Reprinted from the JOURNAL OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION, Vol. 189, No. 9, Pages 1197-1199

Feline leukemia virus infection in a captive cheetah and the clinical and antibody response of six captive cheetahs to vaccination with a subunit feline leukemia virus vaccine

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IN 1982 AND 1983, feline infectious peritonitis (FIP) was diagnosed in a group of 35 cheetahs in a 6.1-ha fenced enclosure at Wildlife Safari in Winston, Ore.[1,2] On Aug 10, 1984 (day 1), one of the 21 remaining cheetahs in this group, a 3.5-year-old female cheetah (No. 1), was reported by a keeper to be depressed and anorectic. Initial examination indicated that the nictitating membranes of the cheetah were protruded and that the cheetah appeared to be underweight and dehydrated. Parasite ova were not found on a fecal flotation examination. The following day (day 2), the cheetah was anesthetized with a combination of ketamine HCl (300 mg) and xylazine (10 mg) administered IM via a blowdart. Examination indicated that the cheetah had a normal rectal temperature (39 C), pulse rate (100/min), and respiratory rate (16/min) and weighed 32 kg, which was considered to be 8 kg underweight. The cheetah was estimated to be 5% dehydrated, on the basis of skin elasticity, as compared with that of healthy cheetahs.

Urinalysis did not indicate abnormalities. Blood analyses indicated a WBC count of 15,000 cells/μl, with a differential count of 80% segmented neutrophils, 19% lymphocytes, and 1% monocytes. Erythrocyte indices indicated that the cheetah had large erythrocytes (mean corpuscular volume, 74 fl [normal = 39 to 55 fl]), but normal hemoglobin content (mean corpuscular hemoglobin content, 30.3%). The PCV (45.1%) and the plasma protein concentration (9.2 g/dl) were high, probably because of the cheetah's dehydration. Moderate anisocytosis and polychromasia were found on blood smears. Serum samples were weakly positive for feline coronavirus antibody (titer = 1:25; indirect immunofluorescent antibody test)[3,a] and were positive for feline leukemia virus (FeLV) antigen (enzyme-linked immunosorbent assay [ELISA]).[b,c]

The cheetah was given lactated Ringer's solution (500 ml) IV and multi-B complex vitamins[d] (2 ml) IM daily for one week. Because tapeworms had been a problem in the group of cheetahs, the cheetah was given praziquantel[e] (2.6 ml) once SC. Because of the positive FeLV test, the cheetah was isolated from the remainder of the group. Amoxicillin (500 mg, orally) was given once daily for 14 days. Because corticosteroids may be beneficial in the treatment of some myeloproliferative disorders associated with FeLV infections,[4,5] the cheetah was given prednisolone orally (50 mg daily for one week, 50 mg every third day for 2 weeks, and 25 mg every third day for 2 weeks). During this 5-week period of prednisolone treatment, the cheetah's appetite returned to normal.

At the end of the 5-week treatment period, the cheetah was anesthetized and examined, weighed 40 kg, and appeared to be normally hydrated. Although the BUN concentration was high (81 mg/dl) and the leukocytosis persisted (22,000 cells/μl), the other blood values were normal, as compared with those of healthy cheetahs in the group. The serum remained slightly positive for FeLV antigen; therefore, the cheetah remained in isolation. The FeLV tests were repeated monthly thereafter. The next 3 FeLV tests were negative for FeLV antigen; therefore, the cheetah was returned to the group. Recurrence of illness did not develop (20 months).

Feline leukemia virus infection was diagnosed on the basis of positive FeLV tests, the nonspecific clinical signs, and retrospective serologic findings in the other cheetahs in the group. Two other cheetahs in the group (cheetahs 2 and 3) had been positive for FeLV antigen by ELISA 1 to 3 months before the development of illness in cheetah 1, and 2 other cheetahs (No. 4 and 8) had suspicious reactions for FeLV antigen by ELISA. Cheetahs 2, 3, 4, and 8 did not develop clinical signs of illness and were negative for FeLV antigen on subsequent ELISA before the occurrence of the problems observed in cheetah 1. Although not conclusive, detection of FeLV antigen in cheetahs 2 and 3, and possibly in cheetahs 4 and 8, indicated that several cheetahs in the group associated with cheetah 1 may have been exposed previously to FeLV. The previous diagnosis of FIP in cheetahs of this group[1,2] also was suggestive of a possible FeLV infection among cheetahs in this preserve.[6-8]

Evaluation of cheetahs vaccinated with a subunit FeLV vaccine—seventeen of the 21 cheetahs (No. 3 through 19) were anesthesized with a combination of ketamine HCl (7 mg/kg of body weight) and xylazine (5 mg/animal) administered IM. Blood (20 ml) was collected from each cheetah into clot tubes. Serum samples (1 ml/cheetah) were evaluated for FeLV anti-

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The authors thank Dr. Richard Sharpee for conducting the antibody studies and Norden Laboratories, Lincoln, Neb, for supplying the vaccine used.

[a]Washington Animal Disease Diagnostic Laboratory, Pullman, Wash.

[b]Parkway Animal Hospital, Roseburg, Ore.

[c]Leukassay F, Pitman-Moore Inc, Washington Crossing, NJ.

[d]Combiplex-B, Tech American Group Inc, Elwood, Kan.

[e]Droncit Injectable, Bayvet Corp, Division of Miles Laboratories, Shawnee Mission, Kan.

gen by use of ELISA. The remaining serum was frozen (−70 C) for future evaluations. The 17 cheetahs were negative for FeLV antigen. Blood was not collected from the affected cheetah (No. 1) at this time, nor was blood collected from 3 cheetahs that were isolated from this group.

The 17 FeLV-negative cheetahs were each given 2 ml of a subunit feline leukemia vaccine[f] IM. A second 2-ml dose was administered 2 to 3 weeks after the first vaccination. Fifteen of the 17 cheetahs were given a third 2-ml dose 2 months after the second dose. Before receiving the third dose of vaccine, one cheetah (No. 4) died of renal failure that was not associated with vaccination, and another cheetah (No. 18) that had been on loan was returned to the owner.

Adverse reactions to the vaccine were minimal. After the first dose of vaccine, 2 cheetahs (No. 5 and 11) developed mild to moderate facial swelling in the areas surrounding the mandibular lymph nodes; these reactions were not severe enough to restrict respiration or ingestion of food or water. After the second dose of vaccine, 2 other cheetahs (No. 6 and 12) developed similar facial swelling around the mandibular lymph nodes. Another cheetah (No. 4) became moderately depressed for 3 to 4 days after the second vaccination. Adverse reactions did not develop in the 15 remaining cheetahs after the third dose of vaccine. Although injection sites were not palpated, swelling or erythema was not seen nor was lameness evident.

Approximately 3 weeks after the third vaccination, 6 of the 15 vaccinated cheetahs (No. 5 through 10) were selected randomly and anesthetized with ketamine HCl and xylazine. Blood was collected, and the serum samples were frozen (−70 C) until determination of antibody titers against feline oncornavirus cell membrane antigen (FOCMA), using an immunofluorescent procedure with FL74 lymphoblastoid cells as the target,[g] and until determination of antibodies against FeLV envelope antigen (gp70), using an ELISA.[g] Compared with prevaccination titers, titers against FOCMA and gp70 markedly increased after vaccination (Table 1). Prevaccination titers against FOCMA were 1:2 to 1:4 (titers of <1:8 are considered negative), whereas postvaccination titers were 1:16 to 1:256. Prevaccination titers against gp70 were 0.037 to 0.067 optic density (OD; values <0.1 OD were considered negative), whereas postvaccination titers were 0.224 to 1.053 OD.

TABLE 1—Antibody responses of 6 cheetahs before and after vaccination with a subunit feline leukemia virus vaccine

Cheetah No.	Sex	Age	Blood sample*	Antibody titers: gp70 (OD)†	Antibody titers: Anti-FOCMA‡
5	Male	Adult	Pre	0.067	1:4
			Post	0.364	1:16
6	Male	3 yrs	Pre	0.042	1:4
			Post	0.933	1:256
7	Female	Adult	Pre	0.039	1:4
			Post	1.033	1:64
8	Male	Adult	Pre	0.054	1:4
			Post	0.768	1:64
9	Female	Adult	Pre	0.059	1:4
			Post	1.053	1:32
10	Male	Adult	Pre	0.037	1:2
			Post	0.224	1:16

*Pre = prevaccination sample; Post = postvaccination sample.
†Results are reported as optic density (OD). Values >0.1 are considered to be positive for antibody against the FeLV envelope antigen (gp70). ‡Titers>1:8 are considered positive for antibody against feline oncornavirus cell membrane antigen (FOCMA)

Discussion

Feline leukemia virus causes severe illness and death in domestic cats; however, FeLV infection and the so-called FeLV-related diseases rarely have been reported in exotic feline species.[9-13] In domestic cats, 46% to 62% of cats with FIP are infected with FeLV.[6-8] Feline infectious peritonitis also has been reported in exotic felids.[1,2,14] Perhaps, FeLV infections are more prevalent in exotic felids than has been recognized previously.

Feline leukemia virus infection or FeLV-related diseases have not been detected in the cheetahs on the preserve since completion of the vaccination program. Whether the serologic responses seen in the vaccinates were a result of the vaccine or possibly due to exposure to FeLV could not be determined conclusively; however, the results of the present report indicate that the responses probably were vaccine-induced. Blood samples were not collected from the nonvaccinated cheetahs because of isolation of these cheetahs, the value of these cheetahs, and the fact that these cheetahs were pregnant or nursing kittens at the time that blood samples were collected from the other cheetahs. Therefore, serologic comparison between the vaccinated and nonvaccinated cheetahs was not done.

The data indicated that vaccination of cheetahs with the FeLV vaccine used in the present report probably is a safe procedure in that the vaccine did not cause detectable ill effects in the 17 cheetahs vaccinated. Vaccination of 6 cheetahs resulted in a marked increase in antibody titers against FOCMA and the gp70 antigen. If these titers are protective against FeLV infection, vaccination of cheetahs against FeLV may be warranted in captive cheetah populations in which FeLV infections are suspected. Such a vaccination program should be combined with evaluations for FeLV and isolation of FeLV-positive animals.

[f]Leukocell, Norden Laboratories, Lincoln, Neb.
[g]Norden Laboratories, Lincoln, Neb.

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