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VERTEBRAL COLLAPSE BENIGN VS MALIGNANT CAUSE MRI EVALUATION: PICTORIAL ESSAY

Radiodiagnosis

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ABSTRACT

Attempting to ascertain the underlying cause of a vertebral compression deformity may present a diagnostic dilemma because spine is a common site for metastasis, osteoporotic fractures, metabolic diseases, neoplasms and infective lesions. Differentiating malignant compression fracture from a benign process with information from clinical findings, use of plain radiographs, bone scans and computed tomography may not be sufficient, in particular for those without a history of obvious trauma or known malignancy MRI is a useful imaging modality for the early differentiation between benign and malignant vertebral fractures. We are presenting a pictorial essay depicting various imaging findings of benign and malignant vertebral collapse.

KEYWORDS

vertebral fractures, magnetic resonance imaging, osteoporosis, metastasis.

Imaging Considerations:- Successful MR imaging of spinal pathology depends on interaction of multiple factors. The use of appropriate sequence parameters for MR imaging is of great importance. These parameters can vary widely according to the field strength, coil design, gradient strength, and software capabilities of the MR imaging system used. Hence each system requires an individualized approach, fine-tuned by trial and error. In general, field of view, slice thickness, matrix, and signal averages must be chosen to balance its effects on signal-to-noise ratio, spatial resolution, and imaging times. [1]MR imaging using T1WI and T2WI has proven useful in differentiating between benign and malignant causes but confident diagnosis may not always possible. [2]Gadolinium enhancement is useful in detection of malignant cause of vertebral collapse.[3] Over last decade DWI MR imaging of vertebral body has proved its importance and has been successfully implemented for the differentiation of benign and malignant fracture edema (due to tumor infiltration) [4]

MRI Features:-

A. Malignant vertebral collapse:-

Signs favoring neoplastic etiology include retropulsion with convex posterior border, soft tissue epidural mass, soft tissue paravertebral mass, pedicle involvement, homogenous enhancement after IV contrast administration, other metastatic lesions, no signal drop in out-of-phase sequence and high signal in DW with/without restriction.

B. Benign vertebral collapse:-

Benignity is suggested with the presence of T2 linear hyper intensity (Water line sign), sharp angle wedged compression, contagious multiplicity with intact neural arches, no significant or mild heterogeneous enhancement, no restriction in DWI and signal drop in out-of-phase sequence.

Water line sign, sharp wedging and signal drop in out-of phase sequence in favor of osteoporotic fractures.

C. Salient features with significant differential value:-

The signs that showed significant values in differentiating between osteoporotic and malignant fractures are Water line sign and sharp wedging in favor of osteoporotic fractures and on the other hand pedicle involvement, non-signal drop in out of phase sequence, homogenous T1 hypo intensity, and restriction in DWI favoring malignancy.

Pedicle involvement was a statistically significant parameter differentiating benign and malignant fractures favoring the latter.

Homogenous replacement of vertebral bone marrow by T1 hypo intensity is another morphological sign that was a statistically significant differentiating point which favors malignancy.

Restriction in DWI with high signal in DWI and low signal in ADC maps was characteristic of malignant fractures. [5]

D. Diffuse involvement:-

Metastatic disease and osteoporosis may have diffuse involvement and may be present with multiple lesions of the spine. Although this characteristic did not appear to be very useful in differentiating benign and malignant fractures in the present study, the signal pattern of the involved vertebrae was different in these two fractures.

In the benign cases, the signal intensity was different in the different involved levels in each patient. On the other hand, the signal intensity appeared same in the involved vertebral lesions in the malignant cases. [3]

E. Infective vertebral collapse:-

MRI features suggestive of infective fractures include contiguous vertebral involvement, end plate disruption, disc involvement, paraspinal abscess and epidural abscess. [6]

F. Role of diffusion weighted magnetic resonance imaging:-

is an accurate non-invasive modality to differentiate vertebral compression fracture from benign and malignant causes, and presence of iso- or hypo intensity of the collapsed vertebral bodies denotes a benign lesion while hyper intensity is highly indicative of malignancy. Similarly low signals on ADC are highly suggestive of collapse from a malignant cause. [7]

Conclusion: -

Certain MRI characteristics allow early differentiation of benign and malignant vertebral fractures. Negative gadolinium-DTPA enhance ment of the vertebral fracture is favoured as a benign lesion. Uniform signal change in multiple vertebral lesions, a round, smooth margin with marked epidural compression, a paraspinal soft tissue mass, and pedicle and posterior element involvement, homogenous T1 hypo intensity, and restriction in DWI, are likely to lead to a diagnosis of

malignant fracture.The signs that showed significant value in differentiating between osteoporotic and malignant fractures are Water line sign and sharp wedging in favor of osteoporotic fractures.

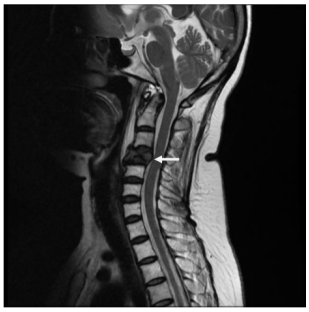

Fig 1. T2WI showing retropulsion with convex posterior border.

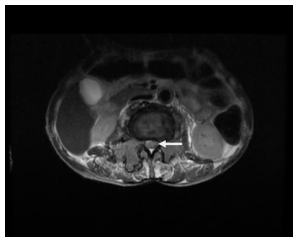

Fig 2. T1 contrast image showing enhancing epidural mass.

Fig 3. T1 contrast image showing enhancing paravertebral soft tissue mass.

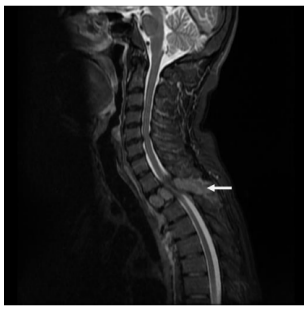

Fig 4. T1 contrast image showing enhancing posterior elements.

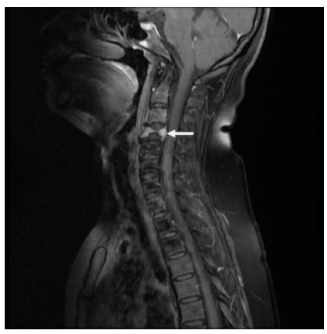

Fig 5. T1 contrast image showing homogenous contrast enhancement.

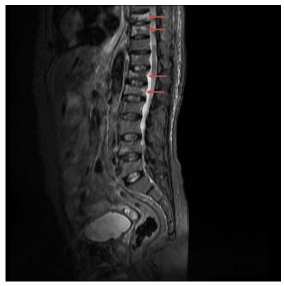

Fig 6. T1 contrast image in a case of multiple myeloma showing multiple compression fractures of vertebral bodies showing enhancement.

Fig 7. DWI showing hyper intensity in vertebral body and posterior element s/o metastasis.

Fig 8. T2 linear hyper intensity (Water line sign), sharp angle wedged compression, contagious multiplicity with intact neural arches, normal signal intensity in collapsed vertebra s/o osteoporotic vertebral collapse.

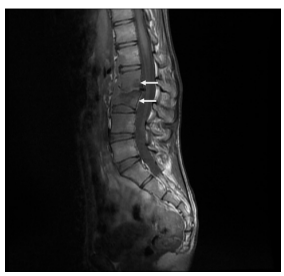

Fig 9. T1WI showing Hypo intense lesion involving body of L2 and L3 and irregularity of end plates.

Fig 10. T2WI showing hyper intense signal in L1, L2, L3 and L4 vertebral body with loss of disc space between L2 and L3, and paravertebral collection.

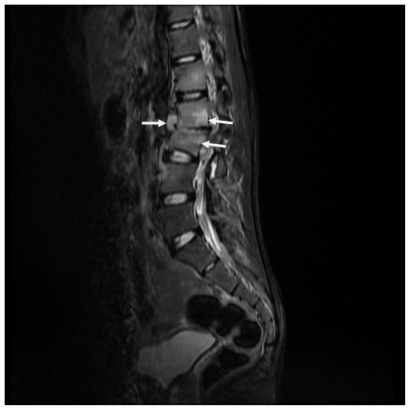

Fig 11. T1 contrast image showing enhancement in vertebral body of L1, L2, L3, L4, loss of disc space L2-L3 and enhancing paravertebral soft tissue.

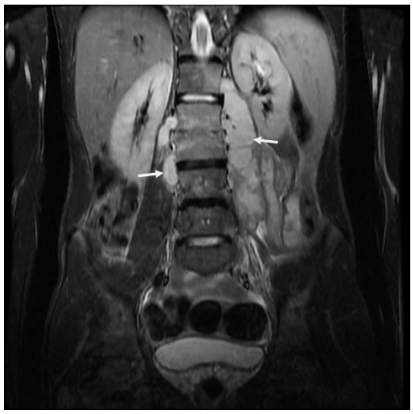

Fig 12. Coronal T1 contrast image showing enhancement in body of L1, L2, L3 and L4 vertebrae and bilateral psoas abscess

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