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# RESEARCH NOTES/CASE REPORTS

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## Epizootic Hemorrhagic Disease in White-tailed Deer from Missouri

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White-tailed deer (*Odocoileus virginianus*) have increased in Missouri since 1925 when a low of 395 deer was recorded (Schwartz and Schwartz, 1981, *The Wild Mammals of Missouri*, 2nd ed., Univ. Missouri Press and Missouri Dept. Conservation, Columbia, Mo., 368 pp.). During the past 30 yr, three epizootics of a hemorrhagic-like disease have been experienced by the herd. A prolonged outbreak occurred during 1952–1956 (Murphy, 1957, *Mo. Conserv.* 18: 4–5), another in 1976 and again in 1980. These were years of extreme drought in Missouri. The causes of the first two epizootics were never determined. This report describes the efforts to establish an etiologic agent for the 1980 epizootic and documents the first isolation of epizootic hemorrhagic disease (EHD) virus from a captive white-tailed deer in Missouri.

During September–October of 1980, reports of moribund or dead deer were received by the Missouri Department of Conservation from bowhunters and other individuals. A total of 316 deer distributed statewide in 42 of the 114 counties was reported to be afflicted. Concomitantly, captive deer at two Kansas City parks and at a conservation research station in Boone County experienced morbidity and mortality. Bison (*Bison bison*) and elk (*Cervus elaphus nelsoni*), which coinhabited enclosures with the deer in Kansas City, remained free of overt illness. The epizootic subsided by early November.

**Free-ranging deer:** While field reports indicated that many dead deer had either bloody discharges or ulcerations of the buccal cavity, only three free-ranging deer found dead were submitted by the Missouri Department of Con-

servation to the Veterinary Medical Diagnostic Laboratory, University of Missouri. These animals were found between September 19 and October 21. Two of the deer were suitable for examination. The gross and microscopic lesions were typical for hemorrhagic disease, i.e., ulcerations of the buccal cavity and vascular alterations leading to extensive systemic hemorrhaging and edema (Hoff and Trainer, 1982, *In Infectious Diseases of Wild Mammals*, 2nd Ed., Davis et al. (eds.), Iowa State Univ. Press, Ames, Iowa, pp. 45–53).

In addition to these deer, during the firearms season 339 deer in three southern counties were examined for sloughing hooves (suggestive of hemorrhagic disease infection) and 8 (2.4%) were found to have this condition.

**Captive deer in Boone County:** Prior to the epizootic there were approximately 30 captive deer on the C. W. Green Wildlife Research Area. Between September 25 and October 29, four adult deer were found either dead or recumbent with severe dyspnea. These deer were submitted to the Veterinary Medical Diagnostic Laboratory, University of Missouri, Columbia.

Gross and microscopic lesions in three deer were remarkably similar: extensive hemorrhaging, subcutaneous edema, hemorrhagic enteritis and the presence of serosanguineous fluid in the stomach, pleural and peritoneal cavities and pericardial sac. Lesions in the fourth deer were primarily oral ulcerations and bronchopneumonia which involved about 30% of the lung parenchyma. Tissues from all the deer were submitted for virus isolation (Hoff and Trainer, 1982, *op. cit.*), but all tests were negative. Based on the pathology a diagnosis of hemorrhagic disease was made.

**Captive deer in Kansas City:** Prior to the epizootic there were 19 captive deer at two parks in the northern portion of the city. Be-

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tween October 2 and 13, three dead deer and one moribund deer were found at these parks. The three dead animals were too decomposed for evaluation. The moribund adult doe had severe dyspnea and a rectal temperature of 38.2 C. The animal was killed and necropsied at the Kansas City Zoological Garden. Specimens for histopathologic examination and virus isolation were submitted to the Department of Veterinary Pathology, Iowa State University and the U.S. Department of Agriculture, National Veterinary Services Laboratory, Ames, Iowa, respectively.

The gross and microscopic lesions were similar to those described above and typical of those found in hemorrhagic disease. Virus isolation attempts were conducted by inoculation of 1:5 dilution of sonicated red blood cells into cell cultures and embryonating chicken eggs. From inoculated baby hamster kidney cultures, EHD virus (not typed) was recovered. This isolation was confirmed by retesting the original blood specimen. Immunodiffusion tests with serum from the deer were positive for antibodies

against EHD virus and negative to bluetongue virus.

The effect of the 1980 epizootic cannot be completely assessed, although its impact on the state deer herd seems to have been minimal. Three hundred sixteen deer were known to have died of supposed hemorrhagic disease. However, the November firearms season yielded 49,261 deer, a near record harvest, and the bow season added another 3,661 deer to the harvest total. In 1981, the gun harvest was 50,242 deer. Also herd recruitment for the western one third of Missouri during 1979 and 1981 was not significantly different for the percent of pregnant does, the fetus-doe ratio, or calculated fawn production. A similar observation was made by Roughton (1975, *J. Wildl. Dis.* 11: 177-186) for herds of white-tailed deer in Kentucky which experienced a hemorrhagic disease outbreak.

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## Non O-Group 1 *Vibrio cholerae* Infection in a Desert Tortoise (*Gopherus berlanderi*)

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A female desert tortoise that had been donated to the zoo 3 yr ago was found dead in an outdoor tortoise exhibit. No sign of illness was seen in any other tortoise in the exhibit. The animal was necropsied and tissue specimens were fixed and processed for histologic examination using standard methods.

At necropsy, a few areas of eroded epidermis were noted on the posterior portions of the front legs. Most of the small intestinal mucosa had multifocal necrotic areas. The mucosa and serosa of the large intestine were reddened. Histologically, the intestinal necrosis involved the

entire mucosa, and there was an infiltrate of mononuclear cells (Figs. 1, 2). In sections stained by the McCallum-Goodpasture method, numerous gram negative, curved or comma-shaped rods were noted in the necrotic areas (Fig. 3). Although not noted grossly, histologic examination indicated a multifocal, necrotizing pneumonia. Mononuclear cells and bacteria similar to those noted in the intestine were present in the pulmonary lesions.

Intestinal contents were streaked on MacConkey plates and colonies were inoculated into the Analytical Profile Index (API) system, which resulted in a presumptive diagnosis of *V. cholerae*. Lung cultures were not done, as no gross lesion was seen. The isolates were sent to a re-

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