Shedding of feline immunodeficiency virus in semen of domestic cats during acute infection

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Objective—To examine shedding of cell-free and cell-associated feline immunodeficiency virus (FIV) in semen of domestic cats during acute infection.

Animals—7 specific-pathogen-free sexually intact male cats.

Procedure—6 cats were inoculated IV with 5×10^6 50% tissue culture infective doses of FIV-$NCSU_1$, and 1 cat served as an uninfected (control) cat. Infection was confirmed in the 6 cats. Periodically for up to 16 weeks after inoculation, cats were anesthetized and ejaculates obtained by use of electroejaculation. Virus was isolated from filtered seminal plasma and washed seminal cells by co-cultivation with a feline $CD4^+$ T-cell line. Seminal cell lysates were also examined for a 582-base pair segment of FIV *gag* provirus DNA, using a nested polymerase chain reaction amplification.

Results—During the acute phase of FIV infection, virus was evident in semen of 5 inoculated cats. Five cats had virus-positive seminal plasma and 3 had virus-positive cellular constituents during the study. Virus was isolated from 8/22 (36%) seminal plasma samples and 2/17 (18%) seminal cell specimens. Provirus DNA was detected in 5/24 (21%) seminal cell lysates. Cell-free virus was isolated as early as 6 weeks after inoculation, whereas cell-associated virus was isolated as early as 12 weeks after inoculation. Provirus DNA was detected in seminal cells from one cat as early as 1 week after inoculation.

Conclusions and Clinical Relevance—Cell-free and cell-associated FIV are shed in semen of cats early during the course of infection. Samples obtained before seroconversion may contain virus. Virus shedding in ejaculates varies between and within cats during acute infection. (*Am J Vet Res* 1999;60:211–215.)

Heterosexual contact currently accounts for most newly acquired **human immunodeficiency virus** type 1 (HIV-1) infections globally.[1] Infectivity of seropositive sexual partners is influenced by factors such as concurrent reproductive tract infections, method of contraception, antiviral treatment, and stage of HIV-1 infection.[2] Epidemiologic studies indicate that late-stage disease and primary (acute) disease appear to enhance the likelihood of venereal transmission.[3] However, characterization of HIV-1 transmission early in the course of infection is hampered by a lack of controlled studies. Such studies have been difficult to accomplish in infected human populations, because the disease is diagnosed in most people only after they seroconvert. **Feline immunodeficiency virus (FIV)** is detectable in semen from chronically infected cats[4] and can be readily transmitted to queens during intrauterine insemination,[5] indicating that this model may be a useful alternative for examining the effect of stage of disease on venereal dissemination of lentiviruses.

Similar to HIV-1, FIV infection in random-source cats is characterized by 3 successive stages: an acute phase with high viremia in the plasma, a prolonged stage of clinical latency with low concentrations of circulating virus, and a terminal disease stage with **acquired immune deficiency syndrome (AIDS)**-like manifestations.[6-8] During primary infection, FIV is disseminated widely throughout the body and can be detected in body fluids, such as saliva,[9-10] colostrum, and milk,[10-11] and in vaginal secretions.[10,12] To further characterize virus shedding in the male reproductive tract and to investigate whether FIV could potentially be sexually transmitted during an acute infection, we examined ejaculates obtained from cats during the first 16 weeks after inoculation.

Material and Methods

Cats and virus infection—Seven specific-pathogen-free sexually intact male domestic cats that were 7 to 13 months old were obtained from commercial vendors.[a,b] Cats were housed at the College of Veterinary Medicine, North Carolina State University. Prior to inoculation, cats were seronegative for FIV antibody and FeLV antigen, as determined by use of an ELISA.[c]

The FIV-$NCSU_1$ isolate has been characterized elsewhere.[13] Six cats were inoculated IV with 5×10^6 50% tissue culture infective doses of cell-free FIV-$NCSU_1$, and 1 cat served as an uninfected (control) cat. This inoculum was obtained from a culture supernatant of infected FCD4E cells, an interleukin-2 dependent feline $CD4^+$ T-lymphocyte cell line that is highly susceptible to FIV infection.[13] Cats were observed daily for signs of illness. During the 4-month period after inoculation, blood samples were periodically obtained from a jugular vein into citrate-containing tubes for use in confirmation of infection, as determined by use of an ELISA to detect plasma anti-FIV antibodies and by means of **polymerase chain reaction (PCR)** amplification of FIV *gag* provirus DNA sequences in circulating leukocytes.[13-14] To indicate progression of primary infection, changes in periph-

Received for publication Jan 16, 1998.
Accepted May 18, 1998.
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Supported in part by Public Health Services grant No. 7 K01 RR00109-02.
The authors thank Deborah Anderson, Nancy Bold-Fletcher, and Stephanie James for technical assistance.