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SHORT COMMUNICATIONS

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Serologic Survey of Giant Pandas (*Ailuropoda melanoleuca*), and Domestic Dogs and Cats in the Wolong Reserve, China

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ABSTRACT: Sera from captive and recently rescued giant pandas (*Ailuropoda melanoleuca*) in the Wolong Reserve, China, were examined by serum neutralization or hemagglutination inhibition for antibodies to canine distemper virus (CDV), canine coronavirus (CCV), canine herpesvirus (CHV), pseudorabies virus (PRV), canine adenovirus type 2 (CAV), and canine parvovirus (CPV). Serum samples from village domestic dogs and cats, which run free throughout the reserve also were examined.

Antibodies against CPV were detected in six of eight giant pandas and all dogs and cats tested. The origin of the virus was not determined. Two of eight giant pandas and two of seven dogs had CDV antibody titers. Three of eight pandas and three of seven dogs had CCV antibody titers. Four of eight pandas and two of seven dogs had CAV titers; the titers in dogs were very high. No pandas or dogs had evidence of exposure to CHV or PRV.

Key words: Giant panda, *Ailuropoda melanoleuca*, serology, canine parvovirus, serologic survey, endangered species.

As part of The National Conservation Management Plan for the Giant Panda and its Habitat, reintroduction of giant pandas (*Ailuropoda melanoleuca*) into some nature reserves in China may occur (MacKinnon et al., 1989). This management plan, developed by the World Wide Fund for Nature (WWF) International and the Ministry of Forestry of China (MOF) recognizes that many threats to panda survival still exist and may delay implementation of any full scale reintroduction.

Kleiman (1990), during her work with golden lion tamarins (*Leontopithecus rosalia*) reintroductions into the Brazilian forest, created a list of 10 criteria that

should be met before a species is considered for reintroduction to the wild. Among these criteria is the assurance that releases of animals will not prejudice existing populations and that sufficient information about the biology of the species exists to evaluate the success of the reintroduction project. When these criteria were applied to the giant panda it was deemed inappropriate to release captive pandas into the wild at this time (He et al., 1991).

Viruses, specifically canine distemper virus (CDV) and canine coronavirus (CCV), have been implicated in disease and mortality in giant pandas (Qiu and Mainka, 1993). Qiu and Mainka (1993) found that gastrointestinal disease was the most common cause of mortality in pandas; intestinal disease, especially hemorrhagic gastroenteritis, was recorded frequently. A coronavirus has been isolated from one panda suffering from diarrhea (Chen and Pan, 1991). The recommendations of the Veterinary Working Group at the recent Giant Panda Symposium in Washington, D.C., included immunization of all captive animals for these diseases when possible (Tanabe et al., 1991).

To help assess the threat of viral disease to giant pandas in the Wolong Reserve (102°52'–103°24'E, 30°45'–31°25'N), China, serum samples from five captive adult pandas, recently rescued pandas and local domestic dogs and cats were examined for antibodies to the following viruses: canine distemper virus, canine coronavirus, canine herpesvirus (CHV), pseudorabies vi-

TABLE 1. Antibody titers in giant pandas, dogs, and cats from the Wolong Reserve, China, February to June 1992.

Test animals	CDV ^a	CCV ^b	CAV ^c	CPV ^d
Captive pandas				
Kang Kang	Neg ^e	1:50	Neg	Neg
Lin Nan	Neg	<1:30 ^f	Neg	1:320
Tang Tang	Neg	<1:30	1:50	1:20
Xin Xing	Neg	1:160	Neg	Neg
Zhen Zhen	1:50	Neg	1:20	1:1,280
Wild pandas recently rescued				
Bai Shi	1:30	1:50	1:10	1:10
Chun Chun	Neg	Neg	Neg	1:40
Zhen He	Neg	<1:30	1:20	1:160
Dogs				
1	Neg	Neg	Neg	>1:10,240
2	Neg	Neg	Neg	1:250
3	Neg	<1:30	Neg	>1:10,240
4	Neg	Neg	Neg	>1:10,240
5	1:50	1:250	Neg	1:1,280
6	Neg	1:30	>1:25,000	1:2,560
7	1:1,000	1:30	>1:25,000	1:1,280
Cats				
1	Neg	Neg	Neg	>1:10,240
2	Neg	Neg	Neg	>1:10,240
3	Neg	Neg	Neg	1:40

^a Canine distemper virus, serum neutralization test.^b Canine coronavirus, serum neutralization test.^c Canine adenovirus type 2, serum neutralization test.^d Canine parvovirus, hemagglutination inhibition test.^e Neg = negative.^f Toxic effect interference with testing.

rus (PRV), canine adenovirus type 2 (CAV), and canine parvovirus (CPV).

During elective procedures done between February and June 1992, blood samples were drawn from the jugular vein of five anesthetized pandas held at the China Conservation and Research Center for the Giant Panda. All five of the pandas were adults (age range 5 to 20 yr) and had been in captivity >1 yr. Samples were also taken from three rescued pandas during anesthesia for treatment procedures. In the anesthesia protocols we used ketamine, ketamine and xylazine, or tiletamine and zo-lazepam as described by Mainka and He (1993). All rescued pandas originated from the reserve area. No specific quarantine area for incoming animals is available so only samples obtained ≤ 24 hr of arrival were classed as wild panda samples.

Domestic dogs and cats run freely throughout the reserve but do not have direct access to any of the captive held pandas. Seven adult village dogs and three adult cats were manually restrained on 21 March 1992 and blood samples were taken from the cephalic vein. According to the owners, none of the dogs or cats had received any immunization prior to sampling.

Serum and plasma were separated and placed in cryotubes and frozen at -20°C until shipment to the laboratory for analysis. Serum neutralization tests were done as described by Appel and Robson (1973) to detect antibodies to CDV, CCV, CHV, CAV and PRV. Neutralization tests for CDV were made in Vero cells (American Type Culture Collection, Rockville, Maryland, USA); for CHV and CAV in second-

ary dog kidney cells prepared by M. J. Appel from SPF pups; and for CCV in feline kidney cell line (NFLK) donated by L. E. Carmichael, Cornell University (Ithaca, New York, USA). Neutralization of PRV was tested in a pig kidney cell line donated by E. Dulovi, Cornell University (Ithaca, New York) (PK15) (Bitsch and Eskildsen, 1982). Hemagglutination inhibition testing was used as described by Carmichael et al. (1980) to detect antibodies to CPV.

Canine parvovirus antibody titers were seen in domestic dogs and cats (Table 1). Both captive and free-ranging pandas also had serologic evidence of exposure to a parvovirus (Table 1). Parvoviruses cause enteritis in many species (Montali et al., 1987). They are suspected as primary agents in hemorrhagic gastroenteritis in pandas although the virus never has been isolated. Thus, the pandas in Wolong are exposed to this virus and develop an immune response. Further work and, ideally, virus isolation, are needed to define more clearly the role of parvoviruses as disease causing agents in giant pandas.

Domestic dogs and cats, with very high CPV titers, must be considered as a possible source of a parvovirus for wild pandas. In order to control spread of parvoviruses from domestic dogs and cats to wild pandas, a vaccination program for pets within the reserve could be considered.

All samples tested were negative for pseudorabies virus antibody (SN < 1:4). Pseudorabies usually is acute and fatal in species other than pigs. Since the eight giant pandas tested did not demonstrate any antibodies to this virus this may indicate the pseudorabies also is fatal in pandas or that pandas in Wolong are not exposed to this virus. Seizures of unknown etiology are a common problem in giant pandas. The role of viruses that affect the central nervous system, including PRV, needs to be investigated further.

Sera were free of antibodies to CHV. Antibodies to CDV, CCV and CAV were found in both domestic dogs and pandas

at Wolong. A CDV and a coronavirus both have been reported as causes of illness and mortality in giant pandas; transmission of these viruses from village pets to wild pandas may occur.

Successful reintroduction of an endangered species requires a thorough understanding of disease threats posed to the habitat by the new animal as well as threats the habitat may present to the new animal. Serologic surveys are vital to this understanding. Based on this study, the role of parvovirus in disease in giant pandas needs to be more fully evaluated prior to considering implementation of any reintroduction program in the Wolong Reserve.

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