycobacterium bovis</i> in white-tailed deer (<i>Odocoileus virginianus</i>). J. Vet. Diagn. Invest. 12:322-327.</li><li>8. Griffin, J. F. T., and G. S. Buchan. 1994. Aetiology, pathogenesis and diagnosis of <i>Mycobacterium bovis</i> in deer. Vet. Micro. 40:193-205,</li><li>9. Miller M.A. 2008. Current Diagnostic Methods for Tuberculosis in Zoo Animals. In : Zoo and Wild Animal medicine (6<sup>th</sup> ed.), Fowler M.E &amp; Miller R.E. Saunders Ed, Missouri, USA : 10-19.</li><li>10. Montali, R. J. (ed.). 1978. Mycobacterial Infections of Zoo Animals. Smithsonian Institution Press, Washington, D.C., USA.</li><li>11. Montali, R. J., Mikota, S. K., and L. I. Cheng. 2001. <i>Mycobacterium tuberculosis</i> in zoo and wildlife species. Rev. Sci. Tech. Off. Int. Epiz. 20:291-303.</li><li>12. Sternberg S. Bernodt K., Holmstrom A., Roken B. 2002. Survey of tuberculin testing in Swedish zoos, J.Zoo.Wildl.Med. 33(4) : 378-380.</li><li>13. Thoen, C. O., Steele, J. H., and Michael J. Gilsdorf (eds.). 2005. <i>Mycobacterium bovis</i> infection in animals and humans; second edition. Blackwell Publishing, Ames, Iowa.</li></ol>