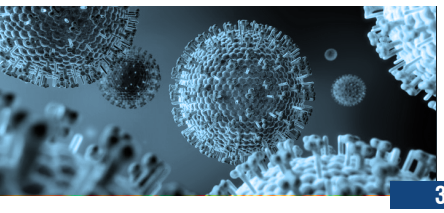
charles river



360 DIAGNOSTICS

Infectious Agent Sheet:

Simian Immunodeficiency Virus (SIV)

Classification
Single-stranded, positive-sense RNA virus

Nomenclature
Family: *Retroviridae*

Affected Species
Nonhuman primates (NHPs), including monkeys, chimpanzees, and gorillas

Frequency

SIV persists in 45 different species of nonhuman primates (NHPs), though it's not prevalent in SPF NHP colonies. SIV is closely related to human immunodeficiency virus types 1 and 2 (HIV-1 and HIV-2), the etiologic agents of acquired immunodeficiency syndrome (AIDS).[1] In fact, SIV in chimpanzees (SIVcpz) and sooty mangabeys are now confirmed to be the origin of the two human immunodeficiency viruses – HIV-1 and HIV-2. A very high percentage of AGMs in their natural environment are infected with SIV. Females (78-90%) have a higher infection rate compared to males (36-57%), but rarely develop the disease.[2]

In the 1980s, researchers were able infect Asian macaques with SIV, resulting in a disease that recapitulates many features of AIDS. Although there were subtle differences between HIV-1 and SIV (SIV resembles HIV-2 more than HIV-1), the many similarities in virus, host, and disease pathogenesis and the availability of many cross-reactive laboratory reagents to monitor immunological markers have made macaques the most relevant NHP model in HIV research.[3]

Transmission

SIV has been present in monkeys and apes for at least 32,000 years,[4] with horizontal and vertical transmission primarily taking place through sexual contact and biting.[5] SIV infection of NHPs invariably results in persistent infection, but rarely acute disease. Non-pathogenic infection is typified by African NHPs naturally infected with SIV. Information related to SIV pathogenic properties and transmission routes in natural hosts is limited.

Clinical Signs and Lesions

SIV-infected chimpanzees can die with simian AIDS-like symptoms. However, bonobos seem to avoid SIV infection and related symptoms. SIV infections in these African NHPs is non-pathogenic possibly due to evolutionary adaptation of the hosts to the virus. In sooty mangabeys with high levels of circulating virus (SIVsmm), no disease is observed in their natural environment. On the other hand, if the same virus infects non-African NHPs (e.g., Indian rhesus), they will develop simian AIDS.[6] Disease progression to AIDS is slow and may take months or years depending upon the SIV strain used. It's believed that AIDS-like disease in African NHPs represents horizontal transmission of the virus from one or more homologous species in the recent evolutionary past, before equilibrium of co-adaptation has occurred.[7] Fertility is significantly reduced in SIV-positive females, both in terms of their birth rate and the survival of the offspring. Both HIV-1 and SIVmac infections cause loss of CD4+ T cells at mucosal sites as the disease progresses.

Diagnosis

Both SIV serology and PCR testing is available for NHPs exposed to infected macaques. Serum, plasma, or whole blood may be used for serology utilizing whole virus lysate (mac253) and recombinant full length or truncated glycoprotein to detect SIV antibodies. Indirect immunofluorescence antibody (IFA) and western blot (WB) immunodetection are two suitable confirmatory antibody-based test methods.[8] Virus culture and nucleic acid amplification can be used for diagnoses, but the former is time consuming and needs the correct sample type at the time of collection. PCR utilizing whole blood is a better alternate.

Interference with Research

HIV, as well as SIV, primarily infect activated CD4+ T cells and macrophages, thus effecting related research. Cell lines of NHP origin should be screened by PCR to check for SIV infection. Routine screening of SPF colonies by serology and PCR is recommended, especially prior to beginning a SIV study. SHIV, a virus combining parts of the HIV and SIV genomes, is also used for studying how different parts of the virus respond to different antimicrobial drugs and vaccines. SIV-positive, SIV-challenged, and SIV-vaccinated rhesus macaques should be sequestered from the general SPF macaque population.[8] Similarly, animals enrolled in non-SIV studies should be housed in facilities away from SIV-positive animals to effectively prevent SIV transmission.

Prevention and Treatment

Macaque caretakers, veterinarians, and researchers should wear PPE to avoid accidental exposure due to potential splash of body fluids from infected macaques. Research involving animals and SIV cultures should be conducted under BSL-2 levels and in biological safety cabinets.[1] Inoculation of SIV-containing material represents a potential route of exposure to SIV in humans, so extra care must be taken when its necessary to use needles.

SIV causes persistent lifelong infection in NHPs for which no treatments are known. Breeding colonies of SIV-infected, African-origin NHPs should be segregated from SIV-negative colonies, and strict husbandry procedures should be followed to segregate Asian-origin animals from African-origin animals. These procedures include separate housing, veterinary treatment, and equipment and facilities to strictly limit the potential for cross-species infections to occur.[8] No effective prophylactic treatment for SIV exists.

Although aerosol transmission of SIV has not been demonstrated, a biosafety cabinet for work is recommended. Similar to HIV, commercially available chemical disinfectants, such as sodium hypochlorite solution 10% (1 to 10 dilution of household beach), ethanol 70%-85%, or ethanol-iodine complex 2%, should be used for decontamination.[1]

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