



## MONKEYPOX

ANIMAL GROUP AFFECTED	TRANSMISSION	CLINICAL SIGNS	FATAL DISEASE ?	TREATMENT	PREVENTION & CONTROL
Nonhuman primates and man, prairie dogs, squirrels	Between nonhuman primates aerogenously, biting, contact. From monkey to man by contact or through vectors (prairie dogs in the USA !)	In man smallpox-like, in nonhuman primates cutaneous eruptions, mucocutaneous vesicles,cough.	Yes –in man 14% fatality rate  High fatality/abortion rate in great apes and squirrel monkeys	Only secondary infections	<i>In houses</i> Quarantine  <i>in zoos</i>  Quarantine

<b>Fact sheet compiled by</b> Manfred Brack, formerly German Primate Center, Göttingen / Germany.	<b>Last update</b> 22.11.2008
<b>Susceptible animal groups</b> All nonhuman primates and man. Reservoir hosts : <i>Cercopithecus ascanius</i> , <i>C.nigriviridis</i> , <i>C.petaurista</i> , <i>Colobus badius</i> , rodents ( <i>Cricetomys sp.</i> ), prairie dogs ( <i>Cynomys sp.</i> )Squirrels ( <i>Heliosciurus rufobrachium</i> , <i>Funisciurus anerythrus</i> )	
<b>Causative organism</b> Monkeypox-virus ( Chordopoxviruses, Orthopoxvirus) . Monkeypoxvirus of West African origin is less virulent in man and cynomolgus monkeys than monkeypoxvirus from the Congo basin .	
<b>Zoonotic potential</b> Yes	
<b>Distribution</b> African rain forest, human cases in Congo (Democratic Republic), Zaire, West- and Central Africa.	
<b>Transmission</b> Between monkeys probably aerogenously, by biting or other contacts. From monkeys to man most likely by contact during processing of monkey- meat for food. Man-man transmission proven in the Democratic Republic of Congo ( Congo basin virus is man-man transmissible on contrast to West African virus ). In the USA transmission of West African monkeypoxvirus to man via prairie dogs ( <i>Cynomys sp.</i> ) and rabbit (reservoir hosts predominantly rodents).	
<b>Incubation period</b> In man: 7 – 21 days.	
<b>Clinical symptoms</b> In Cercopithecidae mostly benign, self-limiting cutaneous eruptions, in the great apes and squirrel monkeys also mucocutaneous (mouth, face, soles) vesicles, itching erythema, cough. High fatality and abortion rate in great apes and squirrel monkeys. In man: febrile rash, malaise, headache, occasionally encephalopathy.	
<b>Post mortem findings</b> Isolated papules especially in the facial region , followed by typical pox lesions (Guarneri bodies!). In the great apes and squirrel monkeys haemorrhagic pox lesions and pneumonia, in the squirrel monkeys metritis. In prairie dogs fibrinonecrotic bronchopneumonia, multifocal haemorrhagic-necrotic lesions in numerous organs	
<b>Diagnosis</b> In histopathology Guarneri-bodies ,electron microscopy (vesicular fluid superior to swabs !) Virology: tissue culture. DNA restriction pattern for distinction monkeypox from smallpox, cowpox etc. Serology: CFI-tests, immunoprecipitation.	
<b>Material required for laboratory analysis</b> Pox lesions, vesicular fluid (native or dried glass slides)	

**Relevant diagnostic laboratories**

1. Virus Reference Laboratories, Inc.  
7540 Louis Pasteur Road  
SAN ANTONIO, Tx. 78229  
Phone: (210) 614 – 7350  
Fax: (210) 614- -7355
2. Konsiliarlaboratorium für Poxviren  
Institut für Medizinische Mikrobiologie, Infektions- und Seuchenmedizin  
Ludwigs-Maximilian-Universität  
MÜNCHEN  
Tel.: 089 2180 2528  
“ “ 2028  
Fax: “ “ 5905  
e-mail: [sandra.essbauer@micro.vetmed.uni-muenchen.de](mailto:sandra.essbauer@micro.vetmed.uni-muenchen.de)
3. Konsiliarlaboratorium für Poxviren,  
Robert Koch-Institut  
Nordufer 20  
13353 BERLIN  
Tel.: 01888.754-2310  
Fax: 01888.754-2605  
E-mail: [PauliG@rki.de](mailto:PauliG@rki.de)
4. CDC, Atlanta, Georgia /USA.

**Treatment**

Cidofovir, vaccinia immune globulin

**Prevention and control in zoos**
**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, Bernhard- Nocht –Institut, Hamburg,
2. Prof.Dr. H. Schmitz, “ “ “ “
3. Prof.Dr. Kaaden, Konsiliarlaboratorium, München

**References**

1. Anon. 1997. Democratic Republic of the Congo (DRC) monkeypox cases continue to increase. Trop. Med. Hyg. News 46: 136.
2. Anon. 2003. Zu einem Ausbruch von Affenpocken in den USA. Erstes Auftreten in der westlichen Hemisphaere. Epidemiol.Bull. 24: 187
3. Anon. 2005. Kongo, Demokratische Republik. Info Dienst Reisemed. Aktuell 11 (22.5.05): 11.
4. Arita, T., Z. Jezek, L. Khodakevich, and K. Ruti. 1985. Human monkeypox : a newly emerged orthopoxvirus zoonosis in the tropical rain forests of Africa. Am J. Trop. Med. Hyg. 34: 781 – 789.
5. Baxby, D. 1988. Human monkeypox infection after the eradication of smallpox. Epidemiol. Infect. 100: 321 – 334.

6. Brack, M. 1987. Agents Transmissible from Simians to Man. Springer, Berlin.
7. Breman, J. G., and D. A. Henderson. 1998. Poxvirus dilemmas - monkeypox, smallpox, and biologic terrorism. *N. Engl. J. Med.* 339: 556 – 559.
8. Breman, J. G., K. Ruti, M. V. Steniowski, E. Zanotto, A. I. Gromyko, and A. Arita. 1980. Monkeypox chez l'homme, 1970 – 1979. *Bull. World Health Org.* 58: 849 – 868.
9. Chen, N., G. Li, M. K. Liszowski, J. Atkinson, P. B. Jahrling, Z. Feng, J. Schriewer, C. Buck, C. Wang, E. J. Lefkowitz, J. J. Esposito, T. Harms, I. K. Damon, R. L. Roper, C. X. Upton, and R. M. Buller. 2005. Virulence differences between monkeypox virus isolates from West Africa and the Congo basin. *Virology* 340 : 46 – 63.
10. Cho, C. T., and H. A. Wenner. 1973. Monkeypox virus. *Bacteriol. Rev.* 37: 1 – 18.
11. Cohen, J. 1997. Is an old virus up to new tricks? *Science* 277: 312 – 313.
12. Gelderblom, H. 2002. Bericht über die Aktivitäten des AK-EMED in den Jahren 2001 und 2002. *Elektronenmikroskopie* 20.12.2002.
13. Gubser, C., S. Hue, P. Kellam, and G. L. Smith. 2004. Poxvirus genomes : a phylogenetic analysis. *J. Gen. Virol.* 85 . 105 – 117.
14. Hankenson, F. C., N. A. Johnston, B. J. Weigler, and R. F. DiGiacomo. 2003. Zoonoses of occupational health importance in contemporary laboratory animal research. *Comp. Med.* 53 : 579 – 601.
15. Heymann, D. L., and G. Rodier. 1997. Re – emerging pathogens and diseases out of control. *Lancet* 349 (Suppl. III) : 8 – 10.
16. Hooper, C. 1998. Poxvirus dilemmas. *N. Engl. J. Med.* 339: 2027.
17. Ivker, R. Human monkeypox hits beleaguered Zaire. *Lancet* 349: 709.
18. Jezek, Z., B. Grab, K. M. Paluku, and M. V. Szczeniowski. 1988. Human monkeypox . Disease pattern, incidence and attack rates in a rural area of northwestern Zaire. *Trop. Geogr. Med.* 40: 73 – 83.
19. Khodakevich, L., Z. Jezek, and D. Messinger. 1988. Monkeypox virus : ecology and public health significance. *Bull. World Health Org.* 66: 747 – 752.
20. Langohr, I. M., G. W. Stevenson, H. L. Thacker, and R. L. Regnery. 2004. Extensive lesions of monkeypox in a prairie dog (*Cynomys* sp.). *Vet. Pathol.* 41 : 702 – 707.
21. LEARNED; L. A., M. G. Reynolds, D. Wasswa Wasswa, Y. Li., V. A. Olson, K. Karem, L. L. Stempora, Z. H. Braden, R. Kline, A. Likos, F. Libama, H. Moudzeo, J. D. Bolanda, P. Tarangonia, P. Boumandoki, P. Formenty, J. M. Harvey, and I. K. Damon. 2005. Extended interhuman transmission of monkeypox in a hospital community in the Republic of the Congo, 2003. 2005. *Am. J. Trop. Med. Hyg.* : 73 ,428 – 434.
22. Likos, A. M., S. A. Sammons, V. A. Olson, A. M. Frace, Y. Li, M. Olsen – Rasmussen, W. Davidson, R. Galloway, M. L. Khristova, M. G. Reynolds, H. Zhao, D. S. Carroll, A- Curns, P. Formenty, J. J. Esposito, R. L. Regnery, and I. K. Damon. 2005. A tale of two clades : monkeypox viruses. *J. Gen. Virol.* 86 : 2661 – 2672.
23. Mahy, B. W., J. W. Almond, K. I. Berns, R. M. Chanock, D. K. Lvov, R. F. Petterson, H. G. Schatzmayr, and F. Fenner. 1993. The remaining stocks of smallpox virus should be destroyed. *Science* 262: 1223 - 1224
24. Marshall, E. 1997. Increase seen in monkeypox cases. *Science* 277: 1027.
25. Meyer, A., J. J. Esposito, F. Gras, T. Kolakowski, M. Fatras, et G. Müller. 1991. Premiere apparition au Gabon de monkey – pox chez l'homme. *Med. Trop.* 51: 53 – 57.
26. Mukinda, B. V. K., G. Mwema, M. Kilundu, D. L. Heymann, A. S. Khan, J. Esposito, et al., 1997. Re-emergence of human monkeypox in Zaire in 1996. *Lancet* 349: 1449 – 1450.
27. Peters, J. L. 1995. Eine "monkex – pox" Enzootie im Affenhaus des Tiergarten "Blijdorp". *Verh. ber. Erkr. Zootiere* 7: 197 – 201.
28. Robinson, A., J., and P. J. Kerr (2001) Poxvirus infections. In : *Infectious Diseases of Wild Animals* ( Williams, and I. K. Baker, eds.) 3 rd edition. Manson Publishing. Iowa State University Press.
29. Sejvar, J. J, Y. Chowdary, M. Schomogyi, S. Stevens, J. Patel, K. Karem, M. Fischer, M. J. Kuehnert, S. R. Zaki, C. D. Paddock, J. Guarner, W. – J. Shieh, J. L. Patton, N. Bernard, Y. Li, V. A. Olson, R. L. Kline, V. N. Loparev, D. D. Schmid, B. Beard, R. R. Regnery, and I. K. Damon. 2004. Human monkexpox infection : A family cluster in the midwestern United States. *J. Infect. Dis.* 190: 1833 – 1840.