

MICROSPORIDIOSIS

ANIMAL GROUP AFFECTED	TRANSMISSION	CLINICAL SIGNS	FATAL DISEASE ?	TREATMENT	PREVENTION & CONTROL
Cebidae, <i>Gorilla beringei</i>	Primarily aerogenous, occasionally congenital	Depending on microsporidia involved encephalitis, abortion or diarrhea	In Callitrichids	Albendazole Fumagillin	<i>In houses</i> <i>in zoos</i>

Fact sheet compiled by Manfred Brack, formerly German Primate Center, Göttingen/Germany.	Last update 22.11.2008
Susceptible animal groups In <i>E.cuniculi</i> : primarily rabbits and birds, occasionally <i>Saimiri sciureus</i> , <i>Saguinus imperator</i> , <i>Leontopithecus rosalia</i> , <i>Callimico goeldii</i> . In <i>E.intestinalis</i> donkeys, dogs, pigs, cows. Goats, also in wild-living <i>Gorilla beringei beringei</i> . In <i>E. bieneusi</i> occasionally <i>M. Mulatta</i> . particularly after SIV-infection.	
Causative organism <i>Encephalitozoon cuniculi</i> , <i>Enterocytozoon (Septata) intestinalis</i> , <i>Enterocytozoon bieneusi</i> in nonhuman primates and man, other microsporidia in other animals. All microsporidia are obligate intracellular parasites, the entire phylum microspora lacks mitochondria.	
Zoonotic potential Yes, particularly in immunocompromised (AIDS, diabetes mellitus) patients.	
Distribution World- wide	
Transmission Primarily perorally through contaminated food or water, congenital infections	
Incubation period	
Clinical symptoms In <i>E.cuniculi</i> encephalitis, abortion, in <i>E.intestinalis</i> and <i>E. bieneusi</i> diarrhea	
Post mortem findings <i>E. cuniculi</i> : granulomatous encephalitis, nonsuppurative meningitis, granulomatous inflammations of other organs including granulomatous placentitis. <i>E. intestinalis</i> : cytoplasmic clusters of microsporidia in duodenal , ileal, colonic and rectal enterocytes and goblet cells without accompanying inflammation. <i>E. bieneusi</i> : microsporidial clusters in intestinal and biliary tract cells	
Diagnosis PCR, Western blot, immunohistochemistry (indirect immunofluorescence using monoclonal antibodies!) Electron microscopy, ELISA, in situ hybridization, chromotrope 2 R staining, calcofluor staining	
Material required for laboratory analysis For cultivation: fresh brain/ kidney tissues, For PCR: fresh or paraffin-embedded tissues, For serology: serum	
Relevant diagnostic laboratories	
Treatment In man: albendazole 200 – 400 mg twice daily perorally, Fumagillin : 0.03 % solution topically (eye). In nonhuman primates fenbendazole possibly unsuccessful! (Wenker et al,2002)	
Prevention and control in zoos Strict hygiene	



Suggested disinfectant for housing facilities
Notification
Guarantees required under EU Legislation
Guarantees required by EAZA Zoos
Measures required under the Animal Disease Surveillance Plan
Measures required for introducing animals from non-approved sources
Measures to be taken in case of disease outbreak or positive laboratory findings
Conditions for restoring disease-free status after an outbreak
Experts who may be consulted
References <ol style="list-style-type: none">1. Anver, M. R., N. W. King, and R. D. Hunt . 1972. Congenital encephalitozoonosis in a squirrel monkey (<i>Saimiri sciureus</i>). Vet. Pathol. 9 : 475 – 480.2. Bornay – Llinares, F. J., A. J. da Silva, H. Moura, D. A. Schwartz, G. S. Visvesvara, N. J. Pieniazek, A. Cruz – Lopez, P. Hernández – jauregui, J. Guerrero, and F. J. Enriquez. 1998. Immunologic, microscopic, and molecular evidence of <i>Encephalitozoon intestinalis</i> (<i>Septata intestinalis</i>) infection in mammals other than humans . J. Infect. Dis. 178 : 820 – 826.3. Chu, P., and A. B. West . 1996. <i>Encephalitozoon</i> (<i>Septata</i>) <i>intestinalis</i>. Cytologic, histologic, and electron microscopic features of a systemic intestinal pathogen. Am. J. Clin. Pathol . 106 : 606 – 614.4. Croppo, G. P., G. S. Visvesvara, G. J. Leitch, S. Wallace, and D. A. Schwartz. 1998. Identification of the microsporidian <i>Encephalitozoon hellem</i> using immunoglobulin G monoclonal antibodies. Arch. Pathol. Lab. Med. 122 : 180 – 181.5. Didier, E.. S. 2005. Microsporidiosis : an emerging and opportunistic infection in humans and animals. Acta Trop. 94 : 61 – 76.6. Didier, E.. S., L.B. Rogers, A. D.Brush, S. Wong, V. Traina – Dorge, and D. Bertucci. 1996. Diagnosis of disseminated microsporidian <i>Encephalitozoon hellem</i> infection by PCR-Southern analysis and successful treatment with albendazole and fumagillin. J. Clin. Microbiol. 34 : 947 – 952.7. Franzen, C., A. Mueller, P. Hartmann, M. Kochanek, V. Diehl, and G. Falkenheuer. 1996. Disseminated <i>Encephalitozoon</i> (<i>Septata</i>) <i>intestinalis</i> infection in a patient with AIDS. New Engl. J. Med. 335 : 1610 - 1611.8. Graczyk, T. K., J. Bosco – Nizeyi, A. J. da Silva, I. N. Moura, N. J. Pieniazek, M. R. Cranfield, and H. D. Lindquist. 2002. A single genotype of <i>Encephalitozoon intestinalis</i> infects free – ranging gorillas and people sharing their habitats in Uganda. Parasitol. Res. 88 : 926 – 931.9. Guscetti, F., A. Mathis, J.-M. Hatt, and P. Deplazes. 2003. Overt fatal and chronic subclinical <i>Encephalitozoon cuniculi</i> microsporidiosis in a colony of captive emperor tamarins (<i>Saguinus imperator</i>). J. Med. Primatol. 52 : 111 – 119.10. Kalema – Zikusoka, G., J. M. Rothman, and M. T. Fox. 2005. Intestinal parasites and bacteria of mountain gorillas (<i>Gorilla beringei beringei</i>) in Bwindi Impenetrable National Park, Uganda. Primates 46 : 59 – 63.11. Mansfield, K. G., A. Carville, D. Herbert, L. Chalifoux, D. Shvetz, K. C. Lin, S. Tzipori, and A. A. Lackner. 1998. Localization of persistent <i>Enterocytozoon bieneusi</i> infection in normal rhesus macaques (<i>Macaca mulatta</i>) to the hepatobiliary tract. J. Clin. Microbiol. 36 : 2336 – 2338.12. Mansfield, K. G., A. Carville, D. Shvetz, J. Mackey, S. Tzipori, and A. Lackner. 1997. Identification of an <i>Enterocytozoon bieneusi</i> - like microsporidian parasite in simian – immunodeficiency – virus inoculated macaques with hepatobiliary disease. Am. J. Pathol. 150 : 1395 – 1405.13. Shaddock, J. A. and G. Baskin. 1989. Serologic evidence of <i>Encephalitozoon cuniculi</i> infection in a colony of squirrel monkeys (<i>Saimiri sciureus</i>). Lab. Anim. Sci. 39 : 328 – 330.14. Wenker, C.J., J. M. Hatt, D. Ziegler, A. Mathis, I. Tanner, and P. Deplazes. 2002. Microsporidiosis (<i>Encephalitozoön</i> spp.) of New World primates - an emerging disease ? A seroepidemiological, pathological, and therapeutical survey in the Zurich Zoo. Proc. Eur. Assoc. Zoo Wildl. Vets. Sci. Meet. 4 : 503 – 506.



15. Zeman, D., H., and G. B. Baskin. 1985. Encephalitozoonosis in squirrel monkeys. (*Saimiri sciureus*). Vet. Pathol. 22 : 24 – 31.