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Original Research Paper

Radio-Diagnosis

DIFFERENTIATION OF PREDOMINANTLY OSTEOBLASTIC AND OSTEOLYTIC SPINE METASTASIS BY USING MAGNETIC RESONANCE IMAGING.

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ABSTRACT

AIMS & OBJECTIVE : The purpose of this study was to describe findings of predominantly osteoblastic and osteolytic spine metastasis by using Magnetic Resonance Imaging (MRI).

METHOD & MATERIAL : This prospective study was approved by and registered with the institutional review board. Written informed consent was obtained from all study participants. In this study total 20 patients referred from oncology department of our institute having history of malignancy with clinical suspicion of bone metastasis were studied during January 2020 to December 2020. Examination was done in all patients on GE Signa Explorer MRI Machine in supine position using suitable coil with MRI protocol. Skeletal abnormalities were detected and categorized for specific diagnosis of metastasis.

INTRODUCTION: One of the most common malignant lesions of the skeleton are metastases (70 %), which can be categorized as osteolytic, osteoblastic or mixed type on the basis of radioimaging. Osteolytic metastases are predominantly associated with lung, breast, thyroid, colorectal, or renal cancer while Osteoblastic metastases are predominantly associated with prostate and breast cancer. For the visualization and characterization of bone metastases, the most frequent modalities used in clinical practice include CT, MRI, and nuclear examination methods like PET CT or bone scintigraphy. With CT, bone metastases are visualized on the basis of changes in Hounsfield units, with higher Hounsfield units indicative of a greater degree of mineralization and/or sclerosis.(1)

DISCUSSION: MRI is an excellent method for accurate evaluation of spinal metastatic lesions, to which CT imaging is a supplementary modality.All these are used to differentiate between these two types of metastases. All these modalities help for the assessment of the risk of vertebral body fractures or the selection of patients who benefit most from the use of medical treatment like bisphosphonates, surgical intervention like vertebroplasty, spinal stabilization or other.

CONCLUSION: Present study on 20 patients leads to the conclusion that MRI has more diagnostic accuracy than CT alone done for detection of predominantly osteoblastic and osteolytic metastasis. Combination of MRI images and CT images showed the highest diagnostic accuracy. CT imaging is complementary and add to its diagnostic accuracy. These images help in diagnosis, localization , better characterization and monitoring response to treatment.

KEYWORDS :

INTRODUCTION :

One of the most common malignant lesions of the skeleton are metastases (around 70 percent). Bone metastasis is a multistage process that manifests at late stages of tumor progression. When tumor cells enter into circulation, they pass through dilated sinusoidal channels, migrate onto the endosteal surface of the bone, and disseminate through all vascular systems including red bone marrow (2). Skeletal metastases can be categorized as osteolytic, osteoblastic or mixed type on the basis of radioimaging. Osteolytic metastases are predominantly associated with lung, breast, thyroid, colorectal or renal cancer while Osteoblastic metastases are predominantly associated with prostate and breast cancer (3,4).

The clinical importance of differentiating osteolytic metastasis from osteoblastic metastases is :

(a) To prevent occurrence of pathologic fractures of the vertebral body , which is most commonly seen with osteolytic metastases compared to osteoblastic metastases (5) ,

(b) the assessment of therapy response because osteolytic metastases can demonstrate a sclerotic transformation after therapy (6),

(c) narrowing down the search for the primary tumor through reliable differentiation in patients with an unknown primary tumor.

For the visualization and characterization of bone metastases, the most frequent modalities used in clinical practice include CT, MRI, and nuclear examination methods like PET CT or bone scintigraphy.

METHOD AND MATERIAL:

In MRI, different imaging sequences are available for detection of bone metastases, including T1- and T2-weighted sequences and contrast material–enhanced T1-weighted sequences. MRI has been reported to be highly accurate for detection of spine metastases (7). However, osteolytic and osteoblastic metastases cannot always be reliably differentiated with standard MRI sequences because they can appear hypointense on T1-weighted images and heterogeneous on T2-weighted images. Because of this limitation, CT scans may be required.

With CT, bone metastases are visualized on the basis of changes in Hounsfield units, with higher Hounsfield units indicative of a greater degree of mineralization and/or sclerosis. (1)

In this study, we will see if MRI would enable more reliable differentiation between osteolytic and osteoblastic spine metastases compared with CT images.

Table 1 : MRI Sequence GE Signa Explorer, corresponding time duration with TR & TE.

Sr. no.	MR sequence	Time duration (min:sec)	TR	TE
1	Sag T1 FSE	2:41	710.0	42.0
2	Sag T2 FSE	2:31	2222.	90.0
3	Sag STIR	2:30	3000	42.0
4	Sag T1 FSE + C	3:30	400-	42.0

FSE enables the acquisition of images with high resolution and good tissue contrast throughout the spine at high field strength. By employing a different echo spacing, one can use different flip angle refocusing pulses and other measures to maximize the signal-to-noise ratio. (8)

RESULTS AND DISCUSSION:

Our study included 20 patients. The patient age ranges from 24 to 90 years (Mean age 57 years).

Most of the patients complained of back pain, vertebral deformity, however few of them were asymptomatic.

Out of 20 patients, six patients had primary breast carcinoma, three had lung cancer, seven had prostatic carcinoma , three had renal cancer and one patient with thyroid malignancy.

Table 2 : Imaging finding (MRI & CT) in skeletal metastases. (9)

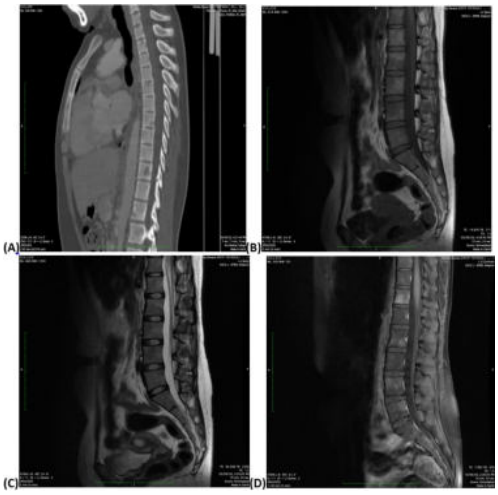
Sr. no.	Metastasis type	T1W images	T2W images	CT scan
1	Predominantly osteoblastic	Hypointense	Hypointense	sclerotic
2	Predominantly osteolytic	Hypointense	iso to hyperintense	lytic
3	Mixed	Hypointense	iso to hyperintense	sclerotic + lytic

Table 3 : Demographic features and MRI Findings correlated with CT findings :

Sr No.	Patient Age (yrs)	Patient sex	Primary carcinoma	secondary skeletal metastasis in MRI	CT imaging findings
1	24	F	Lung	T1 Isointense T2Hyperintense	Lytic
2	51	F	Breast	T1 Isointense T2Hyperintense	Lytic
3	45	F	Breast	T1 Isointense T2Hyperintense	Lytic
4	69	M	Lung	T1 Hypointense T2Hyperintense	Mixed
5	55	M	Prostate	T1 Hypointense T2 Hypointense	Sclerotic
6	57	F	Breast	T1 Isointense T2 Isointense	Lytic
7	71	M	Prostate	T1 Hypointense T2Hyperintense	Mixed
8	64	F	Renal	T1 Isointense T2Hyperintense	Lytic
9	61	M	Prostate	T1 Hypointense T2 Hypointense	Sclerotic
10	53	F	Breast	T1 Hypointense T2Hyperintense	Mixed
11	49	F	Thyroid	T1 Hypointense T2 Hypointense	Sclerotic
12	72	M	Prostate	T1 Hypointense T2 Hypointense	Sclerotic
13	43	F	Breast	T1 Hypointense T2 Hypointense	Mixed
14	56	M	Lung	T1 Hypointense T2 Hypointense	Mixed
15	62	M	Prostate	T1 Hypointense T2 Hypointense	Sclerotic
16	52	F	Renal	T1 Hypointense T2Hyperintense	Lytic
17	80	M	Prostate	T1 Hypointense T2 Hypointense	Sclerotic
18	59	M	Renal	T1 Isointense T2 Isointense	Lytic
19	60	F	Breast	T1 Hypointense T2Hyperintense	Lytic
20	87	M	Prostate	T1 Hypointense T2 Hypointense	Sclerotic

Case 1:

A case of 24 year old female who presented with complaints of cough, weight loss and low back pain since 4 month . CT scan (A) was suggestive of malignant lung mass lesion and osteolytic lesions were noted involving multiple dorso lumbar vertebrae. MRI was done for further evaluation of vertebral lesion. The lesion appears isointense on T1W images (B) and hyperintense on T2W images ©. It shows heterogeneous enhancement on post contrast study (D). These findings favoured the possibility of predominantly osteolytic spinal metastasis secondary to Ca lung.



Case 2 :

A case of a 60 year old female ,recently biopsy proven case of Ca breast, presenting with complaint of low back pain.

Altered signal intensity is noted involving L2 and L3 vertebrae. The lesion appears hypointense on T1WI (A) , isointense (B) on T2W images & hyperintense on STIR images (C) and shows lytic area on CT imaging (D).

This was diagnosed as osteolytic vertebral metastasis secondary to carcinoma of breast.

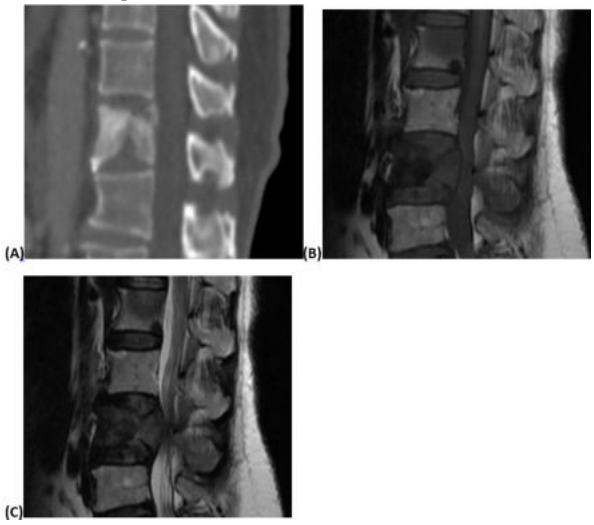
Case 3 :

A case of a 58 years old patient having lower abdominal pain , hematuria, recurrent UTI, weight loss and tingling in bilateral lower limb.

He underwent MRI pelvis with contrast study and was diagnosed with prostatic carcinoma with capsular breach and adjacent major organ involvement. So MRI whole spine screening was done which showed hypointense lesions with erosive changes on T1 (B) and T2W (C) images involving lumbar vertebra. One of the lesions caused narrowing of the spinal canal and compression over the spinal cord . On CT images(A), the lesion shows sclerosis.

The final diagnosis was primary malignancy of the prostate with predominantly osteoblastic vertebral metastasis.

Findings of present study were consistent with study conducted by Daniel Vanel.(10)



Although MDCT provides excellent image quality and a high spatial resolution in the assessment of bony structures, metastatic lesions without significant bone destruction may be missed. The diagnostic accuracy of MRI proved to be significantly superior to MDCT for the detection of osseous metastases(11). Similar results are seen in our cases.

CONCLUSION :

MRI is one of the reliable modality for the evaluation of secondary vertebral metastasis. Most of the patients had undergone CT scan for primary malignancy in which secondary metastasis was detected. Hence, CT imaging not only helps as a screening tool but also as supplementary to MRI findings. Computed tomography (CT) scans can recognize a bony metastatic lesion up to 6 months earlier than an X-ray (12). Recent advances in MRI and other imaging modalities like bone scintigraphy have proved to be of great value for evaluation of malignant lesions. However , as MRI and CT as cost effective and easily available they are indivisible part of examination in patients diagnosed with malignancy.More emphasis is laid on characterisation of the lesion on MRI and CT scan as these are deciding factors for staging of the primary malignancy, prognosis of disease and further management, also to assess the response & efficacy to the treatment being given.

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