Canine Renal Extraskeletal Osteosarcoma

Presented by

Omar Hussein Khalaf
BVMS, MS, Ph.D.

Department of Pathology & Poultry Diseases
College of Veterinary Medicine, University of Baghdad

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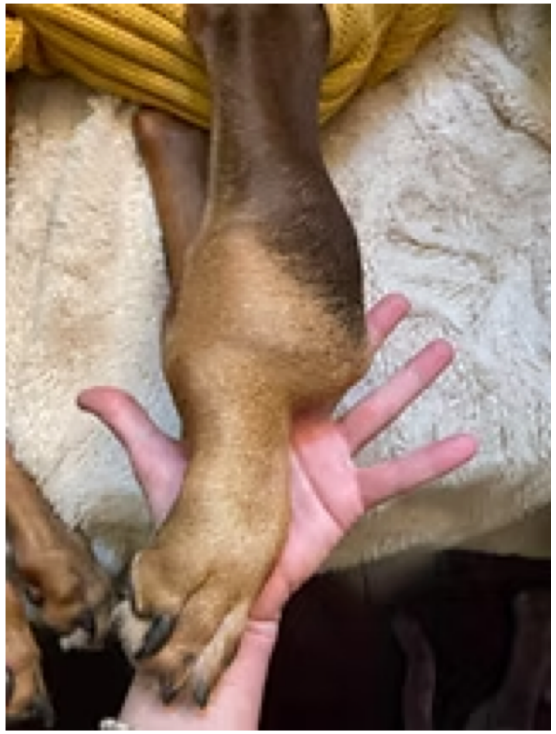
Overview

- Osteosarcoma (OSA) is one of the most common types of bone cancer in dogs, often diagnosed in large or giant breed dogs, such as Rottweilers, Great Danes, St. Bernards, and Golden Retrievers.
- The tumor commonly grows on the long bones of the forelimbs or hindlimbs, causing pain and lameness.
- Unfortunately, this is a very aggressive tumor and often metastasizes (spreads to the lungs) early in the disease. While there is no cure for OSA, there are treatment options to help delay the progression of the disease and alleviate pain.



Cause

- OSA is a malignant bone cancer formed from abnormal production of specific cells in bones that are intended to create and break down bone.
- As the tumor grows, it destroys normal bone and replaces it with cancerous bone, making the bone susceptible to breaking (pathologic fractures).
- The exact cause is unknown, but there is likely a genetic component, given the predisposition for certain breeds, particularly large-breed dogs.
- OSA is more common in older dogs around seven years of age, but a small subset of dogs may also develop OSA as young adolescents.

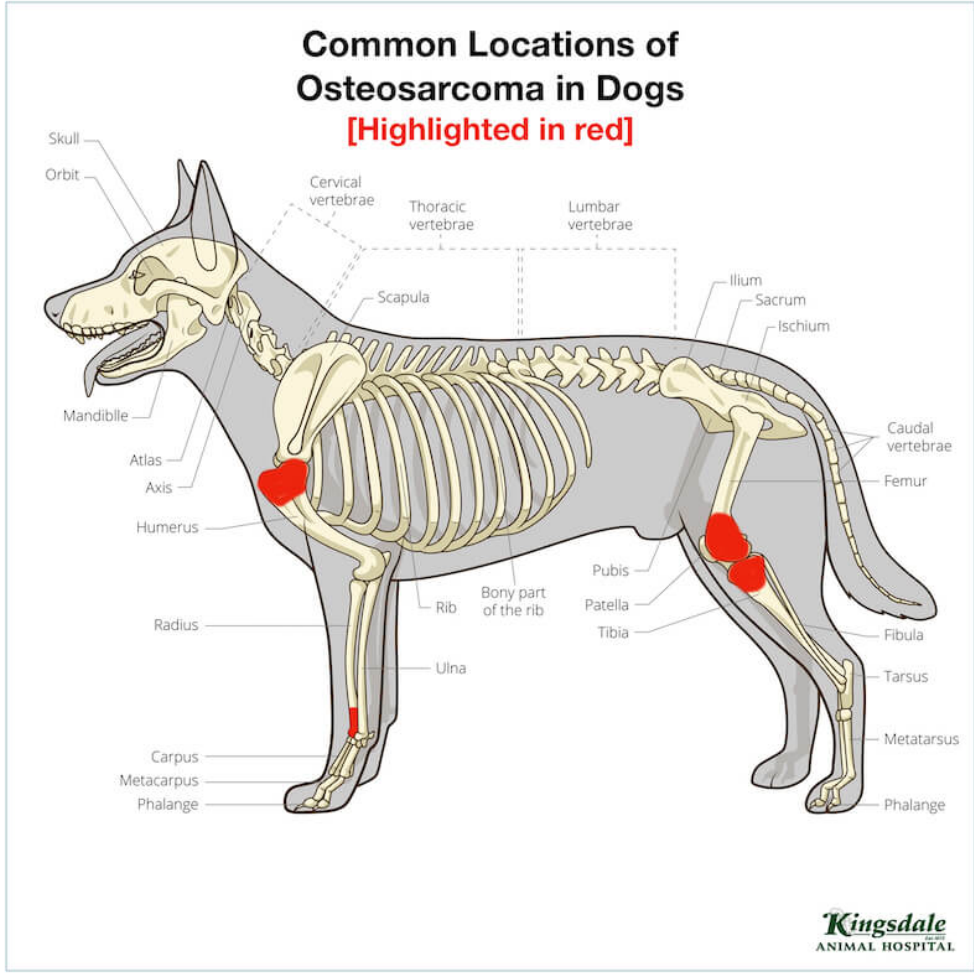
Cause

- While OSA commonly affects the forelimb or hindlimbs (appendicular OSA), less commonly, it can also occur on bones such as the jaw, rib, or pelvis (axial OSA). Axial OSA is less specific to large breed dogs and may be seen in smaller breeds.
- While less common, OSA has developed at the site of a previously healed fracture or chronic osteomyelitis (bone infection), in association with metallic implants, or after exposure to radiation therapy.
- **Rarely**, OSA can occur outside of the bone (extraskeletal OSA) and affect tissues like the mammary gland or other internal organs.

Clinical signs

OSA is often very painful. The most common signs of OSA may depend on the tumor location, often include:

- Lameness, or reluctance to walk.
- Firm, localized swelling, most commonly on the limbs.
- Loss of muscle mass to the affected limb.



Diagnosis

- A combination of history, physical exam findings, and X-rays (radiographs) of the affected limb or swelling are used to diagnose OSA. Radiographs of the tumor often show a characteristic appearance consistent with OSA.
- In some cases, a fine needle aspirate (FNA) or biopsy, which involves taking a sample from the tumor, may be recommended. A biopsy of the tumor is the only way to diagnose OSA definitively.
- Additional testing to determine your dog's overall health may be recommended, such as blood work, urinalysis, and chest radiographs to look for signs of metastasis (spread of disease).

Treatment

- Osteosarcoma treatment may depend on several factors, including tumor location and individual needs, but the main focus is pain management and your dog's quality of life. You may be referred to a veterinary oncology specialist.
- Unfortunately, there is no cure for osteosarcoma, but the best chance of extending time and quality of life includes multimodality therapy that involves: **Pain management, Surgery, Chemotherapy.**
- OSA often carries a poor prognosis as it tends to behave aggressively.

Outcome

- OSA often carries a poor prognosis as it tends to behave aggressively, and unfortunately, there is no cure.

- When surgery is combined with chemotherapy, the median survival time is about nine months, but individual dogs will vary in their response to treatment. Rechecks every 2-3 months may be recommended to monitor radiographs for metastasis. Unfortunately, even with multimodality therapy, metastasis to the lungs often occurs.

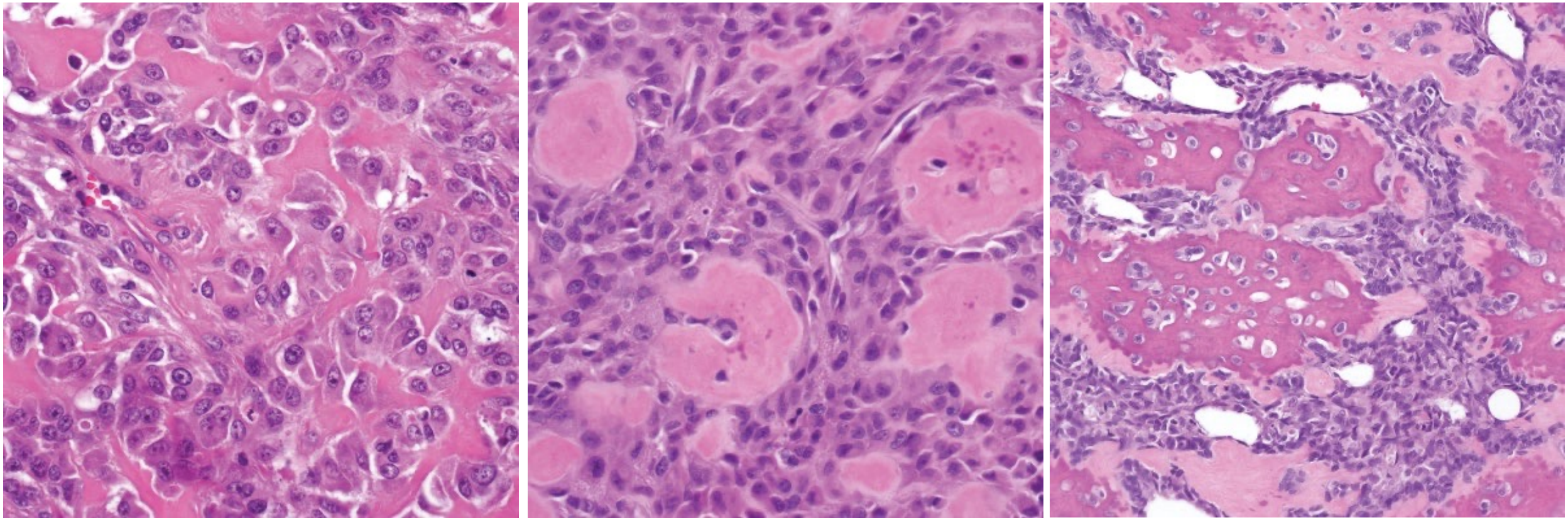
- Amputation without chemotherapy only serves as a form of pain management and fracture prevention but does not prevent the spread of cancer.

Gross and histopathological findings

Osteosarcoma of the distal femur in a 9-year-old golden retriever. The tumor is primarily lytic and has replaced most of the trabecular bone in the metaphysis. The cortex is eroded in some areas and there is extensive proliferation of reactive bone along the periosteal surface. (Image courtesy of D.W. Agnew and UC Davis.)

Osteosarcoma of the proximal humerus in a great Pyrenees dog. The tumor in this case is producing abundant matrix and has penetrated the cortex on the cranial aspect of the bone, forming a large mass of tumor tissue outside the bone surface. (Image courtesy of S.S. Couto and the School of Veterinary Medicine, UC Davis.)

Gross and histopathological findings



Some histological patterns of osteoid formation in osteosarcoma: **Left image**: Eosinophilic osteoid partly surrounding groups of well-differentiated malignant osteoblasts. **Middle image**: Irregular islands of osteoid surrounded by malignant osteoblasts in a productive osteoblastic osteosarcoma. **Right image**: Thick, irregular-shaped trabeculae of partly mineralized osteoid in a highly productive osteoblastic osteosarcoma. The spaces between these trabeculae of tumor bone are filled with tumor cells.

Our case today is canine renal extraskeletal osteosarcoma:

- **History:** An 11-year-old castrated male German Shepard dog was referred by his rDVM for a severely distended abdomen and a three-week history of not eating. In hospital computed tomography (CT) imaging revealed a left peritoneal mass on the cranial pole of the left kidney, so the dog was taken to surgery for mass removal. The dog recovered without complications and was discharged. The left kidney and renal mass were submitted for histopathologic evaluation.

- **Advanced Imaging:** A large, irregularly-shaped, soft tissue attenuating mass that measured 13.8cm x 13.9cm x20.4cm originated from the cranial aspect of the left kidney. Multifocally throughout the mass, there were variably sized, amorphous to wispy, mineral attenuating regions. The mass caused rightward deviation of the small intestines, portal vein, and cranial mesenteric artery with cranial displacement of the spleen.

Advanced Imaging (Pre- and postcontrast abdominal CT images):

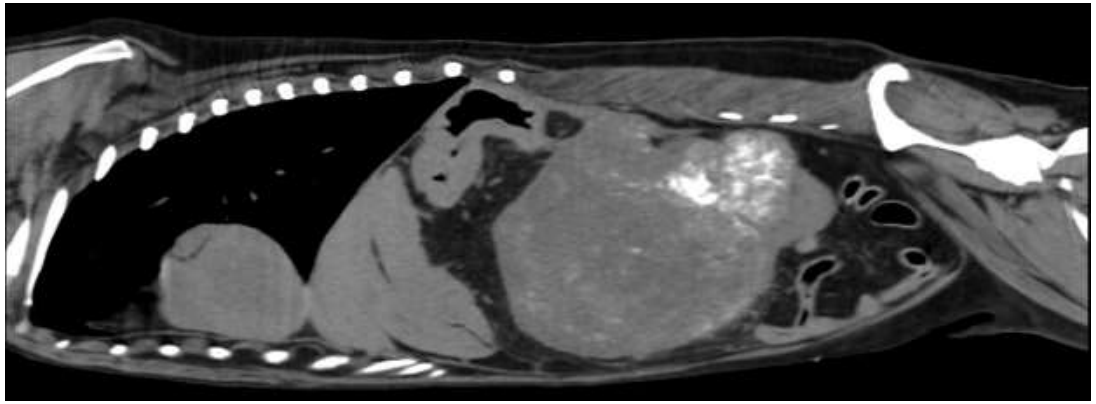


Figure 1. Pre-contrast sagittal image. There is a large heterogeneously soft tissue attenuating mass arising from the cranial pole of the left kidney. Note the multifocal mineral attenuating regions scattered throughout the mass.

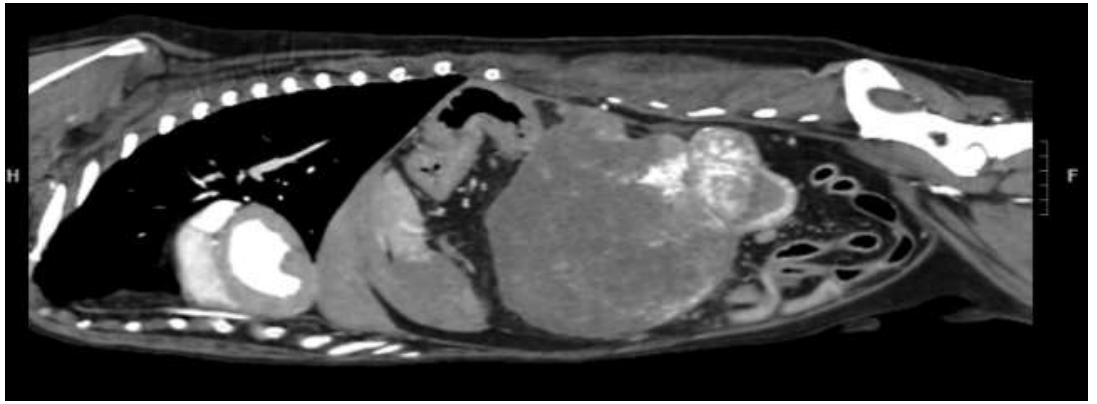


Figure 2. Post-contrast sagittal image. The large mass arising from the cranial pole of the left kidney displays heterogeneous and mild, primarily peripheral contrast enhancement.

Gross findings:

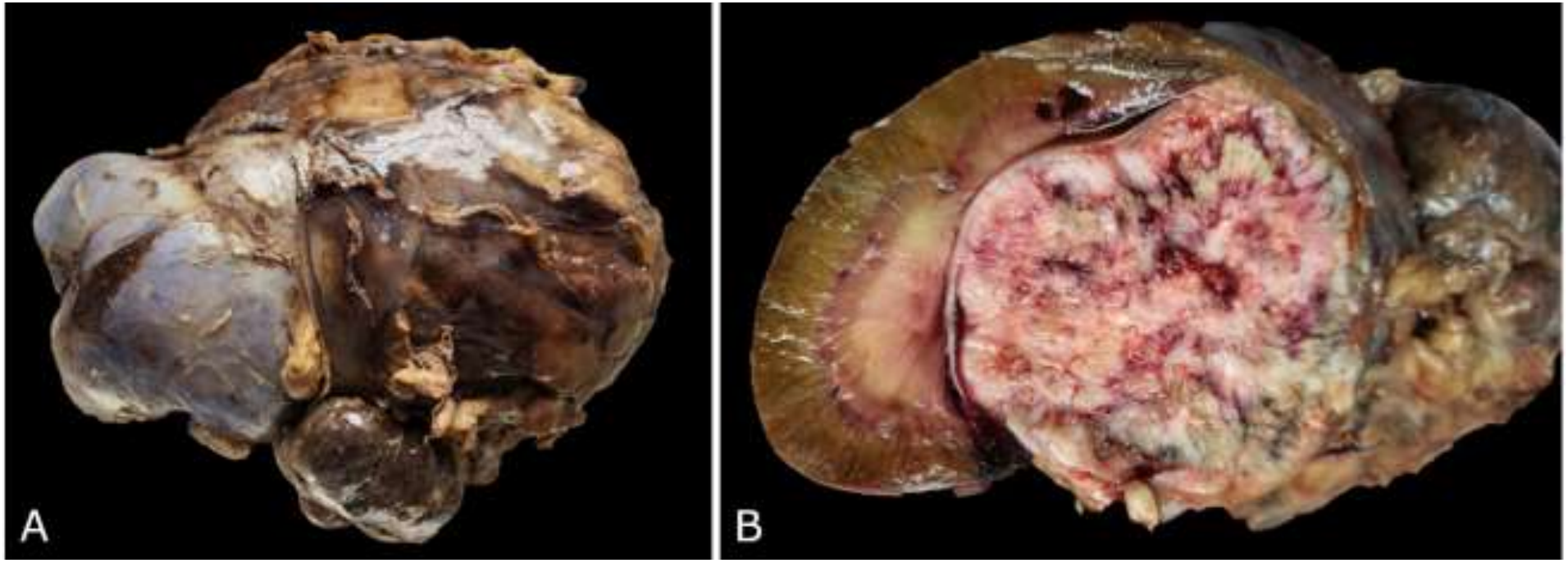


Figure 3. Left kidney, renal mass. **A:** Formalin-fixed tissue presented to biopsy. There is a large, firm, focal, well-demarcated, encapsulated, and multilobulated mass that expands the renal pelvis and compresses the medulla and cortex. **B:** Mass on cut surface. The mass is mottled white to tan to red to dark red with a gritty texture.

Histopathological findings:

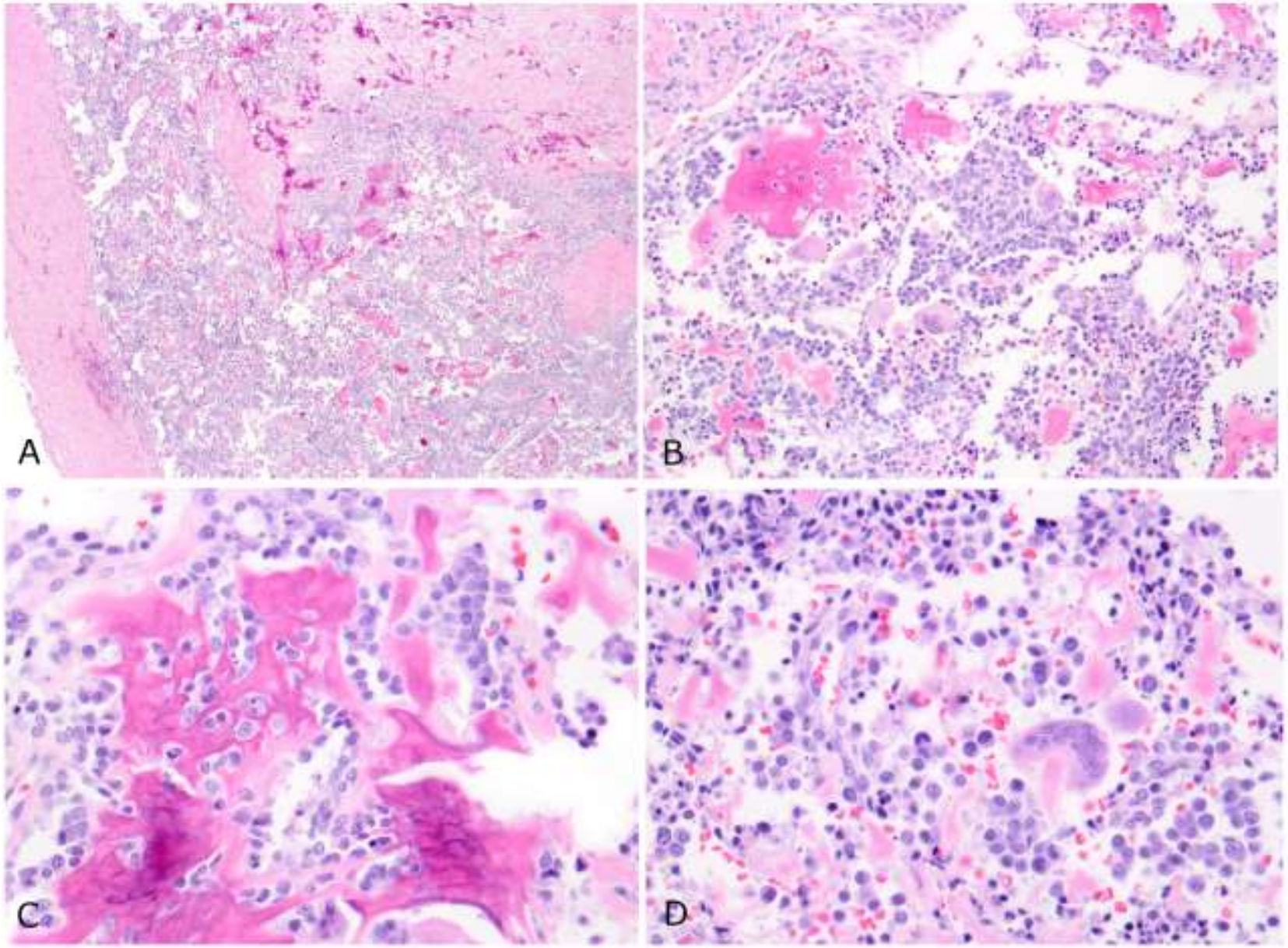


Figure 4. A: H&E, 2x**.** The left renal mass is encapsulated, and the center contains multiple clusters of immature trabecular bone.

B: H&E, 20x**.** Neoplastic spindle cells with multifocal large, multinucleated osteoclasts.

C: H&E, 40x. Neoplastic cells embedded within partially mineralized trabecular bone.

D: H&E, 40x. An isolated osteoclast engulfing osteoid matrix surrounded by the neoplastic cell population.

Diagnosis: *Renal extraskeletal osteosarcoma*

Discussion:

- Extraskeletal osteosarcomas are rare mesenchymal tumors that are poorly documented in both veterinary and human literature.
- Approximately 85% of canine bone tumors are classified as osteosarcomas, however only about 1% of osteosarcomas are characterized as extraskeletal.
- Extraskeletal osteosarcomas can arise from various tissues, with mammary tissue being the most common and well-documented and with the urinary tract being the most uncommon.
- These tumors are grow rapidly giving a poor prognosis. In regards to extraskeletal osteosarcomas of renal origin, the most common presenting clinical signs include a distended abdomen and hematuria.

- One report of extraskeletal osteosarcomas in 169 dogs noted a median survival time of 26 days and fatality as the result of local recurrence.
- One case study, albeit in a mammary extraskeletal osteosarcoma, reported that use of chemotherapeutics, namely cisplatin and doxorubicin, could extend the survival time, with the longest reported survival being 146 days.
- The rate and location of metastasis is variable, but tends to favor the lung and liver.
- Although not originating from bone, this mass was histologically consistent with an osteosarcoma, sharing classic features to axial osteosarcomas including neoplastic cells that produce and embed within hypereosinophilic osteoid matrix, irregular trabecular bone, and the presence of osteoclasts.

- The diagnosis is further supported by findings on advanced imaging. On computed tomography (CT), the mass was heterogeneously soft tissue attenuating with many random, wispy to amorphous mineral attenuating regions throughout it.
- These findings were very similar to a recent report of renal extraskeletal osteosarcoma in a dog.
- Neoplasia was considered most likely, and although rare, extraskeletal osteosarcoma was prioritized given the described imaging characteristics. Additional CT findings included multiple soft tissue attenuating pulmonary nodules in addition to abdominal and sternal lymphadenopathy, suggesting probable metastasis.

Finally:

- This was a striking case of an extraskeletal osteosarcoma arising from the left kidney in a dog. A few weeks after discharge, the patient was reportedly doing well at home with no obvious issues, however, more recent updates on the patient's status have not been received. For this case, advanced imaging in combination with histopathology were key in obtaining a definitive diagnosis.

Contributors:

Amelia Andersson [1]*, DVM; Kaylin McNulty [1], DVM, DACVP;
Leonard Jordan[2], DVM.
1. Department of Pathobiology and Population Medicine, Mississippi State University College of Veterinary Medicine

2. Department of Clinical Sciences, Mississippi State University College of Veterinary Medicine
*Corresponding Author: aia30@msstate.edu