

International Journal of Radiology and Diagnostic Imaging



E-ISSN: 2664-4444
P-ISSN: 2664-4436
www.radiologypaper.com
IJRDI 2020; 3(4): 122-124
Received: 17-10-2020
Accepted: 23-11-2020

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Location and characteristics of osseous spine tumors on MRI

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DOI: <http://dx.doi.org/10.33545/26644436.2020.v3.i4b.162>

Abstract

The non-invasiveness of MRI and lack of known biologic hazards at current magnetic field strengths and radio frequency pulse sequences, ensure high patient tolerance. MRI can be performed on out patient basis, thus lowering the overall costs. In the case of a patient with clinical suspicion of osseous spine tumor, a complete clinical history with special reference to neurological symptoms was taken, followed by general physical examination and detailed central nervous system examination. Other systems were also examined and findings were noted. Next, the procedure for MRI was explained to the patient and consent was taken. A detailed history pertaining to the contraindications to MRI was taken. Ear plugs were provided to the patient to minimise noise within the gantry. The patient was then placed in supine position with head first inside the gantry. Proper positioning and immobilisation was done. 11 tumors of osseous spine were located in thoracic region, 8 in lumbar region, 6 in sacrococcygeal region and 2 in cervical region. Thoracic spine was the favoured site for tumors of osseous spine in this study.

Keywords: MRI, osseous spine tumors, clinical history

Introduction

Visualization of spinal cord and nerve roots is indirect, silhouetted by contrast material in the subarachnoid space. In case of complete block, the cranial extent of the lesion will not be visualized. Detection of spinal cord abnormality depends on recognition of surface anatomy and alterations of the expected configuration in certain locations^[1]. The risks of an invasive procedure and the use of intrathecal contrast material require hospitalization.

The greatest limitation of CT is the poor distinction of spinal cord from the subarachnoid space. Bone streak and beam hardening, the inherent artifacts of CT, lessen the already limited contrast differential between various soft tissue components of the spinal canal. Therefore the intrathecal introduction of water soluble contrast material is essential to delineate the spinal cord^[2].

CT Myelography possesses the combined disadvantages of CT and myelography; invasiveness, contrast material and radiation. The imaging is limited to the transaxial plane.

In Magnetic Resonance Imaging (MRI), the entire length of the spinal cord can now be directly imaged for the first time in any plane without the use of intrathecal contrast material and ionizing radiation^[6,7]. Hence associated cord compression and soft tissue component of osseous spine tumors can be well delineated on MRI. Moreover by changing pulse sequence parameters, tissue characterisation of the lesion can be done^[3].

The non-invasiveness of MRI and lack of known biologic hazards at current magnetic field strengths and radio frequency pulse sequences, ensure high patient tolerance. MRI can be performed on out patient basis, thus lowering the overall costs^[4].

Spin echo pulse sequences are currently the standard method used for imaging osseous spine. With these sequences, the TRs and TEs may be altered in simple ways to accentuate proton density, T1 relaxation or T2 relaxation. With a short TR (300 to 500 msec) and short TE (20 to 30 msec) which is T1 weighted spin echo sequence, contrast is predominantly a function of T1.

Due to short T1 of lipid, the signal from fatty marrow is optimised, and the contrast with most pathological processes is enhanced. Because fat provides such excellent contrast, anatomic definition on these sequences is generally excellent^[5].

With progressively longer TRs (2000 to 3000 msec) and TEs (60 to 120 msec), progressively greater T2 weighted images are achieved.

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Since many pathologic processes have much greater T2 relaxation time prolongation, they are readily identified in the marrow. However fat itself has a relatively long T2. Thus differentiation of some pathologic processes from fat may be difficult. Finally the diminished signal to noise ratio encountered on T2 weighted images often results in poorer anatomic definition [6].

Methodology

The cases studied were those from our own hospital — inpatients, outpatients and those referred from other hospitals and clinics.

In the case of a patient with clinical suspicion of osseous spine tumor, a complete clinical history with special reference to neurological symptoms was taken, followed by general physical examination and detailed central nervous system examination. Other systems were also examined and findings were noted. Next, the procedure for MRI was explained to the patient and consent was taken.

A detailed history pertaining to the contraindications to MRI was taken. Ear plugs were provided to the patient to minimise noise within the gantry. The patient was then placed in supine position with head first inside the gantry. Proper positioning and immobilisation was done.

Equipment

This study used the MRI machine ‘SIGNA CONTOUR’ (General Electric, USA).

It possesses a super conducting K4 magnet with a magnetic field strength of 0.5 Tesla.

Coils used: Phased array Cervical,- Thoracic, Lumbosacral

Pulse sequences

Coronal localiser was obtained first. Then, from this coronal localiser, sagittal localiser was obtained. This was done to apply saturation pulse anterior to the vertebral column to reduce motion artefacts.

Results

Table 1: Tumors of osseous spine – Site

Site	No. of cases	Percentage
Cervical	2	4.76%
Cerv[co-thoracic	1	2.39%
Thoracic	11	26.19%
Thoraco-lumbar	4	9.52%
Lumbar	8	19.04%
Lumbo-sacral	4	9.52%
Thoraco-lumbo-sacral	6	14.29%
Sacro-coccygeal	6	14.29%

Thoracic spine was the most favoured site of osseous spine tumors.

Table 2: Tumors of osseous spine — Post contrast

	No.of cases	Enhancing	Nonenhancing
Contrast given	18 (42.86%)	16 (88.89%)	2 (11.11%)
Contrast not given	24 (57.14%)		-

Discussion

11 tumors of osseous spine were located in thoracic region, 8 in lumbar region, 6 in sacrococcygeal region and 2 in cervical region. Thoracic spine was the favoured site for tumors of osseous spine in this study. According to Algra

PR *et al.* lower thoracic and lumbar spine were the most| favoured site for metastasis. We also noted in this study that thoracic spine was the most favoured site for metastasis. Six cases of metastasis were located in thoracic region, 3 in Sacrococcygeal region, 2 in lumbar region and 1 in cervical region.

In this study, it was observed that focal lytic pattern was the most common imaging pattern on MRI. Of the 9 cases of metastasis which presented with focal lytic pattern, six were from bronchogenic carcinoma, two were from breast carcinoma and one was from renal cell carcinoma. Metastasis from lung and breast carcinoma appear as osteolytic lesions within the vertebral body and pedicle.“ Similarly in this study, majority of osteolytic lesions were from lung and breast carcinoma.

Reactive bone sclerosis is often seen with metastasis from prostate and lymphoma.” We also noted that the two cases that showed focal sclerotic pattern on MRI included metastasis from prostate carcinoma.

In this study, it was observed that 15 cases (68.18%) were hypointense on TAWI and 13 cases (59.09%) were hyperintense on T2WI. 2 cases of metastasis from prostate carcinoma were hypointense on both T1 WI and T2WI. Remaining 7 cases of metastasis showed heterogenous signals on both TIWI and T2WI.

Daffner *et al.* Concluded in their study that any process that alters or replaces marrow will decrease the T1 signal whereas T2 signal is more variable. They further added that in general, vertebral metastasis are relatively hyperintense to unaffected marrow on T2 WI. We also noted in this study that the most common pattern of metastasis was multifocal lytic lesions which were hypointense on T1 WI and hyperintense on T2 WI. Sze G *et al.* concluded in their study that sclerotic metastasis result in low signal intensity on both T1 WI and T2 W1.4’ We also noted the same findings with sclerotic metastasis from prostate carcinoma [7, 8].

Sze *et al.* in their study concluded that on post contrast some lesions enhance and others may not enhance at all. Post contrast studies were done in 12 cases out of 22 cases. Out of 12 cases, 10 cases showed enhancement on post contrast and 2 cases of metastasis from prostate carcinoma showed no enhancement on post contrast [9, 10].

Conclusion

- Malignant nature of collapse is confirmed on MRI.
- MRI helps in tissue characterisation of the tumor lesion
- Metastasis is the commonest malignant tumor of osseous spine in this study.
- The majority of metastases are from bronchogenic carcinoma.

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