|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2019: 79.34
Original Research Article
Volume 5, Issue 1; January: 2021; Page No. 351-353

TO ASSESS THE NEUROLOGICAL DEFICITS OF PATIENTS WITH ACUTE SPINAL TRAUMA ON ADMISSION AND DISCHARGE IN MRI FINDING

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Article Info: Received 26 December 2020; Accepted 29 January 2021
DOI: https://doi.org/10.32553/ijmbs.v5i1.1831
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Conflict of interest: No conflict of interest.

Abstract

Background & Method: Cases of acute spinal trauma who underwent MRI of spine in the department of radio diagnosis, Index Medical College Hospital & Research Centre, Indore from June 2018 to May 2019 were included in the study. Detailed neurological examination of the patient was done during the scan. Detailed neurological examination of the patient was also during his or her discharge from the hospital, with a sample size of 57 was selected.

Result: MRI examination revealed the cord abnormalities in 30 out of 57 patients, i.e. in 52.63% of patients. Rest 47.36% of patients had no cord findings in MRI. Cord oedema more than 3 cms was there in 17 out of 57 patients (29.82%). Cord oedema less than 3 cms was there in 13 out of 57 patients (22.80%). 8 of 57 patients (14.03%) showed haemorrhagic focus within the cord in MRI. In our study 11 of 57 patients (19%) showed improvement and 24 patients (42%) showed no improvement. 22 patients had no neurological deficits on admission.

Conclusion: Present study was conducted with aim to correlate MR findings with neurological outcome of the patients with acute spinal trauma, it was concluded that various MRI findings in acute spinal cord injury correlate well with the neurological deficits on admission and discharge according to ASIA impairment scale.

Keywords: neurological, spinal trauma, & MRI.
Study Designed: Hospital based prospective study

Introduction

Diagnostic imaging, particularly Magnetic Resonance Imaging (MRI), plays a crucial role in evaluating and detecting spinal trauma[1]. 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[2].

Many advantages of MRI such as, higher contrast resolution, absence of bony artefacts, multiplanar capability, and choice of various pulse sequences make possible to diagnose spinal trauma more accurately. 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 oedema, contusion, haemorrhage and ischemia, MRI findings may serve as prognostic indicators[3].

Most of the diagnostic information in spinal trauma is derived from the sagittal images. Axial images serve as a supplement. 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[4]. 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. Axial and sagittal GE images aid in the identification of acute spinal cord haemorrhage, disc herniations, and fractures.

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

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[5].

Material & Method

Cases of acute spinal trauma who underwent MRI of spine in the department of radio diagnosis, Index Medical College Hospital & Research Centre, Indore from June 2018 to May 2019 were included in the study. Detailed neurological examination of the patient was done during the scan. Detailed neurological examination of the patient was also

during his or her discharge from the hospital, with a sample size of 57 was selected.

MR Imaging of spine was performed with 1.5 Tesla MR Scanner both 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 haemorrhage.

Clinical assessment of spinal cord injury

A standardized physical examination as endorsed by the International Standards for Neurological and Functional Classification of Spinal Cord Injury Patients, also commonly called the American Spinal Injury Association (ASIA) guidelines was performed. A detailed motor and sensory examination of the patient was done and graded according to American Spinal Injury Association Scale which is as follows A-Complete: No motor or sensory function is preserved in the sacral segments S4-S5. B-Incomplete: Sensory but not motor function preserved below the neurologic level and includes the sacral segments S4-S5.

The strength of association between extent of spinal cord injury and outcome were described using Odds ratio. Chi square test of significance ($p<0.005$) was used to assess the association between MR findings and clinical outcome.

Inclusion criteria: All the patients of acute spinal trauma undergoing MR Imaging formed the study group.

Exclusion criteria: Patients of spinal trauma undergoing MRI of spine after 4 weeks of injury and patients of spinal trauma with contraindications for MRI like non-cooperation, in situ metallic implants, cochlear implants, pacemakers and claustrophobia were excluded from the study.

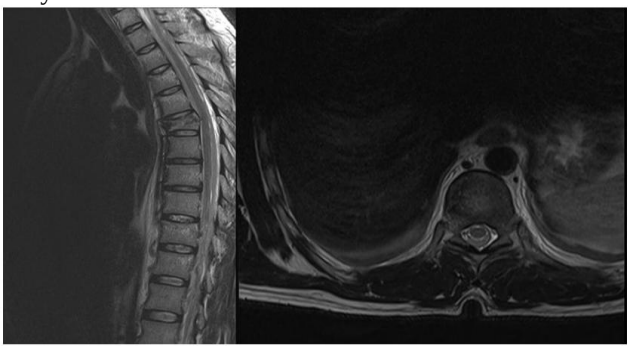

Figure 1: A 32 year old male with history of fall from height presented with mild weakness of the lower limbs. T2 sagittal (a) image shows wedge compression fracture of the D6 vertebra. There are no cord abnormalities. Axial T2 (b) image shows a crescentic isointensity in the dependent portion in the thoracic region, suggestive of an epidural haemorrhage.

Results

Table 1: Sex distribution among the cases

Males	Females
48(84.21%)	9(15.78%)

In this study 57 cases with spinal trauma were observed. Of these 48 (84.21 %) were males and 9 (15.78%) were females.

Table 2: Cord findings in MRI in spinal trauma

Cord Findings	No. of patients	Percentage
Haemorrhage	8	14.03 (with 95% CL, 12.24-40.58)
Cord oedema (< 3cm)	13	22.80 (with 95% CL, 14.13-37.76)
Cord oedema (>3cm)	17	29.82 (with 95% CL, 25.63-52.71)
No abnormality	27	47.36 (with 95% CL, 15.54-49.32)

MRI examination revealed the cord abnormalities in 30 out of 57 patients, i.e. in 52.63% of patients. Rest 47.36% of patients had no cord findings in MRI. Cord oedema more than 3 cms was there in 17 out of 57 patients (29.82%). Cord oedema less than 3 cms was there in 13 out of 57 patients (22.80%). 8 of 57 patients (14.03%) showed haemorrhagic focus within the cord in MRI.

Table 3: Neurological outcome in patients of spinal trauma

Improvement	Non-improvement	Not applicable	T
11(19%, 95% CL, 18.56-42.65)	24(42%, 95% CL, 30.26-62.69)	22(39%, 95% CL, 28.27-44.79)	57

In our study 11 of 57 patients (19%) showed improvement and 24 patients (42%)
showed no improvement. 22 patients had no neurological deficits on admission.

Discussion

In our study 11 of 57 patients (19%) showed improvement and 24 patients (42%) showed no improvement. 22 patients had no neurological deficits on admission. Of 8 patients with cord haemorrhage, only 1 patient (12%) showed improvement and 7 patients (88%) showed no improvement.

Of 13 patients with cord haemorrhage, only 3 patients (23%) showed improvement and 10 patients (77%) showed no improvement. Of 17 patients with cord haemorrhage, only 4 patients (24%) showed improvement and 13 patients (76%) showed no improvement. Of 5 patients with neurological deficit but no cord abnormalities, 4 patients (80%) showed improvement and 1 patient (20%) showed no improvement[6].

This suggests that patients with cord haemorrhage have less chance of recovery. Of 14 patients with initial AIS A only 2, i.e. 14.2 % showed improvement while out of 14 patients with initial AIS D, 4 i.e. 28.4% showed improvement. In patients with AIS B 1 i.e. 50% showed improvement and in patients with AIS C 4 i.e. 80 % showed improvement. This

suggests that chances of improvement are less in patients with initial high grade AIS[7].

In patients with presence of sizable focus of cord haemorrhage, 1 patient i.e. 12.5% (95% CL 0-25) showed improvement in sensory scores. While considering oedema as a risk factor sensory improvement was noted in 6 out of 14 patients with cord oedema less than 3 cm of cord. In patients with cord oedema involving more than 3 cm of cord, 4 out of patients showed sensory improvement

Odds ratio is 2.75 (95% CL 0.95-36) and the Fisher's exact P value is 0.0427 ($P<0.05$), which is significant. It indicates that in patients with cord oedema involving >3 cm of cord, chances of sensory improvement was 2.75 times lesser than in patients with cord oedema involving <3 cm of cord.

Multivariate analysis was done to see the effect of various risk factors studied on the outcome of trauma patients. It shows that over and above all the risk factors only focus of haemorrhage was significantly associated with poor prognosis (OR 6.73; 95% CL 1.2, 38.6; p=0.032).

In a similar study, Demaerel P et al[8] showed the effect of haemorrhage and length of hematoma on neurological impairment. They showed that patients with haemorrhage were more likely to have completed SCI at the time of follow-up (odds ratio = 2.33, 95% confidence interval, 1.42-3.82). Similar to our study they also showed that presence of large haemorrhage was associated with complete SCI and showed poor prognosis.

Similar results were also shown by Andreoli C[9]. They demonstrated that patients with initial haemorrhage had poor prognosis while those with oedema had better prognosis. Flanders et al[10] showed that patients without spinal cord haemorrhage had significant improvement in self-care and mobility scores compared to patients with haemorrhages. Their study revealed that rostral limit of oedema positively correlated with admission and discharge self-care scores. Poor prognostic factors were haemorrhage, long length of cord oedema and high cervical location. Selden NR[11] also showed similar results - presence of long length of intra-axial hematoma and cord oedema, each associated with poor neurological outcome.

Conclusion

Present study was conducted with aim to correlate MR findings with neurological outcome of the patients with acute spinal trauma, it was concluded that various MRI findings in acute spinal cord injury correlate well with the neurological deficits on admission and discharge according to ASIA impairment scale.

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