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Case Report

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Pseudopathologic Vertebral Marrow Enhancement Mimicking Osseous Metastases

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Abstract

Pseudopathologic vertebral marrow enhancement mimicking osseous metastases is rare. We report a case of a 63-year-old woman with retroperitoneal liposarcoma who presented with waxing and waning sclerotic appearing lesions in the cervicothoracic spine on CT, which resembled osseous metastases. Extensive review of multiple prior exams and protocols demonstrated that the sclerotic lesions were only apparent on CT exams that utilized injection of contrast via the left upper extremity, and these exams also demonstrated collateral contrast opacification of the vertebral venous plexus that was not otherwise visualized. This unusual pattern of enhancement suggested a vascular etiology was more likely to explain the imaging findings. Attention to the vasculature demonstrated hemodynamically significant left brachiocephalic vein stenosis, possibly related to the patient's chest port catheter placed via the left internal jugular vein. Analysis of in-phase and opposed-phase signal differences using paired gradient echo sequences on MR cervical spine demonstrated significant signal drop out within the osseous lesions. These signal intensity findings more likely reflect a benign process rather than the marrow replacement seen in malignant lesions. The diagnosis was determined to be benign vertebral marrow enhancement related to venous collaterals in the setting of central venous stenosis.

Keywords

Vetebral marrow enhancement , Osteosclerotic metastasis

Case Report

A 63-year-old woman with dedifferentiated retroperitoneal liposarcoma presented for restaging evaluation by CT. Her oncologic history was complicated by locoregional and nodal recurrence after surgical resection, for which she continued on chemotherapy. Surveillance imaging demonstrated rapid development of cervical and thoracic vertebral body sclerotic lesions for which a presumptive diagnosis of osseous metastases was considered given her oncologic history. This was not accompanied by any related symptoms of back pain or radiculopathy. Over multiple CT examinations, these sclerotic lesions appeared to wax and wane without any additional interval therapy (Figure 1). A follow-up MR examination of the cervical spine did not demonstrate signal abnormalities such as T1 hypointensity or contrast enhancement associated with osseous metastases. Furthermore, a nuclear medicine bone scan did not demonstrate radiotracer uptake (Figure 2) in the region of the sclerotic lesions seen on CT.

The unusual waxing and waning appearance on multiple interval surveillance examinations prompted the consideration of a vascular etiology and contrast enhancement. Extensive review of prior CT imaging and protocols demonstrated

that the osteosclerotic lesions were only apparent on exams that utilized injection of contrast via the left upper extremity. Additionally, these exams also demonstrated opacification of collateral vertebral venous plexus (Figure 3). Exams with injection via right upper extremity demonstrated normal vertebral bodies and did not show opacification of the vertebral venous plexus. This suggested that the visualized sclerotic lesions most likely reflected contrast enhancement of the marrow. This was further supported by the finding of hemodynamically significant stenosis of the left brachiocephalic vein (Figure 4), possibly related to patient's long-standing left internal jugular vein chest port catheter. Therefore, the most plausible diagnosis appeared to be benign enhancement of vertebral marrow in the setting of flow-limiting central venous stenosis, only apparent with left-sided contrast injection technique.

Other differential considerations included primary osseous neoplasms and leukemia/lymphoma, which were deemed unlikely due to lack of imaging findings characteristic of osseous neoplasms, absence of lymphadenopathy, and normal biomarkers. Infection and inflammation were considered unlikely given normal white blood cell count and inflammatory markers and lack of fever. Intraosseous venous vascular malformations or hemangiomas would not be expected to appear in between surveillance exams. Bone infarct was not likely based on lack of reported trauma or vasculopathy and absence of characteristic signal abnormalities on MR.

Given the patient's oncologic history, it was imperative to confidently exclude the possibility of metastatic disease. Further characterization of the lesions was performed via analysis of paired gradient echo sequences from the prior MR cervical spine. This assessment revealed appropriate signal drop out between in-phase (IP) and opposed-phase (OP) imaging further confirming normal marrow signal, i.e., lack of pathologic marrow infiltration. For instance, the T2 vertebral body lesion demonstrated significant IP and OP signal differences with a signal drop out of 532 to 227 units within a region of interest, and a signal intensity ratio (OP/IP) of 0.43 (Figure 5). Overall, it was established that no abnormal marrow replacement had occurred, supporting the diagnosis of benign bone marrow enhancement.

Pseudopathologic marrow enhancement mimicking osteosclerotic metastasis has been described in the setting of central venous stenosis. In a case series and a separate case report describing patients with superior vena cava thrombosis, marrow enhancement was proposed to be secondary to venous collateralization with reflux of contrast into the vertebral venous plexus [1,2]. In another case report depicting a patient with superior vena cava thrombosis, it was postulated that a sufficiently high venous pressure can allow opacification of intravertebral veins and capillary spaces, resulting in patchy increase in vertebral density [3]. Meanwhile, it was noted that the vertebral density appeared normal on non-enhanced CT of the same patient. Marrow enhancement has similarly been reported in a patient with bilateral brachiocephalic vein thrombosis [4]. Pseudopathologic brain parenchymal enhancement has even been reported in a patient with left upper extremity contrast injection in the setting of left brachiocephalic vein narrowing [5]. An understanding of contrast

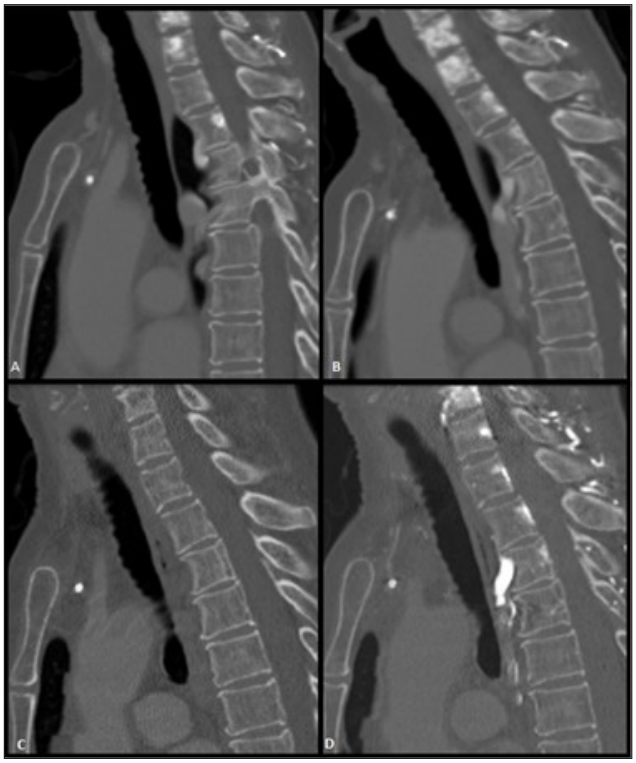


Figure 1: Chest CT sagittal views of the cervicothoracic spine demonstrating waxing and waning lesions over an 8-month time period. A,B,C,D are separated by 2– 3 months in chronological order.



Figure 2: Nuclear medicine bone scan with anterior and posterior views of the spine demonstrating lack of suspicious radiotracer uptake.

opacification of collateral veins and relationship to injection laterality can greatly assist in interpretation of appearing and disappearing CT findings. In our patient with left brachio-

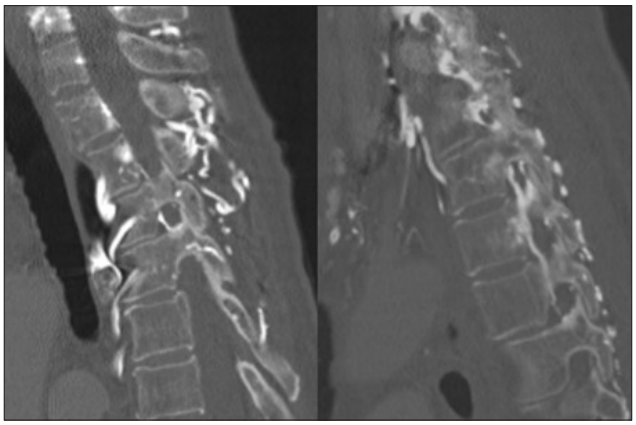


Figure 3: Chest CT sagittal image of the cervicothoracic spine on a contrast-enhanced examination with left upper extremity contrast injection demonstrating vertebral venous plexus enhancement.



Figure 4: Chest CT coronal oblique maximum intensity projection image demonstrating left brachiocephalic vein stenosis and resultant contrast opacification of venous collaterals in the neck. The patient's left internal jugular vein port catheter is not visible here.

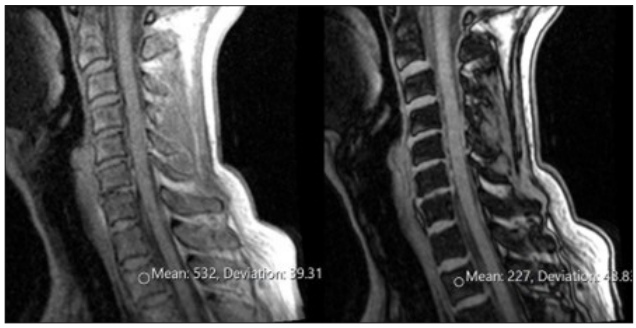


Figure 5: Cervical spine MR paired gradient echo sequences (in-phase and opposed-phase) with signal intensity measured within region of interest (ROI) in the T2 vertebral body.

cephalic vein stenosis, the vertebral body enhancement only occurred with left-sided injection, not with right-sided injection. If confirmation is necessary, MR spine with in-phase and opposed-phase sequences can be obtained. In a study of patients with benign and malignant vertebral fractures, a signal intensity ratio less than 0.80 was defined as a benign result [6].

The diagnosis was determined to be benign bone marrow enhancement—via contrast opacification of venous collaterals secondary to central venous stenosis—mimicking osseous metastasis. Arriving at this diagnosis required extensive review of prior imaging with careful consideration of protocols and pathophysiology.

Conflict of Interest

None.

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