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## The Radiologic Diagnosis and Treatment of Typical and Atypical Bone Hemangiomas: Current Status

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Hemangioma is the most common angiomatous lesion of the bone. Hemangiomas usually are discovered incidentally with patients who are asymptomatic [1] and are seen in 11% of a large postmortem series [2]. Hemangiomas usually are seen in the fourth and fifth decades of life, with men twice as likely to be affected [1]. A diagnosis is often straightforward with typical plain radiographic, computed tomographic (CT), and magnetic resonance imaging (MRI) findings. However, the diagnosis may occasionally be challenging, with hemangiomas displaying a variety of atypical appearances and may be mistaken for an aggressive lesion, which may require further imaging, biopsy, or surgical excision. Knowledge of the more common unusual appearances of hemangiomas can help improve diagnostic confidence and potentially avoid percutaneous biopsies and patient and clinician anxiety. We also discuss the role of interventional radiology in performing a biopsy of atypical lesions as well as treating lesions with selective embolization and vertebroplasty.

### Histopathologic Appearance of Bone Hemangioma

Hemangioma is a benign vascular neoplasm that closely resembles normal vessels [3] of dysembryogenic origin or that represents a hamartomatous lesion [4]. Hemangiomas are

classified pathologically by the predominant type of vascular channel (capillary, cavernous, arteriovenous, venous, or mixed) [1,4]. It usually displays well-differentiated blood vessels of different sizes [5]. Cavernous hemangiomas are characterized by large, closely clustered dilated blood vessels, not separated by normal bone tissue. Capillary hemangioma, however, displays thin-walled capillaries of different sizes, separated by normal bone tissue or stroma [4]. Cavernous hemangiomas are most common, with capillary hemangiomas being the rarest form [5]. Nonvascular components also can be seen, including fat, smooth muscle, fibrous tissue, bone, hemosiderin, and thrombus. Fat overgrowth is a reactive phenomenon as opposed to a true neoplastic component [1].

### Typical Locations of Bone Hemangioma

Bone hemangiomas are often seen in the spine (30%–50%) and calvaria (20%). [1,6]. The majority of lesions seen in the spine involve the vertebral body [3]. Vertebral hemangiomas are most commonly found in the thoracic spine with multiple hemangiomas seen in up to 30% of cases [2,7–9]. Other less common sites include the tibia, femur, and humerus. [1].

### Typical Imaging Appearance of Vertebral Hemangioma

#### Plain Radiographs

On plain radiographs (Figure 1), these lesions typically appear as lucent medullary lesions [10] that display a course,

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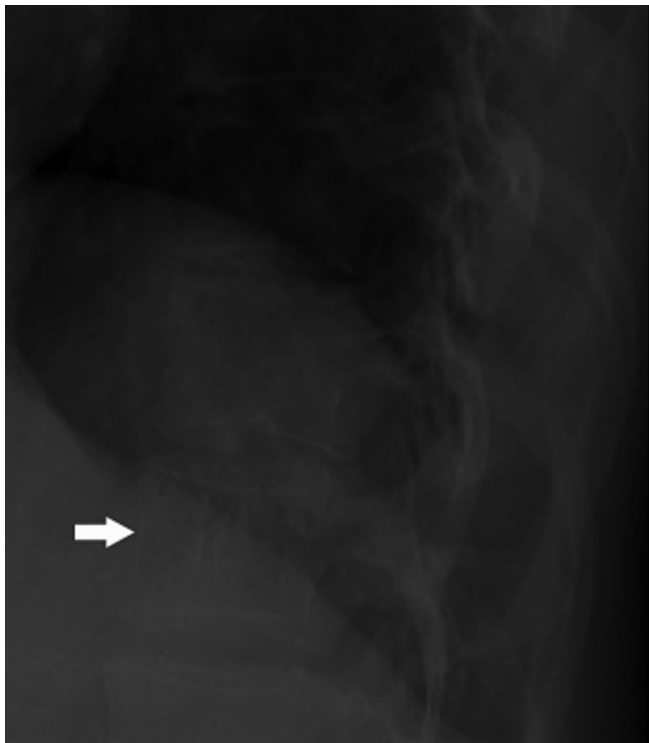


Figure 1. A 75-year-old man presented with lower back pain after a mechanical fall. Thoracic spine radiographs in the lateral projection, showing a typical hemangioma (arrow) at the T12 vertebral body with classic corduroy appearances.

vertical trabecular pattern with bony reinforcement (trabecular thickening) adjacent to vascular channels that caused bony resorption [11] of horizontal trabeculae [6]. This bony stress response has been likened to the appearance of corduroy [1]. A coarse “honeycomb” appearance also can be seen and is more common in the cavernous subtype of hemangiomas [4].

### CT

On CT imaging, the thickened trabeculae of a typical vertebral hemangioma (Figure 2) appears as small punctate

areas of sclerosis, likened to the polka-dot appearance on CT [1]. Vertebral hemangiomas usually are small [3] and involve only a portion of the vertebral body, although the entire vertebral body can be involved [1].

### MRI

On MRI, vertebral hemangiomas (Figure 3, A and B) are typically hyperintense on T1- and T2-weighted series due to the presence of adipose tissue [3] and vascular components, respectively [12]. The areas of trabecular thickening in a typical spinal hemangioma appear as hypointense foci [1] on both T1 and T2. The coarse vertical trabeculae resemble a corduroy or honeycomb appearance on plain radiographs [13]. The typical appearances of vertebral hemangiomas on cross-sectional imaging usually characterize the cavernous histologic subtype detailed above [10]. These well-circumscribed lesions may be hyperintense or hypointense on short tau inversion recovery, depending on the proportion of fatty and vascular elements. No restricted diffusion is seen in typical hemangioma [14]. In addition, hemangiomas typically demonstrate a mean (SD) decrease in signal intensity ( $49.4\% \pm 20.0\%$ ) on the out-of-phase compared with the in-phase imaging [15] (Figure 3, C and D). After contrast administration, CT or MRI will demonstrate enhancement [1], given the vascular component of these lesions [13].

### Nuclear Medicine

Bone hemangioma shows a variable appearance on bone and red-cell-labelled scintigraphy, which range from photopenic (Figure 4, A and D) to moderately increased activity [16,17]. Its photopenic appearance can cause a diagnostic dilemma for patients with skeletal lytic metastatic disease. Hemangiomas in bone also can show increased technetium 99m red blood cell studies [18]. With fluorodeoxyglucose positron emission tomography–CT examinations, hemangioma (Figure 5) is one of the causes of a “cold” vertebrae [19]. Bone hemangioma can mimic metastatic disease in whole

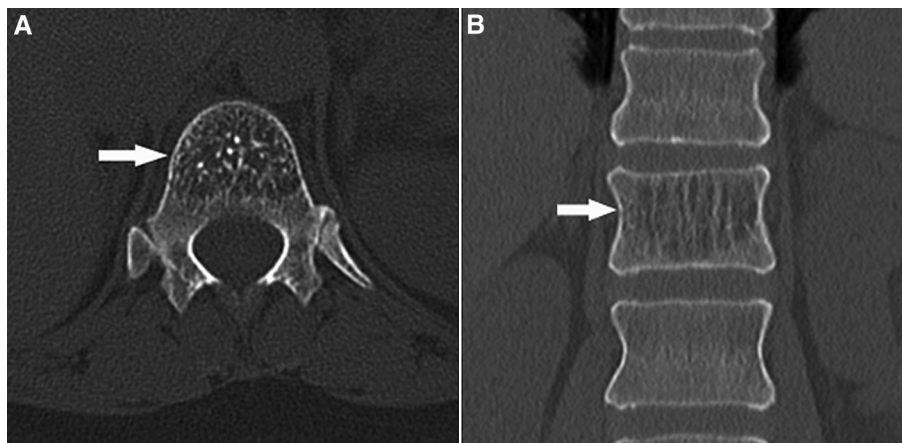


Figure 2. (A, B) A 45-year-old man presented with renal colic underwent a non contrast computed tomography of the abdomen, showing an incidental hemangioma at the L1 vertebral body, with characteristic polka dot (arrow in A) and corduroy and/or honeycomb appearance (arrow in B).

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