

Role of MRI in Evaluation of Spinal Trauma**Sunidhi Pabri¹, G. L. Meena², Banwari Lal Nayak³, Sachin Banthia⁴, Ridhima Gupta⁵, Hemant Jain⁶, Mohnish Bothra⁷**¹Resident Doctor, Department of Radiodiagnosis, Sardar Patel Medical College & PBM Hospital, Bikaner, Rajasthan²Senior Professor, Department of Radiodiagnosis, Sardar Patel Medical College & PBM Hospital, Bikaner, Rajasthan³Professor, Department of Radiodiagnosis, PDU Medical College & D.B. hospital, Churu, Rajasthan⁴Associate Professor, Department of Radiodiagnosis, Sardar Patel Medical College & PBM Hospital, Bikaner, Rajasthan⁵Associate Professor, Department of Radiodiagnosis, Sardar Patel Medical College & PBM Hospital, Bikaner, Rajasthan⁶Assistant Professor, Department of Radiodiagnosis, Sardar Patel Medical College & PBM Hospital, Bikaner, Rajasthan⁷Assistant Professor, Department of Radiodiagnosis, Sardar Patel Medical College & PBM Hospital, Bikaner, Rajasthan

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Conflict of interest: Nil

Abstract:

Early detection often leads to prompt and accurate diagnosis, expeditious management, avoidance of unnecessary procedures. 65 patients of acute spinal trauma were included in the study. Detailed neurological examination of the patient was done during the scan. Detailed neurological examination of the patient was also done during his or her discharge from the Hospital. Clinical assessment was done at the time of admission and discharge using ASIA impairment scale. MRI findings were subsequently compared with clinical profile and neurological outcome. The strength of association between extent of spinal cord injury and outcome were described using Odd's ratio. Chi square test of significance ($p < 0.005$) was used to assess the association between MR findings and clinical outcome.

Keywords: ASIA impairment scale, MRI, spinal trauma, cord injury.

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Introduction

Most of the diagnostic information in spinal trauma is derived from the sagittal images. Axial images serve as a supplement [1]. Sagittal T1- Weighted images offer an excellent anatomic overview. Disc herniations, epidural fluid collections, subluxation, vertebral body fractures, cord swelling and cord compression are also visualized [2]. Sagittal T2-Weighted images depict most of the soft tissue abnormalities including spinal cord oedema and haemorrhage, ligamentous injury, disc herniations and epidural fluid collections [3]. Axial and sagittal GE images aid in the identification of the acute spinal cord haemorrhage, disc herniations and fractures.

The depiction of parenchymal SCI on MRI not only correlated well with the degree of neurologic deficit, but it also bears significant implications in regard to prognosis and potential for neurologic recovery [4-13].

As MRI is an excellent diagnostic modality for evaluation of spinal trauma, it is possible to suggest that the MRI findings correlated directly with the degree of deficit according to ASIA impairment scale. The purpose of this study is to evaluate this correlation.

Materials and Methods:**Type of study:** Hospital based prospective study.**Equipment:** GE MRI 1.5 tesla with phase array coil was used for acquisition of images in all patients.

Method of collection of data: MR imaging of spine was performed in the axial and sagittal planes using a combination of pulse sequences. The study was performed with patient in supine position with quiet breathing obtaining sagittal T2 and T1-weighted fast spin echo images, STIR, coronal STIR and axial T2 and T1-weighted fast spin echo images for proper evaluation of cord hemorrhage.

Sagittal images were 5.0mm thick with a 0.5mm slice gap. The field of view (FOV) of the area of interest is adequate at 24 cm in cervical spine and at 32 cm in lumbosacral spine. In the dorso-lumbar spine, a large FOV was needed (34/36 cm) for accurate labelling of the involved levels.

T2-weighted information was obtained using a single FSE acquisition using a split echo train, resulting in an intermediate T2-weighted sequences. For the short TE image, an echo train of three with two excitations was used, whereas for the long TE image an echo train of 15-30 with single excitation was used. For each sequence, 256-448 steps were followed in both the frequency and phase axes. Fat suppression was employed on the long TR sequences to improve visualisation of edema in the posterior ligamentous complexes (STIR- Short Tau Inversion Recovery). Axial images were obtained using FSE or gradient echo (GRE) pulse sequences. Technical parameters included 16 degree flip angle,

minimum TR/TE, 224 x 320 matrix and two excitations in T1WI and one excitation in T2WI. The TE used was less than 15 ms in T1WI and upto 100 ms in T2WI in order to minimize unwanted susceptibility effects that might exaggerate bony stenosis.

Inclusion Criteria: All the patients of acute spinal trauma undergoing MR imaging formed the study group.

Exclusion Criteria:

1. Post operative patients of spinal trauma undergoing MRI scan of spine.
2. Uncooperative patients.
3. Patients with metallic implants, Patients with pacemaker / cochlear implant in-situ, Patients with claustrophobia/ any other psychiatric abnormality.

Results

Table 1: Cord findings in MRI in spinal trauma

Cord Findings	No. of patients	Percent	95% confidence limit
Hemorrhage	5	7.69	2.54%-17.05%
Cord edema (<3cm)	20	30.76	19.91%-43.45%
Cord edema (>3cm)	11	16.92	12.31%-33.49%
No abnormality	29	44.61	28.04%-52.90%
Total	65	100	

MRI examination revealed the cord abnormalities in 36 out of 65 patients, i.e. in 55.38% of patients. Rest 29 patients (44.61%) had no findings in MRI. Cord edema more than 3 cm was there in 11 out of 65 patients (16.92%). Cord edema less than 3 cm was there in 20 out of 65 patients (30.76%) while 5 patients (7.69%) showed hemorrhagic focus within the cord in MRI.

Discussion

This prospective study was performed in 65 patients of spinal trauma referred for an MRI examination.

The results of the study have shown that the MRI is an excellent diagnostic modality for the evaluation of patients of spinal trauma. It accurately defines the extent of spinal cord injury, and the imaging findings correlate with the clinical neurological examination findings according to the ASIA impairment scale.

Out of 65 patients, 48 were males and 17 were females. The age group most commonly affected were those in the age group of 21-40 years (55.38%). This was in concordance with Shih P. et al [14] which showed that the spinal trauma was more common in men and the age group of 25-40 years.

The most common cause of injury was fall from height which was the cause in 29 patients (44.61%), followed by road traffic accidents in 20 patients (30.76%). Other causes such as assault and blunt

trauma were present in 8 patients each (12.30%). This was in accordance to a study by Gupta N et al, where in fall from heights was observed in 25% of the cases [15]. In another study by Rao MUM et al, 50% of the patients suffered spinal injuries due to fall from heights and 17.4% was due to road traffic accidents, which corroborated this study [16]. In a study by Nagvekar RA et al, 62% was due to fall from heights and 37% due to road accidents [17].

Most commonly affected region by the spinal trauma was cervical spine, comprising of 26 patients (40%). Dorsolumbar and dorsal spine were also commonly affected, comprising of 14 (21.53%) and 12 (18.46%) patients respectively. Lumbar spine involvement was seen in 11 patients (16.92%) and sacral spine was involved in only 2 patients (3.07%). Similar results were observed by Rahman et al [18], Nagvekar RA et al [17] and Lenehan B [19] in their studies.

MRI showed cord abnormalities were present in 36 out of 65 patients, i.e. in 55.38%. No abnormalities were found in 29 patients, i.e. in 44.61%. This was in concordance with Umesh C. Parashari et al [20] which showed spinal cord abnormalities in 55%.

Focus of cord hemorrhage was present in 5 out of 65 patients, i.e., 7.69% of patients with 95% confidence limit of 2.54%-17.05%. Cord edema/non-hemorrhagic contusion involving more than 3 cm was present in 11 out of 65 patients, i.e., 16.92% of

patients with 95% confidence limit of 12.31%-33.49%. Cord edema/non-hemorrhagic contusion involving less than 3 cm was present in 20 out of 65 patients, i.e., 30.76% of patients with 95% confidence limit of 19.91%-43.45%. So, cord edema/contusion involving less than 3 cm of the cord was most common finding in our study.

Conclusion

MRI is the imaging modality of choice in the evaluation of cord abnormality in spinal trauma cases.

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