Vertebral mass in a dog

Contributors

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Specimen

Impression smears from a lytic mass of the T1 spinous process

Signalment

A 9-year-old, spayed female Catahoula Leopard Hog

History

Progressive pelvic limb paresis progressing to nonambulatory state

Clinical findings

Neuroanatomical localization was consistent with a left-sided lesion at T3-L3. Radiographs showed an aggressive, monostotic, lesion with complete lysis of the T1 spinous process and laminae (Figure 1A). On MRI, an heterogeneous mass centered on and completely obliterating the T1 spinous process and pedicles also involved the dorsal laminae with invasion of the vertebral canal. The mass was heterogenous on both T1 and T2 weighted images with a dorsally located well demarcated, round, fluid cavitated region and moderate contrast enhancement, most notable peripherally. The mass caused circumferential attenuation of the subarachnoid fluid/epidural fat signal and moderate spinal cord compression (Figure 1 B-E). A primary bone neoplasm was suspected. Initial cytology was poorly cellular and a preliminary diagnosis with low confidence was rendered with recommendations for further sampling.

Palliative debulking of the mass from the lateral aspects of T2 and C7 revealed a mass surrounded by fibrous tissue with abundant haemorrhage (Figure 2). The dorsal aspect of the spinal cord at the level of T1 was visualized, the dura appeared normal, and the nuchal ligament remained intact. The

surgical site was closed and the mass was submitted for histopathologic evaluation and preparation of impression smears for cytology.

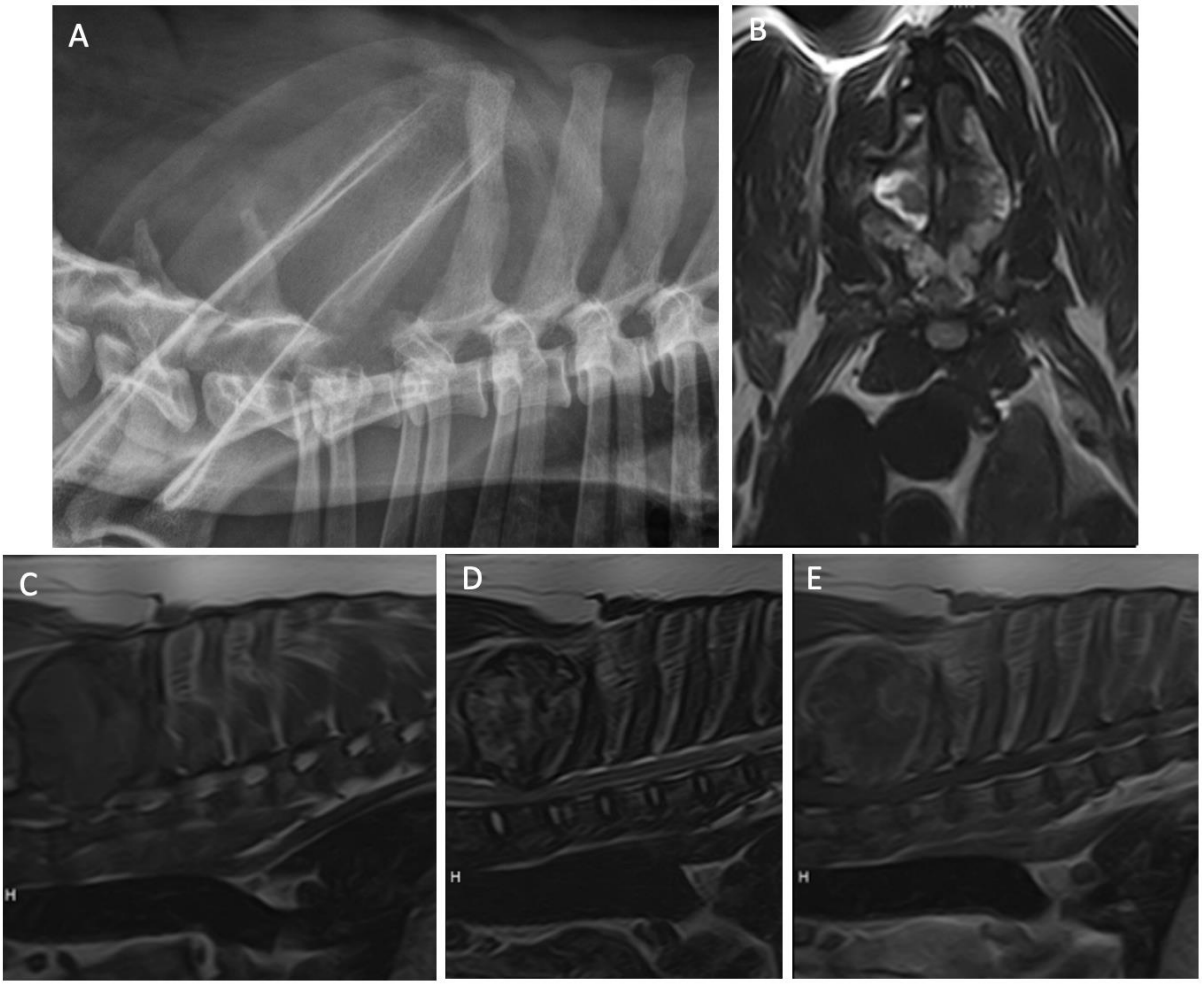

Figure 1. Thoracic Radiograph and Magnetic Resonance Imaging (MRI). (A) Right lateral radiographic projection: a collimated right lateral radiographic projection of the cranial thoracic vertebral column shows an aggressive, monostotic, lesion with complete lysis of the T1 spinous process and laminae. (B) MRI T2w image transverse (C) MRI T2w sagittal image of the cranial thoracic vertebral column show a heterogenous mass centered on and completely obliterating the T1 spinous process and pedicles with involvement of the dorsal laminae and invading the vertebral canal. (D) MRI T1w sagittal and (E) T1w sagittal post intravenous gadolinium contrast administration identified a moderate, predominately peripheral, contrast enhancement of the mass.

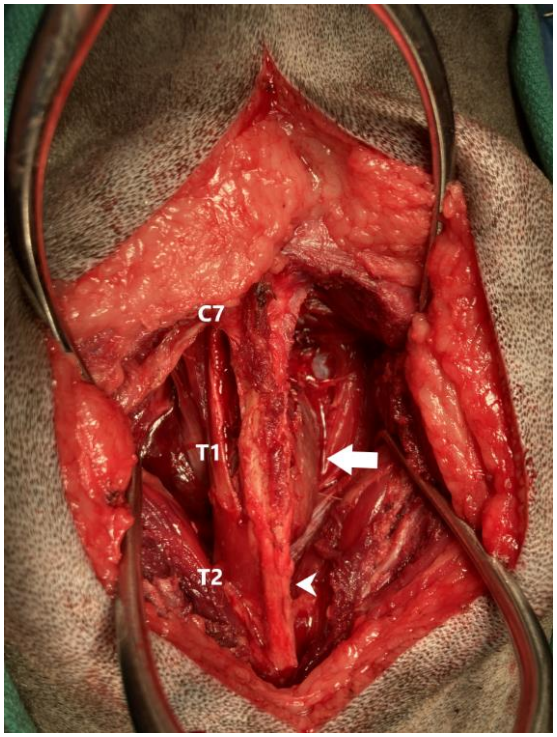

Figure 2. Dorsal view of dorsal laminectomy at the level of T1 with exposure of C7 and T2 with associated musculature dissected and retracted with Gelpis. The encapsulated mass at the level of T1 is indicated by the arrow. The nuchal ligament (still attached) is indicated by the arrowhead.

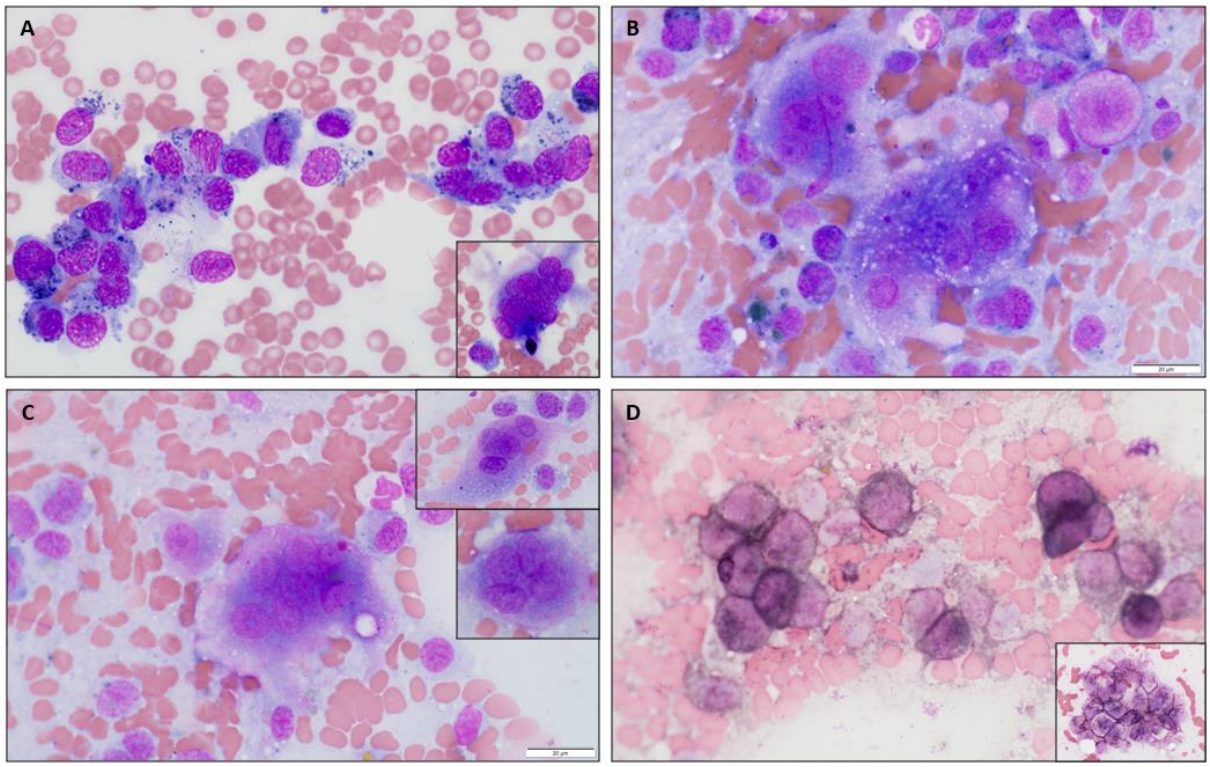

Figure 3. Fine needle aspirate and tissue imprint photomicrographs. (A): Tissue aspirate - atypical mesenchymal cells with an abundance of coarsely granular blue-green pigment with multi-nucleated mesenchymal cell (inset), x100 objective, Wright-Giemsa stain. (B): Tissue imprint - atypical mesenchymal cells with moderate to marked anisocytosis and anisokaryosis and multi-nucleation, x100 objective, Wright-Giemsa stain. (C): Tissue imprint - atypical mesenchymal cells with moderate to marked anisocytosis and anisokaryosis with frequent multi-nucleation (inset), x100x objective, Wright-Giemsa stain. (D): Positive staining uptake of alkaline phosphatase (ALP) with control liver (inset), x 100 objective (inset x50 objective), ALP stain.

Questions

What is your cytologic interpretation?
List your differential diagnoses.
What additional staining would establish a more specific interpretation?

Interpretation/Diagnosis

Sarcoma most consistent with telangiectatic osteosarcoma

Additional information

Highly cellular tissue imprints consisted predominantly of a population of atypical mesenchymal cells similar to those in the less cellular aspirates. Cells occurred individually and formed loose, disorganized aggregates. Cells were characterized by a moderate amount of pale basophilic to amphophilic cytoplasm with rare non-staining vacuoles and blue-green pigment consistent with hemosiderin. Nuclei measured 2-4x the diameter of an erythrocyte with open, stippled chromatin and 1-4 small, distinct, nucleoli. Bi-, tri-, and multi-nucleation were frequently observed along with many multinucleated mesenchymal cells (osteoclasts). Anisocytosis and anisokaryosis were moderate to marked with a moderate to high nucleocytoplasmic ratio. Erythrophagocytosis and hemosiderin was noted within macrophages as well as neoplastic cells. Cytologic interpretation was consistent with a mesenchymal neoplasm with osteosarcoma or hemangiosarcoma favored. ALP (5-bromo, 4-chloro, 3-indolyl phosphate/nitroblue tetrazolium (BCIP/NBT) cytochemical staining was positive, so a tentative diagnosis of telangiectatic osteosarcoma was made.

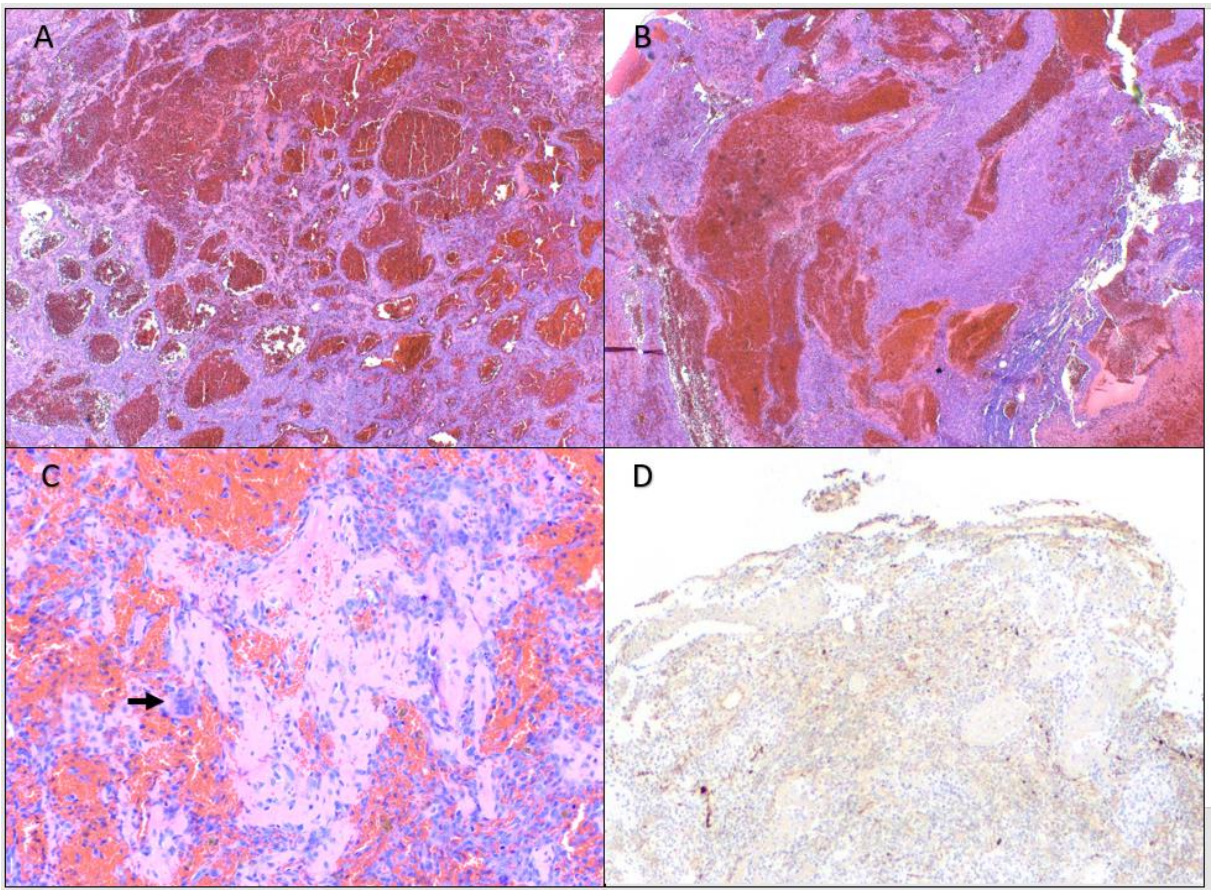

Figure 4. Photomicrographs of histopathologic tissue sections from T1 mass in a dog (case 1). Image A, H&E stain, x4 objective; Image B, H&E stain, x4 objective; Image C, H&E stain, x20 objective; Image D, FVIII immunohistochemistry, x4 objective. The low magnification images reveal numerous blood-filled spaces separated by bundles and streams of neoplastic cells and irregularly-shaped fragments of eosinophilic matrix (osteoid). The higher magnification image highlights the blood-filled spaces, osteoid deposition, neoplastic cell population, and a multinucleated cell consistent with a resident osteoblast (arrow). Factor VIII immunohistochemistry is negatively immunoreactive with the neoplastic cell population, but is strongly immunoreactive with endothelial cells. The presence of osteoid and the negative immunoreactivity of neoplastic cells with Factor VIII differentiate this telangiectatic osteosarcoma from hemangiosarcoma.

Follow up and clinical outcome

The patient was discharged two days post-operatively with persistent pelvic limb paraparesis but improved motor function. Post-operative recovery included analgesia and tapering anti-inflammatory dosages of steroids with a plan for physical therapy and neurologic function monitoring. The patient deteriorated and humane euthanasia without necropsy was elected due to poor quality of life about 2-weeks after discharge.

Discussion

Telangiectatic osteosarcoma is an uncommon form of osteosarcoma in dogs. Like hemangiosarcoma (HSA) of bone, it is characterized by large blood-filled spaces in bone and a radiologic evidence of aggressive bone lesions (Guiffrida 2018). Telangiectatic osteosarcoma and hemangiosarcoma share histologic features including destruction of cortical bone and the presence of neoplastic mesenchymal cells varying from spindle-shaped to polygonal with occasional non-staining vacuoles

(Meuten 2002). Histologic misclassification occurs and immunohistochemical confirmation of the diagnosis is recommended (Guiffrida 2016). Osseous hemangiosarcoma contains vascular spaces lined by atypical endothelial cells that are Factor VIII positive by immunohistochemistry (Giuffrida MA Comp Onc 2016). Telangiectatic osteosarcoma lesions contain blood filled spaces lined by malignant osteoblasts that stain negatively for Factor VIII and which produce osteoid, which is a distinguishing feature of the two tumors (Meuten 2002). If minimal osteoid is present it may be difficult to histologically distinguish osteosarcoma from other primary bone sarcomas in dogs (Guiffrida 2016, Barger 2022). Immunohistochemical staining of formalin fixed tissues for ALP and runx3 in series has been suggested to be 87% sensitive and 85% specific for osteosarcoma in one study of primary bone tumors in dogs (Barger 2022).

Cytologic characteristics of telangiectatic osteosarcoma have rarely been reported and lack detail (Barmettler 2009). For OSA in general, several studies describe very good correlation between the cytologic and histologic diagnosis of osteosarcoma, competitive with incisional biopsy results (Sabbatini 2017, Neihaus 2011, Berzina 2008, Britt 2008). Cytologic criteria for the diagnosis compared with reactive bone have been described (Reinhardt 2005). The ability to distinguish osteosarcoma from other sarcomas of bone is further enhanced using BCIP/NBT cytochemical staining of cytology smears for ALP (Barger 2005, Ryseff 2012, Polak 2020). It is important to scrupulously demonstrate that the neoplastic cells are staining because the stain does not discriminate between benign and malignant cells of bone origin. BCIP/NBT staining for ALP cannot be performed on formalin fixed tissues and current immunohistochemical options may perform less well in accurate identification of bone origin cells (Barger 2022).

General advantages of cytology include relative non-invasiveness and rapid turnaround, including the potential for intraoperative results. Recently, potential subcutaneous seeding from a fine-needle aspiration of an axial osteosarcoma was reported in a dog, but this appears to be extremely uncommon (Faletti 2022). Cytologic diagnoses from bone samples correlate highly with excisional biopsy, with the main discordance being false negative results; false positives are extremely rare (Sabbatini 2017, Neihaus 2011, Berzina 2008, Britt 2008). Our case demonstrates the potential for accuracy of cytologic diagnosis for this uncommon variant of osteosarcoma that may be confused with bone hemangiosarcoma clinically and histologically.

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