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Assessment of role of MRI in the evaluation of spinal trauma: An observational study

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Abstract---A total of 100 patients were analysed. Complete demographic and clinical details of all the patients were obtained. The source of data for this study was patients referred to Department of Radio diagnosis, Imaging and Interventional radiology from OPD. After obtaining clinical history relevant clinical examination was done. ASIA grading was done for neurological injury. MRI examinations were done. Every patient lay in supine position with quiet breathing. No movement was allowed during examination. In 71 percent of the patients, compression fracture of the vertebral body was present. Cord oedema of >3cm was seen in 55 percent of the patients. Sensory loss and motor loss was seen in 26 percent and 21 percent of the patients respectively. MRI findings in acute spinal cord injury correlate well with the initial clinical findings and can be helpful to clinician in predicting the outcome and extent of recovery in patients of spinal cord injury.

Keywords---spinal trauma, MRI, evaluation, spinal cord injury.

Introduction

The spine mainly consists of vertebrae stabilized by multiple ligaments including the anterior longitudinal ligament (ALL), posterior longitudinal ligament (PLL), ligamentum flavum, interspinous ligament, supraspinous ligament, and the apophyseal joint capsules. Anatomy of the craniocervical junction is different from the rest of the spine and consists of many ligaments. However, only tectorial

membrane, the transverse ligament, and the alar ligaments act as major stabilizers. While normal tectorial membrane and transverse ligament can be easily visualized on MRI, due to lack of contrast from adjacent tissues, the normal alar ligaments are difficult to be visualized.^{1- 3} Diagnostic imaging, particularly Magnetic Resonance Imaging (MRI), plays a crucial role in evaluating and detecting spinal trauma. Subtle bone marrow, soft-tissue, and spinal cord abnormalities, which may not be apparent on other imaging modalities, can be readily detected on MRI. Early detection often leads to prompt and accurate diagnosis, expeditious management, and avoidance of unnecessary procedures.^{4, 5} Most of the diagnostic information in spinal trauma is derived from the sagittal images. Sagittal T1-weighted images offer an excellent anatomic overview. Axial images serve as a supplement. Disc herniations, epidural fluid collections, spondylolisthesis, vertebral body fractures, cord swelling, and cord compression are also visualized. Sagittal T2-weighted images depict most of the abnormalities, including spinal cord edema, ligamentous injury, disc herniations, and epidural fluid collections. Axial and sagittal gradient echo (GRE) images to aid in the identification of acute spinal cord haemorrhage.^{6- 8} Hence; the present study was conducted for assessing the role of MRI in the evaluation of spinal trauma.

Materials and Methods

The present study was conducted for assessing the role of MRI in the evaluation of spinal trauma. A total of 100 patients were analysed. Complete demographic and clinical details of all the patients were obtained. The source of data for this study was patients referred to Department of Radio diagnosis, Imaging and Interventional radiology from OPD. After obtaining clinical history relevant clinical examination was done. ASIA grading was done for neurological injury. MRI examinations were done. Every patient lay in supine position with quiet breathing. No movement was allowed during examination. All the results were recorded and analysed by SPSS software.

Results

Mean age of the patients was 56.4 years with 68 percent of the patients being male. In 71 percent of the patients, compression fracture of the vertebral body was present. Cord oedema of >3cm was seen in 55 percent of the patients. Sensory loss and motor loss was seen in 26 percent and 21 percent of the patients respectively.

Table 1
Age and gender

Variable	Value
Mean age (years)	56.4
Males (%)	68
Females (%)	32

Table 2
Type of vertebra involved

Variable		Number	Percentage
Vertebral body	Burst fracture	16	16
	Compression fracture	71	71
	Posterior element	13	13

Table 3
Cord Oedema

Variable		Number	Percentage
Cord Oedema	<3cm	45	45
	>3cm	55	55

Table 4
Sensory and motor loss

Variable		Number	Percentage
Sensory loss	Present	26	26
	Absent	21	21
	Not applicable	52	52
Motor loss	Present	21	21
	Absent	79	79

Discussion

Many advantages of MRI such as, higher contrast resolution, absence of bony artifacts, multiplanar capability, and choice of various pulse sequences make possible to diagnose spinal trauma more accurately. More adequate information about neural, and extra neural injuries requiring surgical interventions, for example, significant disc herniations and epidural hematomas can be obtained. In cases of spinal cord edema, contusion, hemorrhage and ischemia, MRI findings may serve as prognostic indicators.^{8- 11} Hence; the present study was conducted for assessing the role of MRI in the evaluation of spinal trauma.

Mean age of the patients was 56.4 years with 68 percent of the patients being male. In 71 percent of the patients, compression fracture of the vertebral body was present. Cord oedema of >3cm was seen in 55 percent of the patients. Parashari et al evaluated the role of magnetic resonance imaging (MRI) as a non-invasive diagnostic tool in patients with acute and chronic spinal trauma. Sixty two patients of spinal trauma formed the study group in a prospective fashion. The patients undergoing MR imaging and magnetic resonance images were analyzed and correlated with findings on neurological examination according to American Spinal Injury Association (ASIA) impairment scale (AIS) at the time of MRI examination and subsequently at sub-acute interval to assess neurological outcome. The cord edema without hemorrhage was the most common MR finding (41.5%). The others were sizable focus of hemorrhage within the cord (33%),

epidural hematoma (5.0%), and normal cord (26%). Majority of MR findings correlated well with clinical profile of the patient according to ASIA impairment scale. This study demonstrated that patients with presence of sizable focus of haemorrhage had larger cord edema and more severe grade of initial ASIA impairment scale (AIS) with poor recovery at follow up ($P=0.032$). Improvement in upper extremity was more than lower extremity. Severe cord compression was also associated with poor neurological outcome; however it was not statistically significant ($P=0.149$). Various MRI findings in acute spinal cord injury correlated well with the initial clinical findings and on follow-up according to ASIA impairment scale.¹¹

Sensory loss and motor loss was seen in 26 percent and 21 percent of the patients respectively. Naik BR et al assessed various MRI findings which are predictive of initial neurological deficit in patients with spinal trauma. 57 patients with spinal trauma who underwent MRI spine were assessed. Neurological status of patients was assessed at the time of admission and discharge in accordance with the American Spine Injury Association (ASIA) impairment scale. Various MRI parameters were evaluated for correlation with the severity of the spinal injury. Patients with cord transection, cord hemorrhage, and epidural hematoma had initial high-grade ASIA impairment scale. Patients with cord transection and cord hemorrhage did not show any improvement in their neurological status during their hospital stay. Patients with only cord edema and epidural hematoma showed favorable neurological outcome. Cord contusion showed lesser neurological recovery, as compared with cord edema and normal cord. MRI findings in acute SCI correlated well with the initial neurological deficits on admission and at the time of discharge.¹²

Conclusion

MRI findings in acute spinal cord injury correlate well with the initial clinical findings and can be helpful to clinician in predicting the outcome and extent of recovery in patients of spinal cord injury.

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