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## A Case of Leukemia in the Desert Spiny Lizard (*Sceloporus magister*)

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**ABSTRACT:** A leukemia characterized by the proliferation of undifferentiated hematopoietic stem cells is described from a desert spiny lizard (*Sceloporus magister*). This is the first neoplasm reported from this species and the first leukemia from the family Iguanidae. A massive invasion of primitive hematopoietic cells was noted in the vascular system and heart muscle. Spleen, bone marrow, lungs, adrenal gland, pancreas, brain, skin, testes, liver, lamina propria and submucosa of intestines were extensively involved. Tissue-fixed mast cells were noted in the kidney and intestinal submucosa but were not participating in the neoplastic proliferation.

**Key words:** Leukemia, neoplastic cells, hematopoietic, vascular system, mast cells, *Sceloporus magister*, Iguanidae, case history.

As more reptiles are examined, many of the tumors that affect mammals probably will also be found in reptiles (Frye, 1981). A variety of neoplasms from reptiles are described by Frye (1981) and the prevalences of neoplasia in reptiles are summarized by Jacobson (1981). Still, our understanding of neoplastic processes in reptiles remains rudimentary. In this report we describe a leukemia in the desert spiny lizard (*Sceloporus magister*). This is the first report of neoplasia in this species. According to Jacobson (1981), neoplasms have previously been reported in only four iguanid species making our report the fifth neoplasm and the first leukemia. Considering other leukemias reported in reptiles, the following have been recorded: granulocytic leukemia in a viper (*Bitis nasicornis*) and lymphoblastic leukemia in the timber rattlesnake (*Crotalus horridus*) (Harshbarger, 1965–1973); myelogenous leukemia in a turtle (*Pelomedusa subbruta*) (Harshbarger, 1975); lymphoblastic leukemia in an Indian monitor lizard (*Varanus bengalensis*) (Harshbarger, 1976); myeloproliferative disease in the turtle,

*Pseudemys elegans* (Frye and Carney 1972); leukemic malignant lymphoma in the death adder (*Acanthophis antarcticus*) (Griner, 1975); myelogenous leukemia in a turtle and lymphocytic leukemia in two snakes (Langenberg et al., 1983); acute lymphatic leukemia in a boa constrictor (*Constrictor constrictor*) (Frye and Carney, 1973).

A male *S. magister* was collected in San Felipe Canyon, 91 m E of County Road S2 on California Highway 78, elevation 731 m (33°07'N, 116°37'W) San Diego County, California (USA) on 28 May 1988. It had been thriving in captivity when it died 7 May 1989. The lizard measured 114 mm snout-vent length at death and had been preserved in 10% formalin for later necropsy. Upon examination the abdominal cavity was filled with blood and the spleen was enlarged. No additional gross changes were noted in any other fixed organs. Organs were embedded in paraffin. Histological sections were cut at 6  $\mu$ m and stained with hematoxylin and eosin, Price's Giemsa (Luna, 1968), periodic acid-Schiff (PAS)-hematoxylin stain or a modification (Gendron-Fitzpatrick, pers. comm.) of chloroacetate esterase stain (Brazier et al., 1987). Bones from the vertebral and appendicular skeletons were decalcified prior to histological processing. Because this lizard was already fixed when we received it, we were unable to make touch preparations or blood smears. Representative tissues from this lizard have been deposited in the Registry of Comparative Pathology (Armed Forces Institute of Pathology, Washington, D.C. 20306, USA; Accession number 2286436). Representative slides were deposited in Registry of Tumors in Lower Animals (National Museum of Nat-

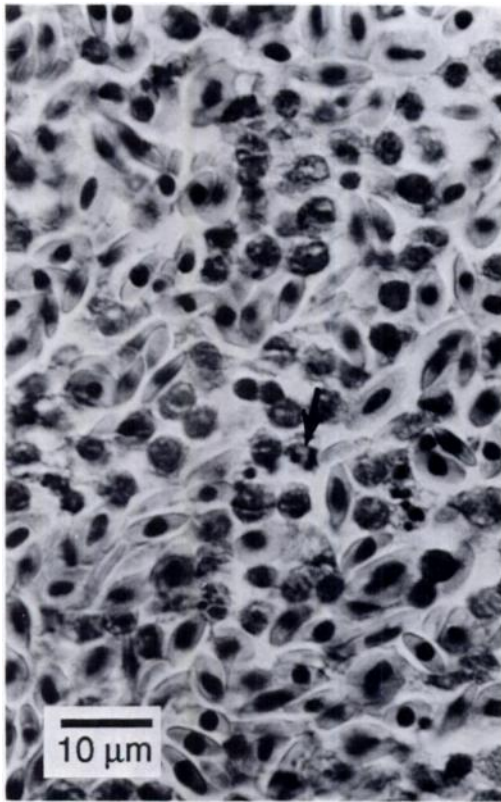


FIGURE 1. Blood vessel of desert spiny lizard containing numerous neoplastic cells. Note mitotic figure (arrow). H&E.

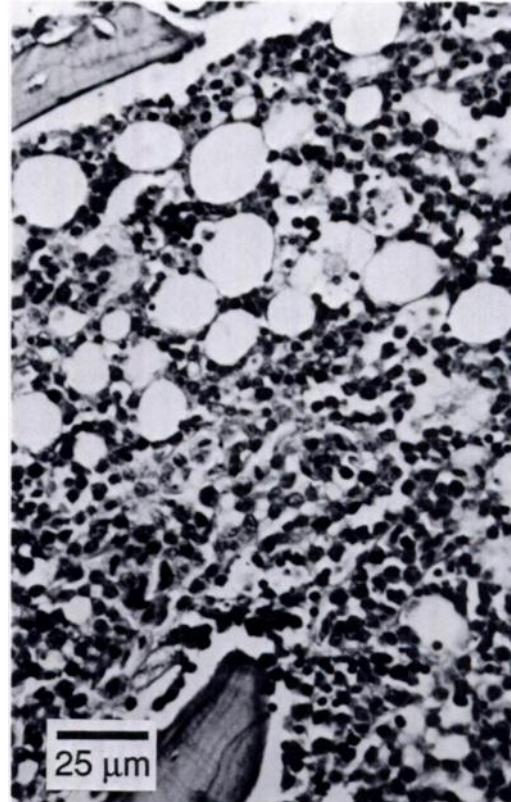


FIGURE 2. Bone marrow of desert spiny lizard showing adipose tissue and hematopoietic elements with scattered tumor cells. H&E.

ural History, Smithsonian Institution, Washington, D.C. 20560, USA; Accession number RTLA 5174).

The organs of this lizard were infiltrated by massive sheets of primitive hematopoietic cells. The cells were round to slightly oval, measuring approximately 6–10  $\mu\text{m}$  and had condensed nuclei and coarse chromatin giving the nuclei a dusky appearance. Occasional cells had prominent nucleoli. Scant granular cytoplasm was occasionally eccentric and bilobed cells were seen along with normal heterophils. Mitoses were common both in infiltrated tissues and plugged blood vessels (Fig. 1).

Marrow was examined from several bones and consistently contained moderate hypercellularity with striking retention of normal architecture including adipose tissue elements (Fig. 2). Tumor cells occurred individually and in small nests, but

were interposed with erythroid and myeloid elements that showed normal differentiation. The spleen was enlarged and diffusely replaced by dense aggregations of neoplastic cells.

The atria were dilated due to a massive invasion of neoplastic cells. The ventricular myocardium was also involved (Fig. 3). Similar primitive hematopoietic cells severely infiltrated the hepatic sinusoids, renal interstitium and glomeruli. The pulmonary septa, testes (Fig. 4) and adrenal gland were similarly infiltrated. Neoplastic cells were present in all blood vessels (Fig. 5), in the sheaths of many peripheral nerves and diffusely infiltrated the fascia of skeletal muscles. There were perivascular and intraluminal nests of tumor cells in the brain. The lamina propria and submucosa of the stomach and intestines were infiltrated with these malignant cells as was

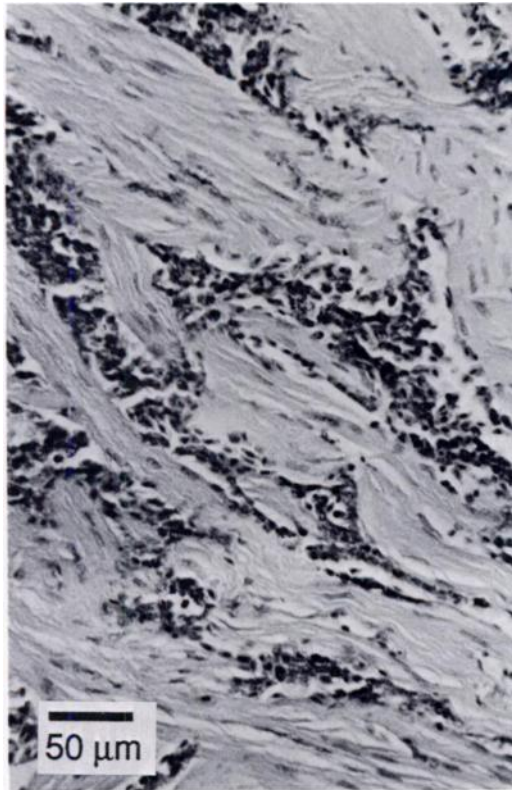


FIGURE 3. Neoplastic cells are invading cardiac muscle and fill the interstitium of a desert spiny lizard. H&E.

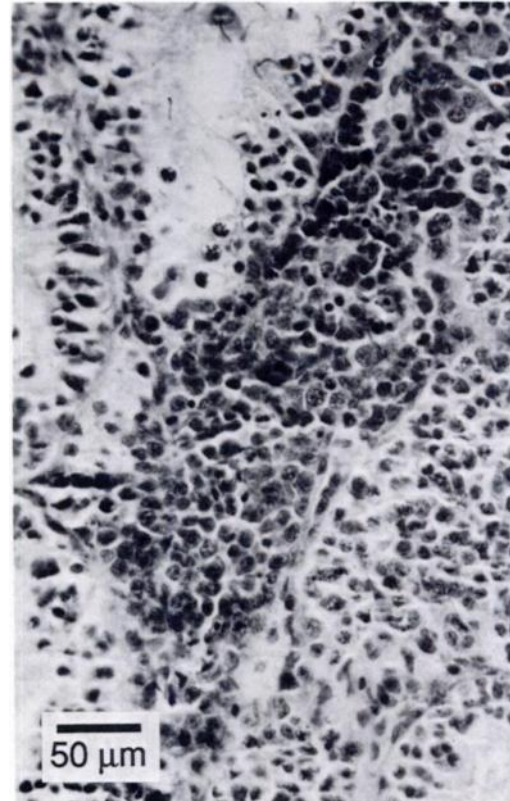


FIGURE 4. Seminiferous tubules; neoplastic cells are distending the interstitial septa of a desert spiny lizard. H&E.

the pancreas. Malignant cells were present in both epidermis and dermis.

We also noted round cells with cytoplasmic granules in the kidney and intestinal submucosa. The granules were metachromatic with Price's Giemsa stain and were identified as tissue-fixed mast cells. They did not appear to be participating in the neoplastic process. Mast cells were found in the lamina propria of the digestive tract in normal lizards (Luppa, 1977). Granulocytes in the bone marrow stained positive with PAS. However, the leukemia cell population in the bone marrow and elsewhere was PAS negative. Also, the chloracetate esterase stain which is strongly positive for neutrophilic granulocytes (Brazier et al., 1987), was inconclusive because both normal bone marrow cells and leukemia cells were negative.

In view of the homogeneous nature of

the invasive hematopoietic cells, we feel the lesion described herein is consistent with a stem cell leukemia. Although antemortem hematology was not done, the degree of tissue invasion and cellular aggregates in large blood vessels pointed to circulation of these primitive blood cells. Leukemias are classified by the cell type present and the maturity of the invasive cell (Robbins et al., 1981). Due to the immature appearance of the invasive cells, the leukemia would probably best be described as acute. Acute leukemias are rapidly fatal in untreated patients (Robbins et al., 1981). That the lizard was in good nutritional condition at the time of death and had been feeding normally suggests that the development of the disease had been rapid. Bleeding, secondary to thrombocytopenia is characteristic of the clinical course of acute lymphoblastic leukemia



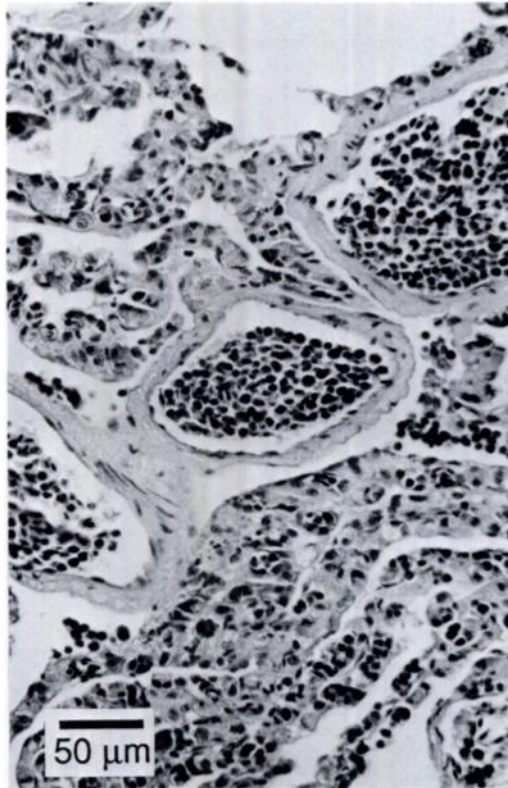


FIGURE 5. Neoplastic cells within pulmonary blood vessels of a desert spiny lizard. H&E.

(Robbins et al., 1981). The finding of the abdominal cavity full of blood indicates substantial bleeding occurred in the lizard and may have contributed to its death. Further support that the leukemia was acute in nature is suggested by the enlarged spleen. In man, splenomegaly is common in acute lymphocytic leukemia (Robbins et al., 1981).

The site of origin of the leukemia cell population could not be determined and we are undecided whether it represents lymphoid leukemia or a myeloproliferative disorder. Consultation with the Armed Forces Institute of Pathology, Veterinary Pathology Division concurred with our interpretation, only adding that occasional cells had plasmacytoid features. This along with our observations of the bone marrow tend to suggest a lymphoid origin. The possibility of a blastic form of erythroleukemia, formerly termed reticuloendothe-

liosis in cats (Moulton and Harvey, 1990) seems less likely but is not totally ruled out. Liu et al. (1987) reported acute undifferentiated leukemias to be PAS negative. We similarly found the leukemia cell population described herein to be PAS negative. In view of this we must refer to the leukemia as being undifferentiated.

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#### LITERATURE CITED

- BRAZIEL, R. M., S. HSU, AND E. S. JAFFE. 1987. Lymph nodes, spleen and thymus. In *Histochemistry in pathologic diagnosis*, S. S. Spicer (ed.). Marcel Dekker, Inc., New York, New York, pp. 203-256.
- FRYE, F. L., AND J. CARNEY. 1972. Myeloproliferative disease in a turtle. *Journal of the American Veterinary Medical Association* 161: 595-599.
- , AND ———. 1973. Acute lymphatic leukemia in a boa constrictor. *Journal of the American Veterinary Medical Association* 163: 653-654.
- . 1981. Biomedical and surgical aspects of captive reptile husbandry. Krieger Publishing Co. Inc., Melbourne, Florida, 456 pp.
- GRINER, L. A. 1975. Hematopoietic neoplasia in animals at the San Diego Zoological Gardens. In *Erkrankungen der Zootiere, Verhandlungsbericht des XVII. International Symposiums über die Erkrankungen der Zootiere*, Tunis 1975, R. Ippen and H. Schröder (eds.). Akademie-Verlag, Berlin, Germany, pp. 253-259.
- HARSHBARGER, J. C. 1965-1973. Activities report Registry of Tumors in Lower Animals. Smithsonian Institution, Washington, D.C., 141 pp.
- . 1975. Activities report Registry of Tumors in Lower Animals: 1975 supplement. Smithsonian Institution, Washington, D.C., 42 pp.
- . 1976. Activities report Registry of Tumors in Lower Animals: 1975 supplement. Smithsonian Institution, Washington, D.C., 42 pp.
- JACOBSON, E. R. 1981. Neoplastic diseases. In *Diseases of the reptilia*, Vol. 2, J. E. Cooper and O. F. Jackson (eds.). Academic Press, New York, New York, pp. 429-468.
- LANGENBERG, J. A., J. A. TEARE, R. J. CAROLAN, AND R. J. MONTALI. 1983. Hematopoietic and lym-

- phoreticular tumors in zoo animals. *Laboratory Investigation* 48: 48A.
- LIU, P. I., G. R. HENNIGAR, AND L. CROOK. 1987. Histochemistry of bone marrow aspirations and biopsies. *In* *Histochemistry in pathologic diagnosis*, S. S. Spicer (ed.). Marcel Dekker, Inc., New York, New York, pp. 179–201.
- LUNA, L. 1968. *Manual of histologic staining methods of the Armed Forces Institute of Pathology*, 3rd ed. McGraw-Hill Book Company, New York, New York, 258 pp.
- LUPPA, H. 1977. *Histology of the digestive tract. In* *Biology of the reptilia*, Vol. 6, Morphology E, C. Gans and T. S. Parsons (eds.). Academic Press, New York, New York, pp. 225–313.
- MOULTON, J. E., AND J. W. HARVEY. 1990. Tumors of the lymphoid and hematopoietic tissues. *In* *Tumors in domestic animals*, 3rd ed., J. E. Moulton (ed.). University of California Press, Berkeley, California, pp. 231–307.
- ROBBINS, S. L., M. ANGELL, AND V. KUMAR. 1981. *Basic pathology*, 3rd ed. W. B. Saunders Company, Philadelphia, Pennsylvania, 694 pp.

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