Atypical Vertebral Haemangiomas: A Pictorial and Literature Review

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Purpose

Haemangioma is a common benign vasoformative neoplasm or developmental condition of endothelial origin that closely resembles normal vessels and can be found in all organs of the human body.

Osseous haemangiomas are usually discovered incidentally in asymptomatic patients and are particularly common in the spine and calvaria. Typical vertebral haemangiomas are a relatively frequent incidental finding and easily identifiable on different imaging modalities. Atypical or aggressive vertebral haemangiomas have been described with different histopathological findings and non classical imaging appearances. They therefore represent a diagnostic dilemma due to these imaging findings that may have local 'aggressive' or 'atypical' features with resultant symptomatology.

We aim to present a pictorial review of some of the atypical vs classical vertebral haemangioma imaging findings correlating with recent literature review.

Methods and Materials

We provide a pictorial review of some of the atypical vs classical vertebral haemangioma imaging findings correlating with recent literature review.

Results

Virchow, in 1867 was the first to describe a vertebral haemangioma whilst Perman, in 1926 noted the radiological appearances. In large autopsy series, Schmorl in 1927, Topferin in 1928, and Junghanns in 1932 found that haemangiomas were present in about 11% of spines. This accounts for 28% of all skeletal haemangiomas, with the most common location being the lower thoracic spine. These lesions generally involve only a portion of the vertebral body and are multiple in one third of the cases. It has been stated that up to one third of the vertebral body must be involved for the classic findings to be present. Involvement of the entire vertebral body and extension into the posterior elements is rare \((\text{Fig. 1 on page 5 and Fig. 2 on page 6})\).

Macroscopically, haemangioma manifests as a soft, well-demarcated, dark red mass. It may also have a honeycomb appearance with intrallesional sclerotic bone trabeculae.
and scattered blood filled cavities. This may in part explain the plain film and computer tomography (CT) findings.

On radiographs, vertebral haemangiomas classically have a coarse, vertical, trabecular pattern, with osseous reinforcement (trabecular thickening) classically described as 'jailhouse striations'. Vertebral fractures at the site of haemangiomas are rare because of this trabecular reinforcement.

On CT scan, the thickened trabeculae are seen in cross section as small punctuate areas of sclerosis, often called the 'polka-dot appearance', 'spikes of bone', 'jailbar', 'corduroy cloth', 'honeycomb' and 'salt and pepper' (Fig. 3 on page 7).

Haemangiomas have variable histological features. Microscopically, haemangiomas can be divided into 4 types: capillary, cavernous, arteriovenous (AV), and venous. In bone, the capillary and cavernous types are more commonly found. Capillary and cavernous haemangiomas are composed of thin walled, blood filled vessels lined by a single layer of flat, cytologically banal endothelial cells. The vessels permeate the marrow and surround pre-existing trabeculae. The signal intensity of typical vertebral haemangiomas is high signal intensity on both T1 and T2 weighted images. The shortened T1 relaxation time reflects the fatty component of the tumours. Because fat shows high signal intensity on T2 weighted sequences, they remain hyperintense on this sequence. The vascular components may also explain the very high signal intensity on T2 weighted images. Depending on the balance of fat and vascular elements, they may or may not be hyperintense on STIR images (Fig. 4 on page 8).

A haemangioma may also include smooth muscle, fibrous tissue, bone, haemosiderin, and thrombus giving further different signal characteristics on MRI. Interestingly, MRI of spinal cavernous haemangiomas are not always characteristic. In most cases, the T1-weighted images of spinal cavernous haemangioma reveal a homogenous signal intensity similar to that of the spinal cord and muscle, whereas on T2-weighted images, the signal of the lesion is consistently high. Frequently, the lesion is characterised by its extension into the intervertebral foramen. The rim of hypointensity resulting from haemosiderin deposits, seen in intramedullary cavernous haemangioma, is not seen in epidural cavernous haemangioma.

Atypical haemangioma such as epithelioid haemangioma is composed of large polyhedral neoplastic endothelial cells that have vesicular nuclei and abundant eosinophilic cytoplasm. Some tumour cells have round clear cytoplasmic vacuoles that may contain intact or fragments of red blood cells. Vacuoles in neighbouring cells often fuse forming vascular lumen. The epithelioid cells may line well formed vascular spaces or grow in solid cords or sheets. The stroma consists of loose connective tissue
and may contain a mixed inflammatory infiltrate including eosinophils. Other atypical haemangioma such as epithelioid haemangioendothelioma may also demonstrate a heterogeneous pattern with mixed signal intensity on T1- and T2-weighted MR images that reflects the absence of fat and the presence of inflammatory infiltrate. The magnetic resonance imaging (MRI) features of vascular malformations therefore depend on the pathologic subtype (Fig. 5 on page 9).

In radiologic evaluation of vertebral haemangiomas, Laredo et al described radiographic criteria seen significantly more often in cases of compressive (atypical) vertebral haemangioma than of asymptomatic vertebral haemangioma. These criteria are thoracic location (T3-9 vertebrae especially); involvement of the entire vertebral body; involvement of the neural arch (particularly pedicles); an irregular, honeycomb appearance; expanded and poorly defined cortex; and swelling of the soft tissue. A case of atypical haemangioma within the sacrum highlights not only the unusual site of the lesion but also the expanded cortex (Fig. 6 on page 9, Fig. 7 on page 10 and Fig. 8 on page 11).

Several features of atypical haemangiomas are highlighted in a case of a 60 year old Caucasian man being investigated for possible renal cell metastases. He had an abnormal CXR (Fig. 9 on page 12 demonstrating a large right paravertebral mass. Subsequent CT and MRI findings demonstrated a likely atypical haemangioma within T4 vertebral body extending to the neural arch and right pedicle with extra osseous soft tissue extension (Fig. 10 on page 13, Fig. 11 on page 14, Fig. 12 on page 15, Fig. 13 on page 16 and Fig. 14 on page 17). The patient had no neurological symptoms but underwent expectant decompressive T4 laminectomy and partial resection of the lesion. Tissue diagnosis confirmed a benign vasoformative lesion with a few vascular channels showing papillary endothelial hyperplasia consistent with haemangioma. Follow up imaging showed recurrence of the lesion (Fig. 15 on page 18) and the patient underwent further thoracotomy.

Vertebral haemangiomas rarely cause neurologic symptoms that are attributable to spinal cord compression. At least 3 mechanisms of spinal cord compromise and nerve root compression have been suggested: (1) hypertrophy or ballooning of the posterior cortex of the vertebral body caused by the angioma, (2) extension of the angioma through the cortex into the epidural space, and (3) compression fracture of the involved vertebra.
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<td>Number</td>
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**Table 1:** Table highlighting differences of typical vs atypical haemangioma.

**References:** Clinical Radiology, Brighton and Sussex University Hospital - Brighton/UK

Table 1; Differences of typical vs atypical haemangioma.

A vertebral haemangioma usually presents as a photopaenic 'cold' defect on bone scintigraphy as well as on F-18 fluorodeoxyglucose on positron emission tomography/computed tomography (FDG PET/CT). But there is variation in these findings with some haemangiommas showing no or increased uptake of Tc-99m methylene diphosphonate (MDP) being described. This is thought secondary to some lesions having metabolically active tissue within it.

Treatment includes observation and, in symptomatic patients, will be individualised to pain, neurologic symptoms, and pathologic process. Radiation therapy, vascular embolisation, or surgery such as anterior resection and fusion may be used as definitive treatment or as an adjunct to other treatments.

**Images for this section:**
Fig. 1: T2 weighted image showing entire T12 vertebral body occupied by atypical haemangioma with extension into the pedicles and heterogenous T2 signal intensity.
Fig. 2: Plain radiograph of atypical haemangioma involving entire vertebral body.
Fig. 3: Axial CT at T12 level. An area of reduced density within the trabecular bone with coarse, vertically orientated, thickened trabeculae within it.

Fig. 4: Classical typical haemangioma signal on MRI. High T1 and T2 signal intensity. STIR signal variable but high in this example.
Fig. 5: Sagittal T1 and T2 MRI showing multiple lumbar haemangiomas. These return high signal on T2 weighting and intermediate T1 signal intensity, indicating a fat poor lesion. Typical haemangiomas are high signal on T1 and T2 weighted sequences.
**Fig. 6:** A large haemangioma located in the right sacral ala. Note atypical location and minor expansion of the superior cortex.
Fig. 7: Corresponding T2 weighted MRI image, with high signal and the true extent of the lesion now visible.
**Fig. 8:** Sagittal T1 and T2 images of the same sacral lesion showing typical signal characteristics and appearance of a haemangioma but in an atypical location.
Fig. 9: Atypical Haemangioma case: PA chest radiograph with red arrow indicating paravertebral mass - initially thought to be a renal cell carcinoma metastasis.
Fig. 10: Atypical Haemangioma case: Pre-operative axial CT in bone windows. Typical CT appearances of vertebral body haemangioma (red arrow) with atypical paravertebral soft tissue extension (asterix).
Fig. 11: Atypical Haemangioma case: Parasagittal CT in soft tissue windows showing foraminal extra osseous extension.
**Fig. 12:** Atypical Haemangioma case: Preoperative MRI sagittal T1 and T2 demonstrating atypical signal (low T1 and high T2 signal) with posterior element involvement (red arrow) and soft tissue extension into the foramen (blue arrow).
Fig. 13: Atypical haemangioma case: Post-contrast axial T1 showing heterogeneous enhancement with enhancing soft tissue extension into and narrowing the spinal canal and exit foramen.
Fig. 14: Atypical haemangioma case: Axial T1 pre and post contrast images showing post operative rim enhancement of the haemangioma within the vertebral body. Further enhancement is seen across the lamina and within the paravertebral mass.
Fig. 15: Atypical haemangioma case: Post-operative axial CT appearances show local recurrence and persistent right sided para vertebral soft tissue extension.

Table 1: Table highlighting differences of typical vs atypical haemangioma.

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Conclusion

Different pathological types of haemangioma can give differing signal intensities on MRI and aggressive/ atypical haemangiomas can extend beyond the vertebral body. These lesions can cause a diagnostic dilemma with differential diagnosis for such lesions including atypical haemangioma, multiple myeloma, metastasis, lymphoma, Paget's disease, and blood dyscrasias. However, we postulate that the appearance of relatively typical vertical striations of haemangiomas on CT may help in decision making for the correct diagnosis. But, even with these findings, surgical biopsy with histopathological correlation may then be the only option for diagnosis confirmation.

References


Hanrahan C, Shah L. MRI of Spinal Bone Marrow: Part 2, T1-weighted Imaging Based Differential Diagnosis. AJR 2011;197(6)

**Personal Information**