

EBOLA / RESTON VIRUSES

ANIMAL GROUP AFFECTED	TRANSMISSION	CLINICAL SIGNS	FATAL DISEASE ?	TREATMENT	PREVENTION & CONTROL
Ebola : Chimpanzee Gorilla, Baboon, Drill, Mandrill, <i>Cercopithecus</i> spp. man (duikers ?) Reston Virus: <i>Macaca fascicularis</i>	Contact, aerogenously (perorally ?)	Nonhuman primates: fever, weight loss, anorexia, nasal discharge, respiratory symptoms, lethargy, coma, haemorrhagic rash, diarrhea, elevated LDH levels, thrombocytopenia	Yes : Reston Virus in <i>M.fascicularis</i> 50% mortality rate. Ebola viruses in man highly fatal (Except Reston virus!)	None	<i>In houses</i> <i>in zoos</i> Extended (60 – 90 days) quarantine.

Fact sheet compiled by Manfred Brack, formerly German Primate Center, Göttingen / Germany.	Last update 22.11.2008
Susceptible animal groups Reston Virus : <i>Macaca fascicularis</i> . Ebola Ivory Coast : <i>Pan troglodytes</i> , <i>Gorilla gorilla</i> , <i>Papio anubis</i> , <i>Mandrillus leucophaeus</i> , <i>M. sphinx</i> , <i>Cercopithecus neglectus</i> . Fruit bats can be asymptomatic reservoir hosts.	
Causative organism Ebola viruses (Filoviridae, Mononegavirales) : Ebola – Sudan, Ebola – Zaire, Ebola – Ivory Coast, Ebola Uganda, Ebola – Reston.	
Zoonotic potential Yes, except Ebola- Reston..	
Distribution Africa , Reston Virus probably imported from Africa to the Philippines.	
Transmission Contact, aerogenously. Transmission to man by eating monkey meat suspected.	
Incubation period 3 – 9 days.	
Clinical symptoms 1. Reston virus in <i>M.fascicularis</i> (Co –infection with simian haemorrhagic fever virus!): fever, weight loss, anorexia, lethargy, nasal discharge, respiratory symptoms, haemorrhagic rash, diarrhea, elevated LDH-levels, thrombocytopenia, mortality rate 50%. Ebola Zaire probably fatal also in gorillas and chimpanzees.	
Post mortem findings Reston virus in <i>M.fascicularis</i> ::(Co- infection with simian haemorrhagic fever virus):maculopapular rash, splenomegaly, petechial haemorrhages, interstitial pneumonia and bronchiolar / alveolar necroses, adrenal cortical necroses, amphophilic cytoplasmic inclusion bodies. Fibrin deposition in splenic cords, lymphoid depletion in the splenic white pulp.	
Diagnosis Virology: antigen-capture ELISA, cell cultures, RNA-/DNA extraction, nucleotid sequencing, electron microscopy. 2. Serology: immunofluorescence, Western blots, Serum neutralization, radioimmunoassays, Immunofluorescence, mass tag PCR.	
Material required for laboratory analysis Blood, serum(paired sera necessary), tissues.	



Relevant diagnostic laboratories 1. CDC Atlanta / Georgia, USA 2. The Simian Diagnostic Laboratory at Virus Reference Laboratories, Inc. 7540 Louis Pasteur Road SAN ANTONIO / Tx. 78229 Tel.: (210) 614 – 7350 Fax: (210) 614 - 7355 3. Robert Koch Institut Fachgebiet Hochpathogene Virale Erreger Nordufer 20 D 13353 Berlin/Germany Tel.: 01888 / 754 – 2277 Fax: 01888 / 754 – 2605 4. MZD für tropische Infektionserreger am Bernhard-Nocht-Institut für Tropenmedizin Bernhard Nocht-Str. 74 20359 Hamburg. Tel.: 040 42818 401 Fax: “ “ 400 e-mail: MZD@bni-hamburg.de
Treatment None
Prevention and control in zoos Extended (60 – 90 days) quarantine. A construct of Ebola- / PI 3- viruses given aerogenously protected rhesus monkeys in experimental challenges with Ebola-virus.
Suggested disinfectant for housing facilities
Notification In Germany: State Veterinarian according to §1 “Verordnung über anzeigepflichtige Tierseuchen, 3.Nov.2004“
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 1. Prof. Dr. B. Fleischer, MZD, Hamburg 2. Prof. Dr. H. Schmitz, “ “ 3. Prof. Dr. G. Pauli, Robert Koch Institut Berlin/Germany
References 1. Anon. 2002. More Ebola fever deaths in Africa. (From the UN integrated regional information networks). Lab. Primate Newsl. 41 (2) : 25 – 26. 2. Anon. 2003. Ebola Hemorrhagic Fever - Congo. Lab. Primate Newsl. 42 (2) : 16 – 17. 3. Dalgard, D. W., R. J. Hardy, S. L. Pearson, G. J. Pucak, R. V. Quander, P. M. Zack, C. J. Peters, and P. B. Jahrling. 1992. Combined simian haemorrhagic fever and Ebola virus infection. Lab. Anim. Sci. 42. 152 – 157. 4. Elliot, C. H., S. P. Bauer, G. Perez – Oronoz, and E. S. Lloyd. 1993. Improved specificity of testing methods for filovirus antibodies. J. Virol. Methods 93 : 85 – 100. 5. Formenty, P., C. Boesch, M. Wyers, C. Steiner, F. Donati, F. Dind, F. Walker, and B. le Guenno. 1999. Ebola virus outbreak among wild chimpanzees living in a rain forest of Côte d’Ivoire. J. Infect. Dis. 179 (Suppl. 1) : S 120 – S 126. 6. Geisbert, T. W., and P. B. Jahrling. 1990. Use of immunoelectron microscopy to show Ebola virus during the 1989 United States epizootic. J. Clin. Pathol. 43 : 813 – 816. 7. Geisbert, T. W., P. B. Jahrling, M. A. Hanes, and P. M. Zack. 1992. Association of Ebola – related



- Reston virus particles and antigen with tissue lesions of monkeys imported to the United States. *J. Comp. Pathol.* 106 : 137 – 152.
8. Geisbert, T. W., J. B. Rhoderick, and P. B. Jahrling. 1991. Rapid identification of Ebola virus and related filoviruses in fluid specimens using indirect immunoelectron microscopy. *J. Clin. Pathol.* 44 : 521 – 522.
 9. Huggins, J. W. 1997. Filoviridae. In Richman, D. D., R. J. Whitley, and F. G. Hayden (eds). *Clinical Virology*. Churchill Livingstone, New York. Pp 899 – 908.
 10. Ikegami, T., M. E. G. Miranda, A. B. Calaor, D. L. Manalo, N. J. Miranda, M. Niikuro, M. Saijo, Y. Une, Y. Nomura, I. Kurane, T. G. Ksiazek, Y. Yoshikawa, and S. Morikawa. 2002. Histopathology of natural Ebola virus subtype Reston infection in cynomolgus macaques during the Philippine outbreak in 1996. *Exp. Anim.* 51 : 447 – 455.
 11. Kalter, S. S., R. L. Heberling, A. W. Cooke, J. D. Barry, P. Y. Tian, and W. J. Northam. 1997. Viral infections of nonhuman primates. *Lab. Anim. Sci.* 47 : 461 – 467.
 12. Lenz, H. D., W. Slenczka und H. Feldmann. 1998. Infektionen durch Marburg- und Ebolaviren. Übersicht und Möglichkeiten der Labordiagnostik. *Epidemiol. Bull.* 45 : 317 – 319.
 13. Leroy, E. M., B. Kumulungui, X. Pourrut, P. Rouquet, A. Hassanin, P. Yaba, A. Délicat, J. T. Paweska, J. P. Gonzalez, and R. Swanepoel. 2005. Fruit bats as reservoirs of Ebola virus. *Nature* 438 : 575 – 576.
 14. Leroy, E. M., P. Rouquet, P. Formenty, S. Souquiere, A., Kilbourne, J. - M. Froment, M. Bermejo, S. Smit, W. Karesh, R. Swanepoel, S. R. Zaki, and P. E. Rollins. 2004. Multiple Ebola virus transmission events and rapid decline of Central African wildlife. *Science* 303 : 33 – 34.
 15. Leroy, E. M., P. Teller, B. Kumulungui, P. Yaba, P. Roques, J. -P. Gonzalez, T. G. Ksiazek, P. E. Rollin, and E. Nerrienet. 2004. A serological survey of infection in central African of Ebola virus nonhuman primates. *J. Infect. Dis.* 190 : 1895 – 1899.
 16. Maruyama, T., L. I. Rodriguez, P. B. Jahrling, A. Sanchez, A. S. Khan, S. T. Nichol, C. J. Peters, P. W. H. I. Parren, and D. R. Burton. 1999. Ebola viruses can be effectively neutralized by antibody produced in natural human infections. *J. Virol.* 73 : 6024 – 6030.
 17. Miller, R. K., J. Y. Baumgardner, C. W. Armstrong, S. R. Jenkins, C. D. Woolard, G. B. Miller, G. G. Wrigley, L. D. Pulk, D. R. Tavirus, M. E. G. Miranda, M. M. Dayrit, and M. I. Saniel. 1990. Update : Ebola – related filovirus infection in nonhuman primates and interim guidelines for handling nonhuman primates during transit and quarantine. *Morb. Mortal. Wkly. Rep.* 39 (2) : 22 – 23.
 18. Miranda, M. E., T. G. Ksiazek, T. J. Retuya, A. S. Khan, A. Sanchez, C. F. Fulhorst, P. E. Rollin, A. B. Calaor, D. L. Manalo, M. C. Roces, M. M. Dayrit, and C. J. Peters. 1999. Epidemiology of Ebola (subtype Reston) virus in the Philippines, 1996. *J. Infect. Dis.* 179 (Suppl. 1) : S 115 – S 119.
 19. Morvan, J. M., V. Deubel, P. Gounon, E. Nakoune, P. Barrière, S. Murri, V. Volchov, O. Perpète, B. Selekon, D. Coudrier, A. Gautier – Hion, and M. Colyn. 1999. Identification of Ebola virus sequences present as RNA or DNA in organs of terrestrial small mammals of the Central African Republic. *Microbes Infect.* 1 : 1193 – 1201.
 20. Palacios, G., T. Briese, V. Kapoor, O. Jabado, Z. Liu, M. Venter, J. Zhai, N. Renwick, A. Grolla, T. W. Geisbert, C. Drosten, J. Towner, J. Ju, J. Paweska, S. T. Nichol, R. Swanepoel, H. Feldmann, P. B. Jahrling, and W. I. Lipkin (2006) Mass tag polymerase chain reaction for differential diagnosis of viral hemorrhagic fevers. *Emerg. Infect. Dis.* 12 : 692 – 695.
 21. Peters, C. J., A. Sanchez, H. Feldmann, P. E. Rollin, S. Nichol, and T. G. Ksiazek. 1994. Filoviruses as emerging pathogens. *Semin. Virol.* 5 : 147 – 154.
 22. Rollin, P. E., and T. G. Ksiazek. 1998. Ebola haemorrhagic fever. *Trans. R. Soc. Trop. Med. Hyg.* 92 : 1 – 2.
 23. Rollin, P. E., T. G. Ksiazek, P. B. Jahrling, M. Haines, and C. J. Peters. 1990. Detection of Ebola – like viruses by immunofluorescence. *Lancet* 336 : 1591.
 24. Rollin, P. E., J. J. Williams, D. S. Bressler, S. Pearson, M. Cottingham, G. Pucak, A. Sanchez, S. G. Trappier, R. L. Peters, P. W. Greer, S. Zaki, T. Demarcus, K. Hendricks, M. Kelley, D. Simpson, T. W. Geisbert, P. B. Jahrling, C. J. Peters, and T. G. Ksiazek. 1999. Ebola (Subtype Reston) virus among quarantined nonhuman primates recently imported from the Philippines to the United States. *J. Infect. Dis.* 179 (Suppl. 1) : S 108 – S 114.
 25. Roper, W. L. 1990. Filovirus infections in newly imported monkeys. *Science* 250 : 492.
 26. Wolfe, N. D., A. A. Escalante, W. B. Karesh, A. Kilbourn, A. Spielman, and A. A. Lal. 1998. Wild primate populations in emerging infectious disease research. The missing link ? *Emerg. Infect. Dis.* 4 : 149 – 158.
 27. Wyers, M., P. Formenty, Y. Cherel, L. Luigand, B. Fernandez, C. Boesch, and B. le Guenno. 1999. Histopathological and immunohistochemical studies of lesions associated with Ebola virus in an naturally infected chimpanzee. *J. Infect. Dis.* 179 (Suppl.1) : S 54 – S 59.