

PERSEPECTIVE

NON-HUMAN PRIMATE BITES IN AFRICA: RECOMMENDATIONS ON EVALUATION AND TREATMENT

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ABSTRACT

Non-human primates are one of the closest living animals to humans, often mingling in households and street life. Due to their proximity in many societies globally, bites and subsequently consultations for infectious risks are commonly seen in infectious diseases' clinical practice. An approach to the evaluation and treatment of similar non

INTRODUCTION

A nine year old boy presented 12 hours after a monkey bite to his left calf. The incident happened upon a visit to a holiday resort 120 km south of Addis Ababa whose premises are frequented by baboons who feed on left-over food from visitors. The area is also inhabited by stray dogs and cats as well as different wildlife. On examination, he had a solitary bite wound with puncture sites and superficial laceration. His vaccine records were up to date for his age. He was treated with wound cleansing, antibiotic prophylaxis against super-infection, a series of four Rabies vaccines (Verorab) and Tetanus anti-toxin vaccine. An approach to the evaluation and treatment of similar non-human primate bites is summarized.

Potentially infectious non-human primates

There are more than 500 species of non-human primates (NHPs) in the world. These primates are one of

Species like Macaque and Langur monkeys are common features of urban life in South Asia.

Primates can also be devoured as bush-meat, compounding the routes of exposure to infectious pathogens harbored by these animals (1,2). The epidemiology of the major species of NHPs associated with infectious risks to humans in Africa is mapped below (Figure 1).

Bites from NHPs are one of the commonest routes of dissemination of infectious agents – both when the NHP is the initial host of infection and also when the NHP was secondarily infected from biting another human being. Monkey bites are the second most common form of animal bites in India – next to dog bites (3). Potential hazards range from the mostly asymptomatic ones like foamy virus infections to the life-threatening disorders caused by simian herpes B viruses and Ebola viruses (4).

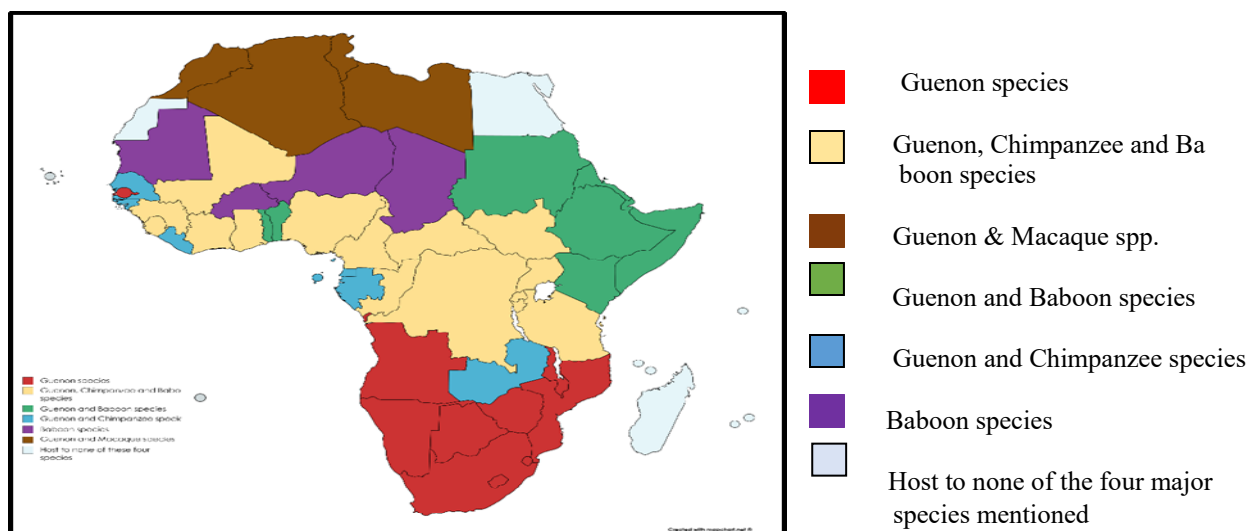


Figure 1: Distributions of major non-human primate species in African countries which are potentially infectious

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Syndromes resulting from non-human primate bites

There are multiple human viral and bacterial infections which can follow NHP bites (Table 1). B viruses or *Cercopithecine herpes* viruses 1 can cause fatal encephalitis in bitten humans while they remain asymptomatic in most of the culprit primates. The main monkeys associated with this infection are Macaque species (Figure 2A). Infections occur after about one month of incubation. Proximity of bite to the central nervous system and the degree of inoculum (mucosal splash, loss of skin integrity, depth of bite) are major determinants of disease (5,6).

Symptoms can be myriad as B virus encephalitis can affect any part of the nervous system. Reports exist of ataxia, sensory and behavioral abnormalities, ascending flaccid paralysis or diplopia being presenting signs. Even if caught, the clinical appearance of the macaque monkey is not helpful in decisions for prophylaxis or treatment (5,7).

Table 1: Notable infectious hazards from bites from major species of NHPs found in Africa

Guenons	Pox viruses, Ebola Aerobes and anaerobes including <i>Neisseria</i> , <i>Streptococci</i> , <i>Staphylococci</i> , <i>Hemophilus parainfluenzae</i> , <i>Moraxhella</i> , <i>Eikenella</i> , <i>Bacteroides</i> , <i>Fusobacterium</i> , <i>Clostridium tetani</i> and <i>Pasteurella multocida</i>
Baboons	Pox viruses Aerobes and anaerobes including <i>Neisseria</i> , <i>Streptococci</i> , <i>Staphylococci</i> , <i>Hemophilus parainfluenzae</i> , <i>Moraxhella</i> , <i>Eikenella</i> , <i>Bacteroides</i> , <i>Fusobacterium</i> , <i>Clostridium tetani</i> and <i>Pasteurella multocida</i>
Macaques	B virus, Pox viruses, Ebola Aerobes and anaerobes (<i>Burkholderia pseudomallei</i> , <i>Staphylococci</i> , <i>Neisseria</i> , <i>Moraxhella</i> , <i>Streptococci</i> , <i>Hemophilus parainfluenzae</i> , <i>Eikenella</i> , <i>Bacteroides</i> , <i>Fusobacterium</i> , <i>Clostridium tetani</i> , <i>Pasteurella multocida</i> etc)
Chimpanzees	<i>Molluscum contagiosum</i> , Pox viruses, Ebola Aerobes and anaerobes (<i>Burkholderia pseudomallei</i> , <i>Staphylococci</i> , <i>Neisseria</i> , <i>Moraxhella</i> , <i>Streptococci</i> , <i>Hemophilus parainfluenzae</i> , <i>Eikenella</i> , <i>Bacteroides</i> , <i>Fusobacterium</i> , <i>Clostridium tetani</i> , <i>Pasteurella multocida</i> etc)

Key: SIV – Simian immunodeficiency virus

(Table modified from National Research Council (US) Committee on Occupational Health and Safety in the Care and Use of Nonhuman Primates. National Academies Press (US); 2003) (4)

Bites and other forms of exposure (droplet, contact) from different species of NHPs including Guenons, Chimpanzees and Macaques (Figures 2 A – C) have been reported to be sources of Ebola and Marburg infections in humans (4,8,9). Marburg infections present after a 1 – 2 weeks incubation while symptoms may appear as late as three weeks after exposure in Ebola viral hemorrhagic disease.

Patients may present with fever, headache, myalgia and abdominal pain which may then be followed by vomiting, diarrhea, petechial rash over face and trunk and conjunctivitis. Children may develop cough or fast breathing too.

Molluscum contagiosum, a disorder thought to be exclusive to humans, has been documented in chimpanzees and can be transmitted via close contact (4).

Monkey pox is a related infection which presents with similar skin lesions but uniquely having hemorrhagic necrosis at bite sites. Symptoms are preceded by a prodrome of fever, headache, and sweats and involving prominent lymphadenopathy (10).

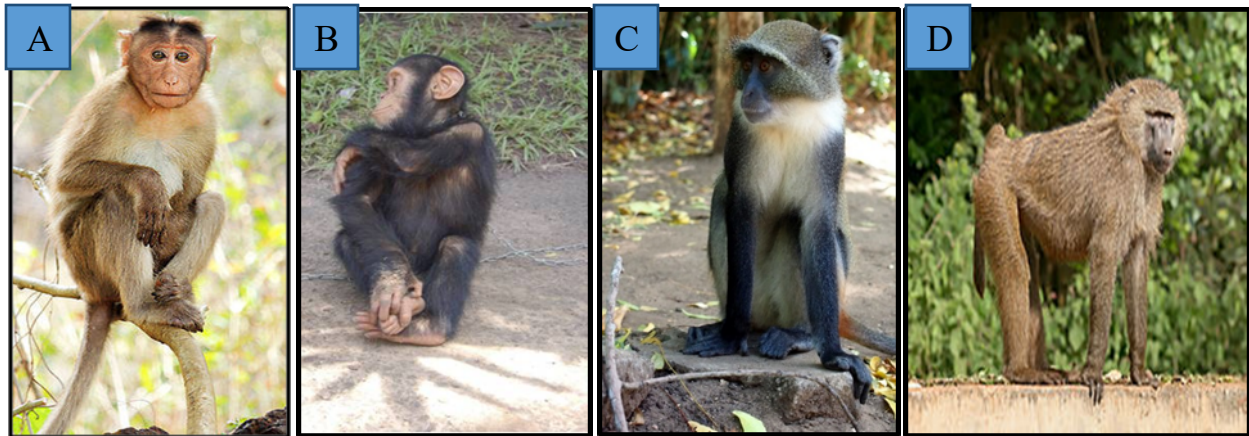


Figure 2A:
Macaque monkey

Figure 2B:
Chimpanzee

Figure 2C: Sykes' monkey – a type of Guenon monkey (Genus: *Cercopithecus*)

Figure 2D: Olive baboon

Rabies following NHP bites is rarely reported with only 25 cases reported over a period of five decades (1960 – 2013) (11). But Monkeys have been demonstrated to carry the virus in Rabies-endemic countries (figure 3) (12,13).

Evaluation and management

The assessment of a victim of a non-human primate bite includes:

- Reviewing past medical history to assess need for immunoprophylaxis against Tetanus (age of patient, vaccination history etc) (11).
- Assessing need for immunoprophylaxis against Rabies (reviewing the distribution of domestic and wild animals around the area of the incident, understanding whether the bite was provoked or not etc) (figure 3) (12).
- Showing pictures of common primates of infectious risk to humans may help identify species of particular risk – Example: Macaques in relation to simian herpes risk.

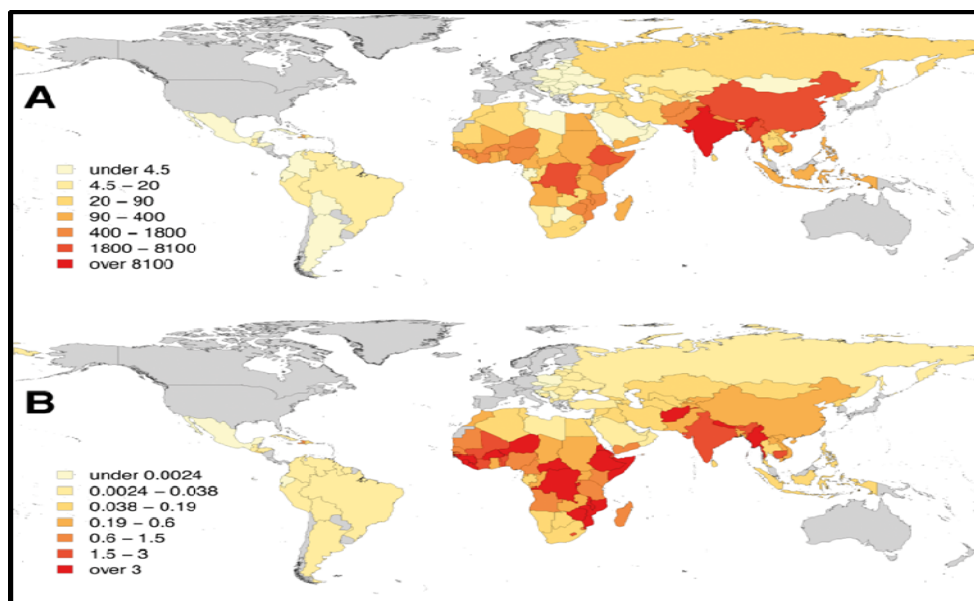


Figure 3: Global burden of dog-transmitted human rabies (14) A) Human rabies deaths and B)

Cultures for both aerobic and anaerobic bacteria should be taken followed by copious irrigation of wound with soap or detergent (skin) or with saline or water (mucosa) for 15 minutes or more.

Antibiotic prophylaxis is recommended for NHP bites which are contaminated, puncture wounds and involving the hands. Amoxicillin-Clavulanate for 3 – 5 days is the preferred option. In Penicillin allergic patients, a combination of Cotrimoxazole and Clindamycin or a 3rd generation Cephalosporin with Clindamycin can be used (4,11,12).

Antiviral treatment against B viruses (risky encounters reported from a few countries in the north of Africa so far, though more cases reported from south Asia) is successful if started before neurologic symptoms appear. Intravenous Acyclovir (when neurologic symptoms are absent) or Ganciclovir (when neurologic symptoms are present) both till symptoms resolve are appropriate therapeutic options. Without therapy, mortality rates in humans exceed 70%. Post-exposure prophylaxis can be given by oral Acyclovir five times per day for 14 days (7).

REFERENCES

1. Estrada A, Garber PA, Mittermeier RA, Wich S, Gouveia S, Dobrovolski R et al. Primates in peril: the significance of Brazil, Madagascar, Indonesia and the Democratic Republic of the Congo for global primate conservation. *PeerJ* 2018, 6:e4869 <https://doi.org/10.7717/peerj.4869>
2. Jones-Engel L, May CC, Engel GA, Steinkraus KA, Schillaci MA, Fuentes A et al. Diverse contexts of zoonotic transmission of simian foamy viruses in Asia. *Emerg Infect dis* 2008, 14 – 8, 1200 – 8. doi: 10.3201/eid1408.0711430
3. *World Health Organization*. Animal bites Fact sheet. *February 2013*.
4. National Research Council (US) Committee on Occupational Health and Safety in the Care and Use of Nonhuman Primates. Occupational Health and Safety in the Care and Use of Nonhuman Primates. *National Academies Press* (US); 2003. 3, Identifying Infectious Hazards Associated with the Use of Nonhuman Primates in Research. <https://www.ncbi.nlm.nih.gov/books/NBK43452/>
5. Huff JL, Barry PA. B-virus (*Cercopithecine herpes* viruses 1) infection in humans and macaques: potential for zoonotic disease. *Emerg Infect Dis* 2003, 9 (2), 246 – 250
6. Barkati S, Taher HB, Beauchamp E, Yansouni CP, Ward BJ, Libman MD. Decision Tool for Herpes B Virus Antiviral Prophylaxis after Macaque-Related Injuries in Research Laboratory Workers. *Emerg Infect Dis* 2019, 25(9), e190045. <https://doi.org/10.3201/eid2509.190045>
7. Cohen JI, Davenport DS, Stewart JA, Deitchman S, Hilliard JK, Chapman LE et al. Recommendations for the prevention of and therapy for exposure to B virus (*Cercopithecine herpes* viruses 1). *Clin Infect Dis* 2002, 35: 1191 - 203
8. Brown DWG. Threat to humans from virus infections of non-human primates. *Rev. Med. Virol.* 1997, 7:239-246.
9. Formenty P, Boesch C, Wyers M et al. Ebola virus outbreak among wild chimpanzees living in a rain forest of Cote d'Ivoire. *J. Infect. Dis.* 1999, 179(Suppl 1):S120-126
10. Reed KD, Melski JW, Graham MG et al. The detection of monkey pox in humans in the Western hemisphere. *N Engl J Med* 2004;350:342-50.
11. Red book: 2018 report of the committee on infectious diseases, 31st edition. American Academy of Pediatrics.
12. Riesland NJ, Wilde H. Expert review of evidence bases for managing monkey bites in travelers. *Journal of Travel Medicine* 2015; 22, 259 – 262. <https://doi.org/10.1111/jtm/12214>
13. Bharti OK. Human rabies in monkey (*Macaca mulatta*) bite patients a reality in India now! *Journal of Travel Medicine* 2016; 23 (4). taw028, <https://doi.org/10.1093/jtm/taw028>
14. Hampson K, Coudeville L, Lembo T et al. Estimating the Global Burden of Endemic Canine Rabies. *PLOS Neglected Tropical Diseases* 2015; 9(5):e0003786.
15. <https://doi.org/10.1371/journal.pntd.0003786>