

RADIOGRAPHIC DIAGNOSIS: PULMONARY LYMPHOSARCOMA IN A GOAT

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Signalment

7-year-old, female, lactating, 55 kg French Alpine Goat.

History

Two weeks after giving birth, the left mammary gland became swollen and hard, with dramatically decreased milk production. The referring veterinarian sent milk samples to a diagnostic laboratory, from which *Nocardia asteroides* was isolated. The goat was treated with a course of intramammary cephalixin sodium. The *Nocardia* infection persisted 3 to 4 weeks postantibiotic treatment. A second therapeutic course with a combination of systemic ceftiofur sodium and intramammary cephalixin sodium was also unsuccessful in eliminating the infection. A third treatment with a course of procaine penicillin and milbemycin was implemented. The specific dose and frequency of all treatments were not specified. In milk samples taken following the final treatment, there was no growth of *Nocardia*. However, nodules were felt in the left mammary gland, which were assumed to be granulomas caused by chronic *Nocardia* infection. Neither biopsy nor fine-needle aspiration was performed at that time. The goat was referred to the North Carolina State Veterinary Teaching Hospital (NCSU-VTH) for possible mastectomy. The time between initial infection and presentation to the NCSU-VTH was 6 months.

Physical Findings, Initial Presentation

At the time of presentation, the goat was mildly febrile (39.8°C) and tachypneic (60 breaths per minute). Multiple masses were palpated in the left mammary gland. They ranged in size from approximately 3 to 15 mm in diameter. Mastitis was diagnosed based on a 2+ positive result on a California Mastitis Test (CMT) of the left mammary gland. The CMT of the right gland was normal. The CBC was unremarkable. Strongyle type ova were identified on fecal parasitology exam. A productive cough was noted. A trans-tracheal wash was performed. A Gram stain of the wash was performed in which *Nocardia* was not isolated, although a

Bacillus species was identified. The *Bacillus* species was considered insignificant.

Radiography/Radiographic Findings, Initial Presentation

Standing horizontal beam left-to-right (Fig. 1) and right-to-left lateral thoracic radiographs were made. An ill-defined nodular interstitial pattern was identified in the caudodorsal lung fields. There was an increased perihilar soft tissue opacity. There was slight elevation of the terminal trachea. There was also a generalized increased unstructured interstitial pattern. Evaluation of the cranial lung fields was difficult because of superimposition of the forelimb musculature.

Differential diagnostic considerations for the nodular interstitial pattern included granulomas secondary to bacterial, mycotic, or verminous pneumonia, pulmonary abscesses, nodular eosinophilic inflammatory disease, or primary or metastatic neoplasia. The perihilar opacity with tracheal elevation is consistent with tracheobronchial lymphadenopathy. The nodules and lymphadenopathy were thought to be consistent with granulomatous pneumonia secondary to mammary nocardiosis.

Considerations for the unstructured interstitial pattern included generalized pulmonary inflammation attributable to bronchopneumonia, pneumonitis (attributable to parasitism, viral, or bacterial infection), fibrosis from long-standing lung disease, or diffuse pulmonary metastasis. The interstitial pattern was thought to be a generalized inflammatory process related to the suspected pulmonary nocardiosis.

Treatment, Initial Presentation

Because of the radiographic pulmonary changes and the respiratory signs, the patient was given a poor prognosis, and the owner elected to not perform the mastectomy. Surgery was postponed indefinitely, and the goat was discharged with orders to be isolated from the herd and monitored by the owners. Penicillin was prescribed at 1,500,000 IU every 24 hours for 3 days for possible pneumonia secondary to pulmonary granulomas. The owner treated the goat with fenbendazole for possible lungworm (*Dictyocaulis* spp., *Parastrongylus* spp., *Muellerius* spp., etc.) infection.

Three months later, the goat returned to the NCSU-VTH for euthanasia and necropsy. Her clinical condition had deteriorated. The patient had chronic weight loss, diarrhea, and difficulty eating. In an attempt to alleviate the dyspha-

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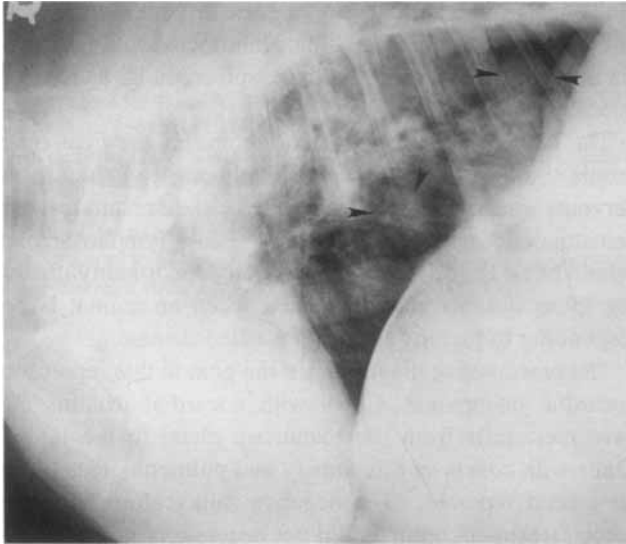


FIG. 1. Stranding left-to-right lateral view of the thorax of a goat with multicentric lymphosarcoma. An ill-defined nodular interstitial pattern can be seen (black arrowheads). There is a diffuse unstructured interstitial pattern. There is an increased perihilar soft tissue opacity corresponding to the location of the perihilar lymph nodes as well as slight elevation of the terminal trachea. Superimposition of the forelimb musculature obscures the cranioventral lung fields.

gia, the referring veterinarian had pulled several loose teeth 4 weeks after the goat returned home from the initial visit to NCSU-VTH.

Physical Examination, Second Presentation

The goat had diarrhea and an elevated rectal temperature of 40.4°C. She was eupnic, and there were no abnormal auscultatory findings. Her appetite and attitude were good. There were multiple loose teeth in the lower arcades. The sites of tooth extraction appeared infected. A firm hemispherical mass 1-cm in diameter was palpable on the ventromedial aspect of the rostral left mandible. Multiple nodules were palpable in the udder, primarily in the left gland.

Radiography/Radiographic Findings, Second Presentation

Left-to-right (Fig. 2) and right-to-left lateral thoracic radiographs were made with the animal in lateral recumbency. The ill-defined nodular interstitial pattern persisted in the caudodorsal lung fields and appeared essentially unchanged. There was persistence of the perihilar opacity. The elevation of the trachea was more apparent. There was a slight decrease of the unstructured interstitial opacity.

Differential diagnostic considerations for the radiographic findings did not change from the initial presentation. The nodules were felt to be consistent with persistent pulmonary granulomas from the mammary nocardiosis.

Left ventral 15° lateral-right dorsolateral oblique and right ventral 25° lateral-left dorsolateral projections of the

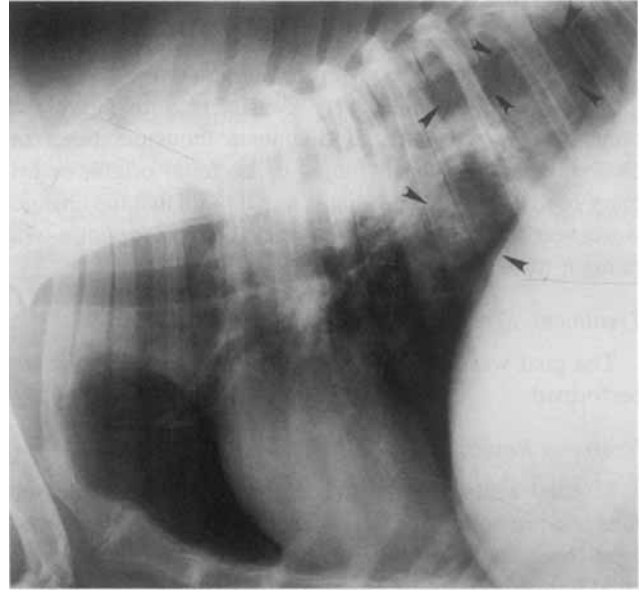


FIG. 2. Right-to-left lateral follow-up thoracic radiograph with the animal in left lateral recumbency. The nodular interstitial pattern persists (black arrowheads) as do the perihilar soft tissue opacity and elevation of the terminal trachea. The diffuse interstitial pattern persists but is not as marked as on first presentation. The cranioventral lung fields are visible in this view.

skull were made (a portion of the left ventral 15° lateral-right dorsolateral oblique view focusing on the relevant lesions is shown in Fig. 3). There was an ovoid aggressive, expansile decrease in bone opacity involving approximately 3 cm of the midbody of the left mandible. The lesion was characterized by marked osteolysis and cortical destruction. The lesion extended beyond the ventral cortex of the mandible, creating an exostosis on the ventral aspect of the bone. There were multiple punctate lucencies in the man-

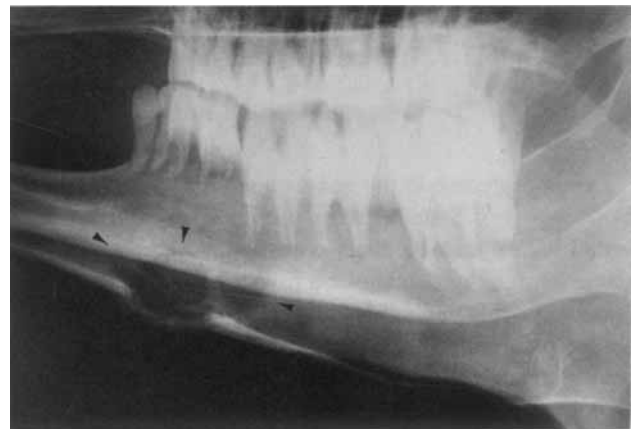


FIG. 3. Enlarged portion of left ventral 15 degrees lateral-right dorsolateral oblique skull radiographs. There is an ovoid expansile lesion involving the middle of the left horizontal mandibular ramus (black arrowheads). There are multiple punctate lucencies in the mandible caudal to this lesion.

dible caudal to the lesion. Multiple teeth were seen missing from the right mandible on the right ventral 20° lateral-left dorsolateral oblique view (image not shown).

The osseous changes were consistent with aggressive bone disease. Differential diagnostic considerations included: osteomyelitis of fungal or bacterial origin, or primary or metastatic neoplasia. It was thought that the changes were secondary to osteomyelitis. The oligodontia was thought to be iatrogenic based on patient history.

Treatment, Second Presentation

The goat was humanely euthanised, and a necropsy was performed.

Necropsy Results

Mottled white, brown, and red lungs that were diffusely firm and noncollapsible were identified grossly. The caudal lung lobes were more severely affected. The tracheobronchial lymph nodes were enlarged approximately 3 to 4 times normal size. The left mammary gland contained multiple abscesses. The supramammary lymph node was abscessed. The antimesenteric surface of the spleen had two locally extensive oval regions of the capsule that were soft, yellow, and thickened. The left mandible had a focal enlargement that was smooth in contour on the periosteal surface.

Microscopically, the changes seen involving the mammae and supramammary lymph nodes were characteristic of chronic granulomatous inflammation. Intralesional acid-fast bacteria were identified in the mammary tissue consistent with *Nocardia asteroides*, although organisms were not isolated from cultures of the purulent material.

Densely cellular infiltrates that were pleomorphic, round-to-oval, and had poikilocytosis were seen in the lung parenchyma, tracheobronchial lymph node, oral mucosa, splenic lesion, and right and left midshaft mandibles. The nuclei were mildly pleomorphic and vesicular. The cells were CD3-positive. These findings are most consistent with T-cell lymphoma.

Discussion

Lymphosarcoma in the goat is uncommon. A study from the New York State College of Veterinary Medicine reported identifying 10 goats with lymphosarcoma and one with a benign thymoma over a 6-year period.¹ The cases of lymphosarcoma included nine cases of multicentric lymphosarcoma and one of localized thymic lymphosarcoma. During this 6-year period, 458 goats were examined by the pathology department, indicating a 2.2% prevalence for lymphosarcoma.

In the few reports of goat lymphosarcoma, a wide variety of presentations and clinical signs are described.¹⁻⁵ The variety of clinical signs is thought to be attributable to the variable nature of tumor site and size.¹ The tumor site pre-

dilection is often similar to that seen in young cattle with bovine juvenile lymphosarcoma.¹ In affected cattle, neoplasia is generally found in the liver, spleen, lung, and lymph nodes.

The clinical signs of lymphosarcoma in the goat often mimic those of other diseases. Involvement of the central nervous, gastrointestinal, musculoskeletal, respiratory, or hematopoietic systems can occur.¹ Thus, lymphosarcoma should be on the differential list for any abnormality involving these systems and considered when an animal is not responding to therapy for the presumed disease.

The presumptive diagnosis for the goat in this report was nocardial pneumonia. Cows with nocardial mastitis can have metastasis from the mammary gland to the lungs.⁶ Goats with concurrent mammary and pulmonic nocardiosis have been reported.⁷ The negative milk culture after the second treatment regimen did not necessarily indicate a resolved infection. In nocardial infections, bacteria are shed intermittently, and false-negative milk cultures are common.⁸ Because of the nonspecific nature of a structured interstitial pattern,⁹ a distinction between granulomatous and neoplastic nodules/masses could not be made in this patient. In addition, the rarity of caprine lymphosarcoma made it a less likely differential diagnosis.

The importance of distinguishing lymphosarcoma from nocardiosis lies in the hazards for both herd health and public health created if nocardial mastitis and pneumonia become problems on a farm. *Nocardia* mastitis can cause economically significant losses in the goat herd because of repeated treatments and lost production.⁸ Treatment is generally unrewarding and culling is recommended. *Nocardia* can also cause pulmonary disease in humans that mimics tuberculosis. It can also cause subcutaneous abscesses in humans. Both goats and humans can acquire the infection from the environment and from contact with each other.¹⁰

The etiology of lymphosarcoma in goats is unknown. A viral agent similar to Bovine Leukosis Virus is possible. Lymphosarcoma has been successfully induced in a goat by inoculating it with sheep lymphocytes from cultures that produced bovine leukemia virus.⁵ The neoplasia developed 8 years after inoculation. It is unlikely that leukemia virus is a common cause of lymphosarcoma in goats. There is a similarity in site predilection of caprine lymphosarcoma to that of bovine juvenile leukemia.¹ The cause of bovine juvenile leukemia is unknown. There is no evidence to indicate that there is a common etiology between these two diseases, however their similarities may warrant an investigation into the possibility.

The prognosis for caprine lymphosarcoma is grave. Ten goats identified as having lymphosarcoma in one report died within 1 month of developing clinical signs, but only 1 to 2 weeks after their owners sought veterinary services.¹

REFERENCES

1. Craig R, Roth L, Smith MC. Lymphosarcoma in goats. *Comp Cont Ed* 1986;8:4:s190-s197.
2. Higgins RJ, Poole A, Wilson KE. Multicentric lymphosarcoma in a Saanen Goat. 1984;7:114:114-170.
3. de Silva LNA, Winter MH, Jackson PGG, Bostock DE. Lymphosarcoma involving the mandible in two goats. *Vet Record* 1985;117:276.
4. Baker JC, Sherman DM. Lymphosarcoma in a Nubian Goat. *Vet Med Small Anin Clin* 1982;77:4:557-559.
5. Olson C, Kettmann R, Burny A, Kaja R. Goat lymphosarcoma from bovine leukemia virus. *J Natl Cancer Inst* 1981;67:3:671-675.
6. Fraser CM, Bergeron JA, Mays A, Aiello SE, eds. *Merck veterinary manual*, 7th ed. Rahway, NJ: Merck & Co, 1991;362.
7. Megid J, Muller EE, Freitas JC, et al. *Nocardia asteroides* mastitis in goats. *Arquivo Brasileiro de Medicina Veterinaria e Zootecnia* 1990;42:545-547.
8. Lynch JA. Nocardiosis. In: Howard, JL. *Current veterinary therapy 3: Food animal practice*. Philadelphia: WB Saunders, 1993;521-522.
9. Lamb CR. The canine lung. In: Thrall, DE. *Textbook of veterinary diagnostic radiology*, 2nd ed. Philadelphia: WB Saunders, 1994;338.
10. Hungerford TG. *Diseases of livestock*, 9th ed. Sydney: McGraw-Hill, 1990;1332.