Maxillary Lymphosarcoma in a White-tailed Deer (Odocoileus virginianus)

Authors: Larsen, R. Scott, Carpenter, James W., Kennedy, George A., and Morales, N.

Source: Journal of Wildlife Diseases, 38(3) : 611-615

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-38.3.611

Journal of Wildlife Diseases, 38(3), 2002, pp. 611–615

Maxillary Lymphosarcoma in a White-tailed Deer (*Odocoileus virginianus*)

R. Scott Larsen,[1,3,5] **James W. Carpenter,**[1] **George A. Kennedy,**[2] **and N. Morales**[1,4] [1]Department of Clinical Sciences, College of Veterinary Medicine, Kansas State University, Manhattan, Kansas 66506, USA; [2]Department of Diagnostic Medicine/Pathobiology, College of Veterinary Medicine, Kansas State University, Manhattan, Kansas 66506, USA; [3]Present address: Department of Medicine and Epidemiology, School of Veterinary Medicine, University of California, One Shields Avenue, Davis, California 95616-8747, USA; [4]Present address: 1023 Heather Lane SE, Salem, Oregon 93702, USA; [5]Corresponding author (email: rslarsen@unity.ncsu.edu)

ABSTRACT: In 1996, lymphosarcoma was observed in a captive adult female white-tailed deer (*Odocoileus virginianus*) from northeastern Kansas (USA). A subcutaneous mass on the deer's left cheek was surgically removed and lymphosarcoma was diagnosed. The mass recurred within 3 wk. A second surgical removal was attempted but the tumor had grown much larger, had become intimately involved with the buccal mucosa, and was beginning to interfere with mastication. For these reasons, the deer was euthanized. At postmortem examination the only abnormal findings were the primary tumor and enlarged ipsilateral parotid and mandibular lymph nodes. Histologically these tissues demonstrated changes characteristic of lymphosarcoma but no other organs had evidence of neoplastic disease. A diagnosis of focal lymphosarcoma with local metastasis was made. The organ distribution of lymphosarcoma in this deer differs from previously described cases of lymphosarcoma in cervids.

Key words: Case report, lymphosarcoma, maxilla, *Odocoileus virginianus,* white-tailed deer.

Lymphosarcoma has been reported sporadically in white-tailed deer (*Odocoileus virginianus*) and other cervids. Multicentric or disseminated lymphosarcoma has been reported in moose (*Alces alces*; Hansen and Borg, 1996), roe deer (*Capreolus capreolus*; Elvestad and Henriques, 1985; Hansen and Borg, 1996), red deer (*Cervus elaphus*; Elvestad and Henriques, 1985), Eld's deer (*Cervus eldi thamin*; Montali, 1980), fallow deer (*Dama dama*; Jennings, 1968; English, 1985), and white-tailed deer (Debbie and Friend, 1967; Cosgrove et al., 1981). Reindeer (*Rangifer tarandus*) have been documented with visceral lymphoma (Jarplid and Rehbinder, 1995) and malignant cutaneous lymphoma (Kummeneje and Poppe, 1978). Herein, we describe a case of focal lymphosarcoma with local metastasis in a white-tailed deer.

In 1996, a 13 yr old, 45 kg captive-born female white-tailed deer was housed at the Sunset Zoological Park in northeastern Kansas (USA; 39°32′N, 96°35′W). In October, the animal was observed to have a large swelling on the left side of its face. The mass was 4×3×2 cm and was located just rostral and ventral to the left eye. It did not appear to be causing problems with prehension or mastication. An abscess was suspected and 1,250 mg sulfadimethoxine (Albon^R, SmithKline Beecham Animal Health, Exton, Pennsylvania, USA) was administered daily to the deer in feed. After 10 days the mass appeared to have increased slightly in size, so the deer was immobilized for examination. The deer was in good physical condition with no abnormalities detected other than the mass. The teeth appeared normal and the mass did not appear to affect the left eye or orbit. At this time, the subcutaneous mass was 4×4×2 cm and was not attached to the skin. A fine needle aspirate of the mass was obtained, radiographs were taken of the head, and blood was obtained from the right jugular vein for complete blood count and serum biochemistry analysis.

The aspirate was placed on several slides and stained with Wright-Giemsa. Slides were generally very thick with many red blood cells. Lymphoid cells were the predominant nucleated cell type, with 20% normal lymphocytes and 10% lymphoblasts. The remaining lymphocytes had intermediate-sized nuclei, but maturity of the cells could not be determined. Occasional plasma cells and nonvacuolated

macrophages were observed. No protozoa, bacteria, or fungi were seen. The presence of lymphocytes with large nuclei was suggestive of lymphocytic neoplasia.

The radiographs revealed soft tissue swelling with no bony changes. The white blood cell count was 4,100/μl (reference range: 1,000–4,200/μl; Seal et al., 1981), the lymphocyte count was 620/μl (reference range: 600–2,800/μl; Seal et al., 1981), and there was a mild hypochromic (hemoglobin, 12.2 g/dl; reference range: 14.5–22.5 g/dl; Seal et al., 1981), normocytic anemia (hematocrit, 34%; reference range: 39–58%; Seal et al., 1981). The only abnormalities on serum biochemistry analysis were slightly low calcium (8.2 mg/dl; reference range: 8.8–10.8 mg/dl; Seal et al., 1981) and slightly elevated potassium (5.3 mmol/l; reference range: 3.4–5.0 mmol/l; Seal et al., 1981). Serum phosphorous was normal (6.0 mg/dl; reference range: 4.5–8.5 mg/dl; Seal et al., 1981).

The mass appeared to be discrete and no enlarged lymph nodes were detected, so we immobilized the deer and surgically removed the mass. Surrounding subcutaneous and muscle tissues were also removed in order to provide 1 cm margins around the visibly abnormal tissue. Two million international units (IU) of penicillin G procaine (Pfi-Pen G^R, Pfizer, Inc., Lee's Summit, Missouri, USA) and 100 mg ceftiofur (Naxcel^R, Upjohn Company, Kalamazoo, Michigan, USA) were administered subcutaneously immediately postoperatively and 1,250 mg sulfadimethoxine was administered orally in the feed for 14 days.

The mass was fixed in 10% neutral buffered formalin and embedded in paraffin. Five μm sections were cut and stained with hematoxylin and eosin. Histologic examination revealed sheets of lymphoid cells with round indistinct nucleoli, clumped chromatin pattern, and scant eosinophilic cytoplasm. Occasional nuclei had cleaved or round, densely basophilic nucleoli. The density of mitotic figures was variable but there were generally 1–2 mitotic figures per high-powered field (Fig. 1). The infiltrating neoplastic cells obliterated normal subcutaneous tissue architecture, invaded into underlying skeletal muscle, and were evident at the borders of the biopsy. Immunohistochemical staining was performed using CD3 antibody (DAKO Corporation, Carpinteria, California, USA) diluted 1:200, secondary biotinylated goat anti-rabbit antibody with avidin biotin horseradish peroxidase complex (Vector Labs, Burlingame, California), and diaminobenzidine as the chromagen. Neoplastic cells were positive for CD3 antigen indicating the tumor was of T-lymphocyte origin. The tumor was classified as a prolymphocytic, diffuse, solitary T-cell lymphoma (Moulton and Harvey, 1990).

Swelling of the incision site was apparent for 2 days postoperatively, but then gradually decreased. A 1×1×1 cm mass was visible at the incision site 14 days postoperatively. This mass slowly enlarged until it was back to the original size by 26 days post-operative. Two other masses, 1×1×1 cm in size, became apparent caudoventral and caudodorsal to the original mass. These masses slowly increased in size and the original mass continued to expand ventrally until it was at the level of the commissure of the mouth.

Forty-nine days after the original surgery, we immobilized the deer to surgically remove as much of the tumor as possible. Radiographs were taken of the thorax and head and blood was collected from the right jugular vein. The primary mass was 6×5×3 cm and was intimately associated with the buccal mucosa, which was displaced medially so that it was directly between the upper and lower dental arcades. The deer was euthanized because resection of the mass would have required removing an extensive amount of buccal mucosa. Except for the three masses described above, no abnormalities were seen on radiographs of the head and thorax. A complete blood count revealed mild leukocytosis (5,200/μl) with mild neutrophilia (4,000/μl; reference range: 600–2,800/μl;

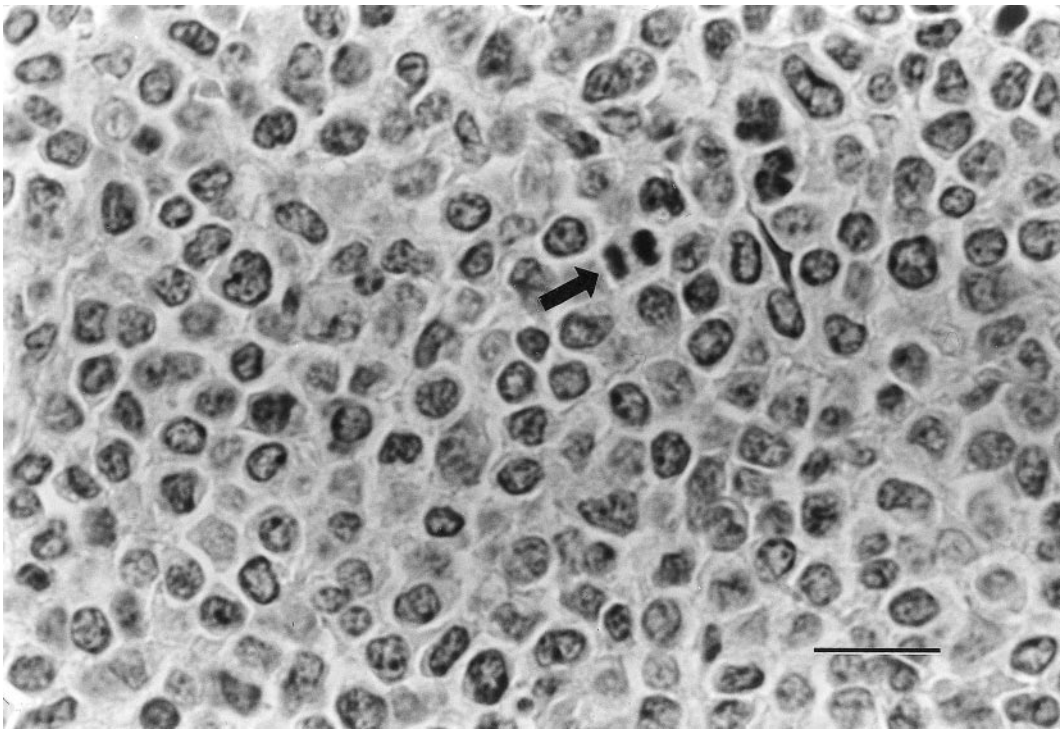

FIGURE 1. Photomicrograph of subcutaneous mass on face of a captive white-tailed deer composed of sheets of lymphoid cells with generally round nuclei, a clumped pattern, and indistinct nucleoli. There are occasional cleaved nuclei and sparse mitotic figures (arrow). HE stain. Bar=20 μm.

Seal et al., 1981) and a normal number of lymphocytes (830/μl). Mild hypochromic (hemoglobin, 13.4 g/dl), normocytic anemia (hematocrit, 36%) was also observed and fibrinogen was mildly elevated (500 mg/dl; reference range: 170–300 mg/dl; Seal et al., 1981). The serum biochemical profile revealed mild hypocalcemia (7.0 mg/dl) with a normal serum phosphorous concentration (6.6 mg/dl). Malignant hypercalcemia is commonly associated with lymphosarcoma in domestic dogs (Feldman, 1995), but the serum calcium levels for this deer were low and there was no evidence of abnormal tissue mineralization or bony involvement.

At necropsy, the deer was in good condition with adequate stores of body fat. The primary mass was white-gray and very soft. It was well demarcated from surrounding normal tissue and was not invading bone. The caudoventral mass (4×3×2 cm) was the mandibular lymph node, which was the same color and texture as the primary mass. The caudodorsal mass (3×2×2 cm) was the parotid lymph node, which was intimately associated with, but not attached to, the parotid salivary gland. The lymph nodes on the right side of the head were much smaller and showed no abnormalities.

Histologic characteristics of the primary mass and enlarged lymph nodes were similar to those described for the previously examined tumor. Lymph nodes were infiltrated by dense sheets of monomorphic lymphoid cells that obliterated normal architecture. The primary mass invaded surrounding connective tissue and skeletal muscle (Fig. 2), however both of the abnormal lymph nodes were separated from adjacent salivary glands by a thin layer of fibrous connective tissue. Histologically all other tissues, including the caudal cervical lymph nodes, liver, kidney, spleen, thyroid,

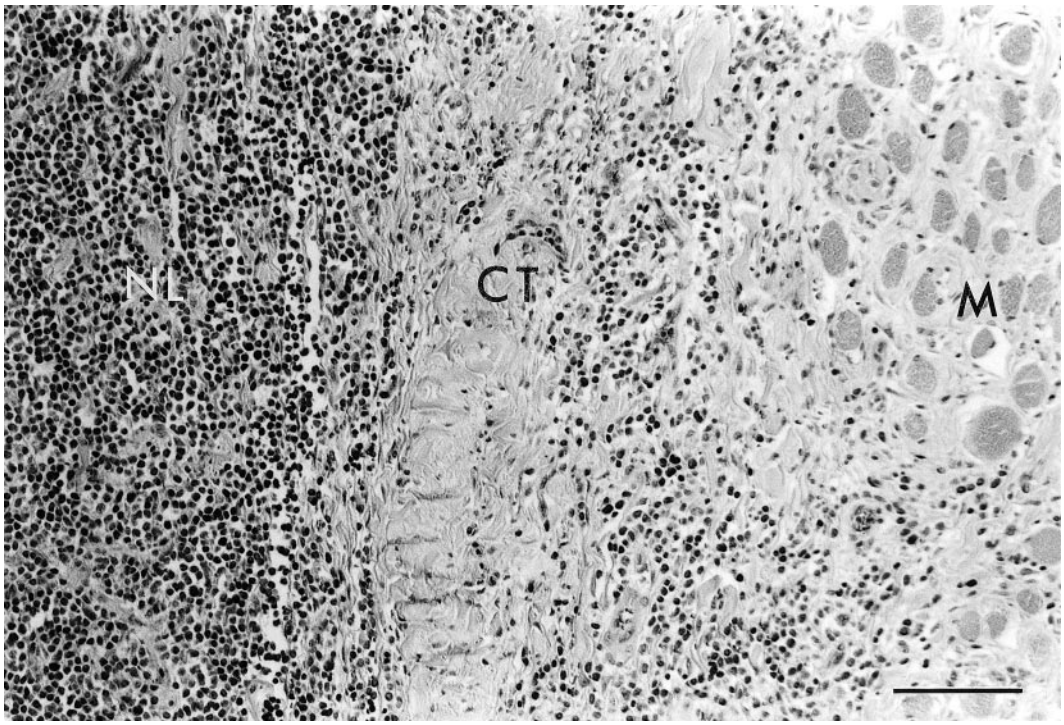

FIGURE 2. Photomicrograph of a subcutaneous mass on the face of a captive white-tailed deer. Note sheets of monomorphic neoplastic lymphocytes (NL) characteristic of lymphosarcoma, invading into surrounding connective tissue (CT) and skeletal muscle (M). HE stain. Bar=100 μm.

heart, abomasum, pancreas, lung, and brain appeared normal.

Lymphoid tumors are among the most common tumors in domestic animals (Moulton and Harvey, 1990) and lymphomas are relatively common neoplasms in white-tailed deer (Cosgrove et al., 1981). Lymphomas are generally grouped by anatomic locations into five forms: multicentric, thymic, alimentary, cutaneous, and solitary (Moulton and Harvey, 1990). In this case, the tumor did not involve distant nodes or other organs, thus we diagnosed a solitary tumor with local metastasis. This is an unusual presentation for lymphoma in white-tailed deer; previous reports of lymphoid tumors in this species have described multicentric disease with involvement of heart, lungs, blood vessels, kidney, urinary bladder, and/or peritoneum (Debbie and Friend, 1967; Cosgrove et al., 1981). Two cases of lymphoma were reported in white-tailed deer at the Philadelphia Zoological Garden, but distribution of the lesions was not described (Lombard and Witte, 1959).

In domestic cattle, lymphosarcoma is associated with bovine leukemia virus (BLV) infection and is typically disseminated (Thurmond, 1996). Lymphosarcoma without concurrent BLV infection is rare in cattle (Thurmond et al., 1985) but, to our knowledge, BLV infection has not been diagnosed in cervids.

In humans, various types of leukemia may infiltrate the oral mucosa and oral manifestations often occur early in the course of disease (Dreizen et al., 1983; Anil et al., 1996). To our knowledge, similar changes have not been described in cervids and it is unknown if the oral lesion of this white-tailed deer represented a solitary tumor or if it could have represented early stage systemic disease.

Earlier diagnosis and aggressive therapy might have been useful in our deer. While

most lymphosarcoma is disseminated to multiple organs in bovids and cervids, not all cases are multicentric. Lymphosarcoma should be a differential diagnosis when considering a subcutaneous mass in an adult white-tailed deer.

LITERATURE CITED

ANIL, S. L., L. P. SMARANAYAKE, R. G. NAIR, AND V. T. BEENA. 1996. Gingival enlargement as a diagnostic indicator in leukaemia. Case report. Australian Dental Journal 41: 235–237.

COSGROVE, G. E., L. C. SATTERFIELD, AND V. F. NETTLES. 1981. Neoplasia. *In* Diseases and parasites of white-tailed deer, W. R. Davidson, F. A. Hayes, V. F. Nettles and F. E. Kellog (eds.). Miscellaneous Publication No. 7. Tall Timbers Research Station, Tallahassee, Florida, pp. 62–71.

DEBBIE, J. G., AND M. FRIEND. 1967. Lymphosarcoma in a white-tailed deer. Bulletin of the Wildlife Disease Association 3: 38–39.

DREIZEN, S., K. B. MCCREDIE, M. J. KEATING, AND M. A. LUNA. 1983. Malignant gingival and skin "infiltrates" in adult leukemia. Oral Surgery, Oral Medicine and Oral Pathology 55: 572–579.

ELVESTAD, K., AND U. V. HENRIQUES. 1985. Leukaemic neoplasia in free-living mammals in Denmark. Acta Veterinaria Scandinavica 26: 61–71.

ENGLISH, A. W. 1985. Diseases of fallow deer in New South Wales, Australia. *In* Biology of deer production, P. F. Fennessy and K. R. Drew (eds.). The Royal Society of New Zealand Bulletin 22: 93–96.

FELDMAN, E. C. 1995. Disorders of the parathyroid glands. *In* Textbook of veterinary internal medicine, 4th Edition, Vol. 2, S. J. Ettinger and E. C. Feldman (eds.). W.B. Saunders, Co., pp. 1437–1465.

HANSEN, H. J., AND K. BORG. 1966. Leucosis in wild-living ruminants. *In* Comparative leukaemia research; Proceedings of an international Wenner-Gren symposium held in Stockholm, G. Winqvist (ed.). Pergamon Press, New York, New York, pp. 221–225.

JARPLID, B., AND C. REHBINDER. 1995. Lymphoma in reindeer (*Rangifer tarandus tarandus L.*) Rangifer 15: 37–38.

JENNINGS, A. R. 1968. Tumours of free-living wild mammals and birds in Great Britain. Symposium of the Zoological Society of London 24: 273–287.

KUMMENEJE, K., AND T. T. POPPE. 1978. A case of multiple cutaneous malignant lymphoma in reindeer, probably of immunologic-parasitic origin. Acta Veterinaria Scandinavica 19: 129–132.

LOMBARD, L. S., AND E. J. WITTE. 1959. Frequency and types of tumors in mammals and birds of the Philadelphia Zoological Garden. Cancer Research 19: 127–141.

MONTALI, R. J. 1980. An overview of tumors in zoo animals. *In* Comparative pathology of zoo animals, R. J. Montali and G. Migaki (eds.). Smithsonian Institution, Washington D.C., pp. 531–542.

MOULTON, J. E., AND J. W. HARVEY. 1990. Tumors of the lymphoid and hematopoietic tissues. *In* Tumors in domestic animals, 3rd Edition, J. E. Moulton (ed.). University of California Press, Berkeley, California, pp. 231–307.

SEAL, U. S., L. J. VERME, AND J. J. OZOGA. 1981. Physiologic values. *In* Diseases and parasites of white-tailed deer, W. R. Davidson, F. A. Hayes, V. F. Nettles and F. E. Kellog (eds.). Miscellaneous Publication No. 7. Tall Timbers Research Station, Tallahassee, Florida, pp. 17–34.

THURMOND, M. 1996. Bovine lymphosarcoma. *In* Large animal internal medicine, B. P. Smith (ed.). Mosby-Yearbook, Inc., St. Louis, Missouri, pp. 1237–1242.

———, C. A. HOLMBERG, AND J. P. PICANSO. 1985. Antibodies to bovine leukemia virus and presence of malignant lymphoma in slaughtered California dairy cattle. Journal of the National Cancer Institute 74: 711–714.

Received for publication 2 January 2002.