Risks and Management of SIV in De Brazza Guenon *(Cercopithecus neglectus)*

NB: This paper is produced specifically for SIV in De Brazza Monkeys. There are significant species differences and therefore the recommendations and information contained within should NOT be used for other species. This is particularly important for L'Hoests Monkey and Mandril which have their own SIV with significant differences to SIV in De Brazzas.

A. Background

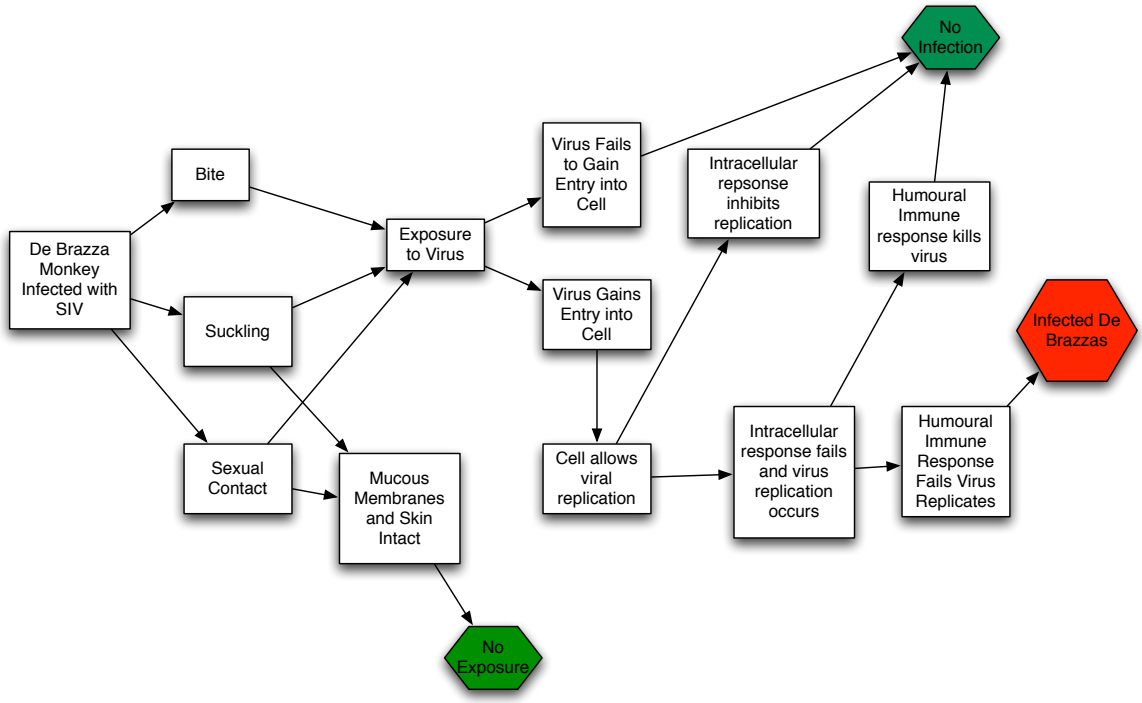
Simian Immunodeficiency Viruses (SIV) are primate lentiviruses which infect a wide variety of non-human primates species in sub-Saharan Africa. The evolution of the lentiviruses is very complex but there is some evidence to suggest that the virus are ancient and co-evolved with specific species. The virus that naturally infects the specific species does not cause clinical disease causing lifelong but unapparent infection. However there is significant evidence of multiple cross species infections. In African primates these rarely cause clinical disease but in Asian primates clinical disease characterized by immunosuppression, meningioencephalitis, lymphoproliferative disease.

B. Managing SIV in Debrazza Guenons

The De Brazza is naturally infected with its own SIV virus SIV_{deb} which is very distinct from other guenon SIV viruses (Bibollet-Ruche et al, 2004). It is non-pathogenic to De Brazzas. Research suggests that up to 30% of this species are infected in the wild (Peeters et al, 2002). It is therefore quite possible that a similar number are infected in captive populations.

The virus is primarily transmitted horizontally through bite wounds and less commonly through sexual contact and breast milk. Indeed the virus can rarely be isolated from semen, cervical secretions and breast milk (CDC,1988). This does vary between species with research suggesting that SIV in sooty mangabey's is definitely spread sexually and that SIV in Mandrils is transmitted in breast milk more commonly that in other species.

The risk scenario tree – the pathway of transmission between an infected De Brazza and an uninfected animal is shown in figure 1.



This raises a number of issues for captive management.

Recommendations for the EEP ;

1. There is NO justification for euthanasia of De Brazza monkeys testing positive for SIV – this should be a direct instruction for all participants.
2. All Debrazzas should be tested for SIV prior to being moved and introduced to new animals.
3. When a movement recommendation has been made and an animal that tests positive is due to join a new group the receiving zoo should test their animals. If their animals are also positive then the move should continue.
4. When ever possible zoos should routinely screen for SIV so a known status for each animal is obtained.
5. Due to the difficulty in breeding this species – stable family groups do NOT need to be broken up if one of the animals tests positive. This positive result has no implications for the health of the group and indeed, an increased risk of SIV transmission will be caused by disrupting the group and increasing the likelihood of fighting.
6. It should not be assumed that offspring of positive parents will be positive – they should be tested for confirmation.
7. Only in view of acceptance for some participants – if new groups are being established every effort should be made to pair animals of the same status.

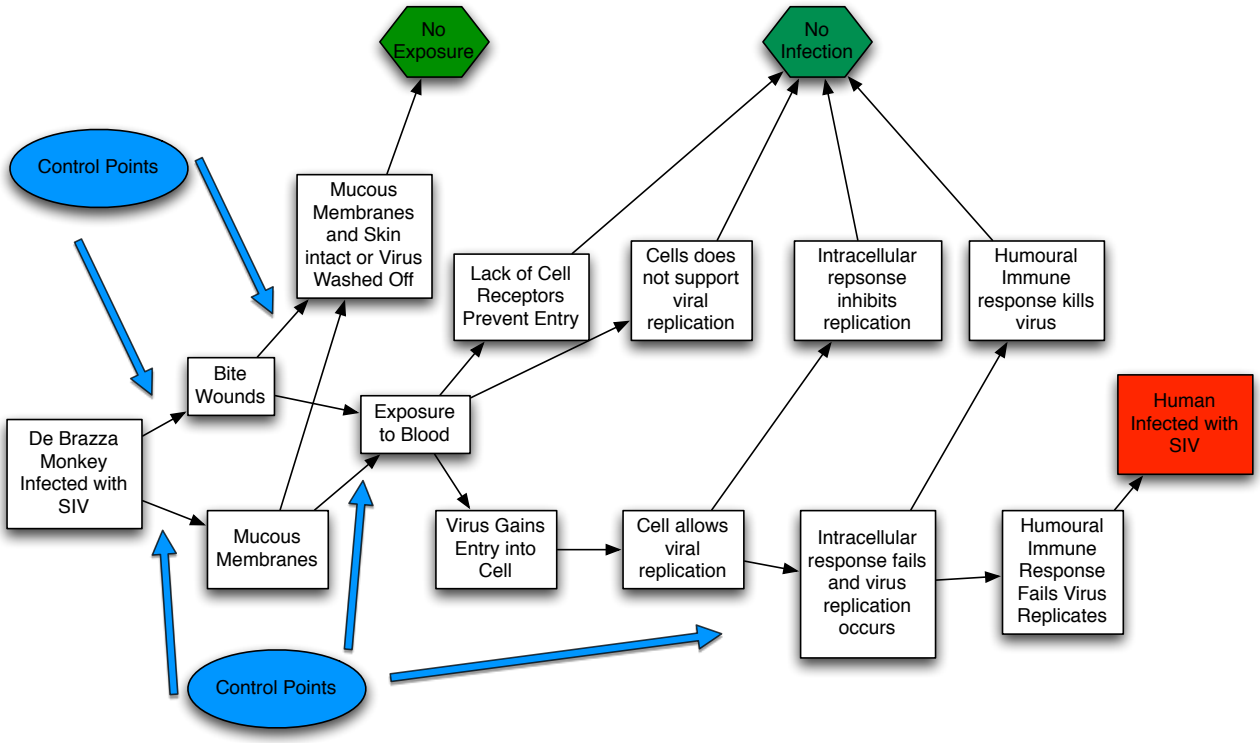
Recommendations for managing an SIV positive De Brazza Monkey Group are:

1. Due to the low but possible risk of cross infection SIV positive animals should not be housed in a mixed exhibit with other primates and should not have direct contact with other primates. (these animals pose no risk to other animals).

2. The greatest risk of SIV transmission is through biting – stable family groups are at a lower risk. The group should be managed to encourage this.
3. It must not be presumed that all animals in a group are SIV positive – each animal should be tested individually. It is possible that offspring are negative and can be moved to a new group following EEP recommendations.
4. It is equally possible that one animal in a pair is negative the status of this animals should be monitored to detect seroconversion on an annual basis.
5. If one animal tests positive for SIV the whole group should be tested. If only a single animal is positive then this animal could be potentially rehomed to a known positive group but this needs to be balanced against risks of aggression and fighting.

C. Human Risks Associated with SIV in Debrazza Guenon

Transmission Pathway from SIV Infected De Brazza to a Human



Can SIV Infect Humans ?

Cross species infection from the natural host to other species can occur and can result in pathological disease. Cross species transmission of the specific Chimpanzee and Sooty Mangabeys to humans has been linked to the origin of the HIV-1 and HIV-2 virus respectively. It is thought that the SIVs entered human cells, underwent genetic changes, which then allowed human to human transmission. This is supported by the fact that humans in Africa have been exposed for centuries to SIVs and yet the HIV epidemic has only apparently emerged in the second half of the last century, which suggests that some other

factor influenced the virus. This suggests that viral cross –species transmission is in itself not the only factor required for development of pathological disease.

Despite the large exposure of humans to SIV-infected primates in central and west Africa, through consumption of bushmeat, extensive molecular epidemiological studies have shown only 10 cross-species transmission events during the last century only four of these resulted in epidemic transmission.

Experimental cross species infection of SIVs in different species of primates has shown that in many cases the virus is harmless or cleared by the new hosts immune system

Can SIV_{deb} Infect Humans ?

There are over 40 SIV species specific virus and only those from chimpanzees SIV_{cpz} and sooty managabeys SIV_{sm} have been shown to be associated with HIV. Indeed SIV_{deb} is one of the most genetically distinct viruses and is not similar to these two SIV viruses.

The general experimental approach to determine this is to try and grow virus in human cells (human peripheral blood mononuclear cells, PBMCs) *in vitro.* Although many SIV virus have been shown to grow in PBMCs most of the cercopithecine SIV virus do NOT grow in human PBMCs (References)

None of the cercopithecine SIV viruses have been identified in humans (Apetrei et al, 2004).

What route would SIV_{deb} be transmitted to humans by ?

A study of people with occupational exposure to primates was conducted by the USA CDC. 3,000 samples from people potentially exposed to SIV were tested only two demonstrated antibodies cross reactive to SIV, a prevalence of less than 1%. One of these people handled known (experimentally) SIV infected material without gloves whilst having an severe dermatitis of the hands and forearms. The second person had suffered from a needle stick injury whilst handling known experimentally infected blood.

Both of these people had virtually undetectable levels of virus and this explains the lack of AIDS like symptoms as a high circulating viral load is required for disease and transmission in HIV infected humans.

Evidence of SIV infection in zoo keepers has not been reported (Switzer et al, 2004).

Epidemiologic surveys of 1800 persons from nine villages in Cameroon suggested very high (>60%) exposure to primate blood and body fluids and demonstrated that 1% of exposed individuals were seropositive for SIV of three different nonhuman primate origins (Wolfe et al., 2004). Despite the fact that these events clearly demonstrate that human-primate contact occurs commonly, and can result in primate to human retroviral transmissions, human exposure to SIVs resulting in patent infections has been extremely rare. Therefore, exposure of humans to SIVs does not *a priori* result in successful cross-species infection.

Seropositivity merely demonstrates exposure to SIV and a subsequent immune reaction. It does not demonstrate infection.

Managing Risk of Infection to Humans:

The above evidence suggests that routine precautionary measures should be implemented for working with known SIV infected animals.

- The risk of transmission from urine and faeces is negligible.
- SIV virus is susceptible to household bleach and disinfectants, which should be used routinely for general cleansing.
- Blood is the main risk to humans. SIV positive De Brazzas should not be handled when conscious to avoid biting injuries and should not be netted but should be darted or a crush cage and then anaesthetic should be used.
- As with all primates – latex gloves should be used when handing De Brazza Monkeys
- During blood collection or other invasive procedures on SIV positive animals goggles and face masks should be worn to prevent mucous membrane contamination.
- Should humans be bitten or have mucous membranes contaminated by SIV infected primate bodily fluids the area should be immediately washed with Chlorhexidine. Post Exposure Prophylaxis with anti-retroviral drugs may be indicated (Weston Murphy et al, 2006).

Risk Assessment:

Stage in Risk Pathway	Bite Wound or MM Exposure	Virus Infects Cell	Virus replicates in Cell	Virus causes active disease in human
Mitigating Action	Handling Precautions, Gloves, Goggles, Face Mask, Washing,	Post Exposure Prophylaxis	Cells do not have correct receptors or cellular function to allow virus to replicate	None
Further Evidence		In both occupational at risk workers and bush meat hunters seroprevalence was less than 1%. Infection in Zoo keepers has not been reported.	Cercopithecine virus do not replicate in human PMBCs.	Despite regular and widespread exposure cross for centuries only 10 incidences of cross- species infection have been identified and only 4 of these have resulted in human disease.
Risk	Low	Very Low	Negligible	Very Low
Uncertainty	Low	Medium	Low	Medium

Overall Risk Assessment = Very Low
Uncertainty = Medium to Low.

D. References:

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