

Examination of liver sections only showed minimal portal infiltration by lymphocytes and macrophages. Other organs including spleen were normal. Immunohistochemistry performed on paraffin-embedded tissue sections using a rabbit antibody directed against glycoproteins of HSV-1 and HSV-2 envelope (DAKO, Glostrup, Denmark) demonstrated strong positive staining in brain neuronal cells, in lips, and tongue epithelial cells as well as in mononuclear cells of pulmonary infiltrates. The presence of intranuclear inclusions in epithelial and neuronal cells and the positivity of immunohistochemistry with anti-HSV antibody were highly suggestive of disseminated herpesvirus infection.

Deoxyribonucleic acid (DNA) was extracted from cryopreserved tissue samples collected at necropsy from animal No. 4 using proteinase K digestion, phenol-chloroform extraction, and ethanol precipitation. Nested-polymerase chain reaction (PCR) analysis with primers targeted to the highly conserved DNA polymerase sequence of herpesvirus was performed according to a previously published method.⁴ Water and PCR mix were used as negative controls and DNA from Epstein-Barr virus-infected BC-1 cells as positive control. A fragment of the predicted size (236 base pairs ; bp) was amplified in specimens collected from brain, tongue, muscle, and skin. The same fragment was also detected in samples from gut, lung, and liver, although with a weaker signal. Nucleotide sequence analysis of this 236-bp fragment showed a 100% sequence identity with the DNA polymerase gene of HSV-1.

In humans, the clinical course of HSV-1 infection is usually benign, although severe or disseminated forms can occur in neonates and immunocompromised hosts. High susceptibility of nonhuman primates to human HSV has been established in several case reports. Localized benign HSV infections have been reported in chimpanzees, whereas systemic infections with fatal outcome have been described in gorillas, white-handed gibbons, white-faced saki monkeys, owl monkeys, and common marmosets.^{1-3,5-10} Severe gingivostomatitis, characterized by vesicular and ulcerative mucocutaneous lesions, and meningoencephalitis are the most prominent symptoms. Disseminated infections with necrotic lesions of digestive tract, lungs, liver, and adrenal glands have also been reported.^{1,7,9} Histologic findings consisted of necrosis, inflammatory infiltrates, and intranuclear inclusions. Antibodies used for immunohistochemistry might cross-react with several α -herpesviruses from both human and non-human primates and thus fail to discriminate between HSV-1 and HSV-2. In our cases, molecular analysis on the basis of PCR and sequencing provided the evidence for HSV-1 infection in the affected tissues and excluded the involvement of other herpesviruses of animal origin. Negative results of serologic analysis in two animals of our colony might be explained by short delays between the onset of symptoms and the collection of sera. Such negative serologic results have been reported previously.^{9,10}

To our knowledge, HSV-1 infection has never been reported previously in *C. geoffroyi*. However, the origin of HSV-1 infection was unknown. The first step might be the contamination of one animal by a HSV-1-infected human either through indirect contact with a park visitor (probably through food) or through closer contact especially with an-

imal handlers. Rapid spreading of HSV-1 through the colony strongly suggested a subsequent animal-to-animal transmission that might be facilitated by the high susceptibility of monkeys to HSV-1 and the presence of virus in mucosal secretions of infected animals. The high mortality rate of such infections is a solid argument to justify prophylactic strategies. The simplest one would consist of recommending to strictly avoiding contact of captive marmosets with HSV-1-infected humans.

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