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Original Research Article

Evaluation of spinal injuries by MRI

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ABSTRACT

Background: Radio-imaging is one of the most important tools in the diagnosis of spinal injury and helps to start a prompt and correct treatment to patients. Compared to CT, MRI allows better visualization of various tissues, including spinal cord and ligaments, not to mention discs and vessels. This study was done to evaluate the efficacy of low tesla MRI in acute spinal injuries.
Methods: Site of injury, neurological status of the patient etc., were noted from 78 patients included in the study. The neurological status was evaluated according to the American Spinal Injury Association Impairment Scale. Within 2days of admission, MRI was done. In case of doubt, radiographs for superior and articular processes was done where necessary. CT was done in case edema was seen without a fracture line.
Results: Most of the patients were males with the maximum of the patients being between the ages 21-50 years. Fall from height was the most common cause of injury and cervical region was the most common site. Osseous injury, ligament disruption and spinal cord injury were the most common MRI findings.
Conclusions: Being non-invasive procedure with high specificity and sensitivity, MRI is a preferred diagnostic tool to assess the spinal cord injuries.

Keywords: Acute spinal injury, American spinal injury association impairment scale, Magnetic radio-imaging, Trauma

INTRODUCTION

Trauma to the spine has different severity and prognosis. It may range from asymptomatic to neurological dysfunction to even fatality. Trauma is more likely to occur due to high or low energy fall, a road traffic accident, due to sports or any other blunt impact.[1] Spinal trauma also has a direct effect on the increase in costs and hospitalization as well on the social and economic development of the society.[1]

In USA, it is estimated that around 40 per mil cases of spinal injury are reported every year and out of these 12000 cases of paraplegia are reported, 4000 of the patients die even before admission to the hospital and 1000 patients die after admission to hospital.[2]

It is the role of the radiologist to evaluate the spinal trauma so that the lesion can be correctly identified and further damage to the patient would be arrested. Injury is said to be acute if it has occurred within 3weeks of diagnosis and thus have to be considered as fresh fractures.[3] They may cause damage at not only one but at many sited of the spinal cord. Thus, early detection of the spinal injury results in better prognosis.

Radio-imaging is one of the most important tools in the diagnosis of spinal injury and helps to start a prompt and correct treatment to patients. Some of the diagnostic tools used earlier were the computed tomography, conventional radiography and myelography.[4] Another tool that was also been used is the 3-dimensional CT. While these modalities show the trauma to the skeletal

and the ligaments, the diagnosis to the spinal cord is only done by indirect means.[5] Moreover, there is usually a poor correlation between these injuries and acute neurological deficit has also been reported. With CT, though stability of the spine is correctly assessed for surgery, MRI is usually preferred not only due to its superior contrast resolution but also due to the easy availability.[6]

Compared to CT, MRI allows better visualization of various tissues including spinal cord and ligaments not to mention discs and vessels. It is also better to assess the damage to the anterior, posterior and interspinous ligaments.[7] It also helps in the identification of chronic changes such as disc spondylosis, end plate marrow changes, focal disc herniation etc.[8] The early prognostication of the spinal injury was done in 1988 by Kulkarni MV et al, into hemorrhage in cord, edema in cord and a combination of the two.[4] Now a days, variation of these combination is used.

Since, MRI is often preferred now a days, author have done this study to evaluate the efficacy of low Tesla MRI in acute spinal injuries.

METHODS

This study was done by the Department of Radio-diagnosis at Katuri Medical College over a period of august 2016 to April 2018. 78 patients who had come to the emergency ward of this hospital with spinal injuries were included into this study. All the patients were between the ages 10-80 years. Patients with pacemakers, ferromagnetic aneurysm clips, other implants including that of the ear or eye were excluded from the study. Pregnant women, patients with claustrophobia, those with a history of spinal surgeries were excluded from the study.

This study was cleared by the institutional Ethical Committee. The nature of the study was explained to the patients and their relative and informed consent was taken from all of them. Detailed demographic details were collected from all of them. Site of injury, neurological status of the patient etc., were also noted. The neurological status was evaluated according to the American Spinal Injury Association Impairment Scale (ASIA) (Table 1).

All the patients were admitted to the hospital and a brief clinical history was taken for all the patients and other trauma associated chest and abdominal injuries were noted. General medical examination was done for all of the patients and relevant investigations including radiographs were performed. Within 2 days of admission, MRI was done. In case of doubt, radiographs for superior and articular processes was done where necessary. CT was done in case edema was seen without a fracture line. The statistical analysis was done using Microsoft excel, for means and percentages.

Table 1: American spinal injury association impairment scale (ASIA).

ASIA grade	Type	Description
Grade A	Complete	No sensory and motor function in sacral segments S4-S5.
Grade B	Incomplet	Sensory function but not motor function is preserved below the neurological level and includes the sacral segments S4-S5.
Grade C	Incomplet	Motor function is preserved below the neurological level and more than half of key muscles below the neurological level have a muscle grade less than 3.
Grade D	Incomplet	Motor function is preserved below the neurological level and at least half of key muscles below the neurological level have a muscle grade if 3 or more.
Grade E	Normal	Motor and sensory function are normal.

RESULTS

Out of 78 patients 61 (78.2%) were males and 17 (21.8%) were females (Figure 1).

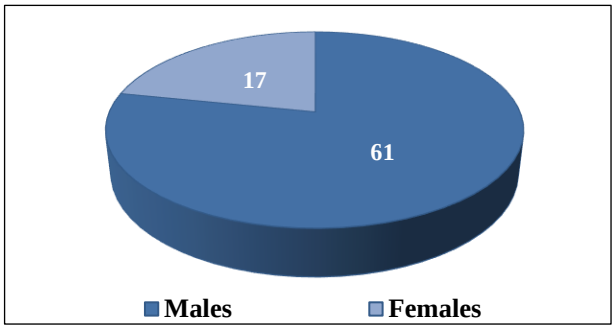

Figure 1: Gender wise distribution of the patients.

The most common age group to be affected was 31-40years of age with 22 (28.2%) patients. This was followed by 19 (24.4%) between 21-30years, 16 (20.5%) in 41-50years age group. There were 5 (6.4%) I between 10-20years and only 1 patient between 71-0years (Figure 2). The most common cause of injury was fall from height where 39 (50%) of the patients were affected, followed by 23 patients who had road traffic accident (28.5%). Due to fall of brick on them 7 (10%) of the patients were injured and most of them were construction workers. 9 (11.5%) of the patients had blunt trauma (Table 2).

The most common site of injury was cervical injury in 42 (53.8%), followed by 16 patients with dorsolumbar injury (20.5%). 12 (15.4%) of the patients had lumbar injuries and 9% (7 patients) had dorsal injuries. Only 1 (1.3%) patient had sacral injury (Table 3).

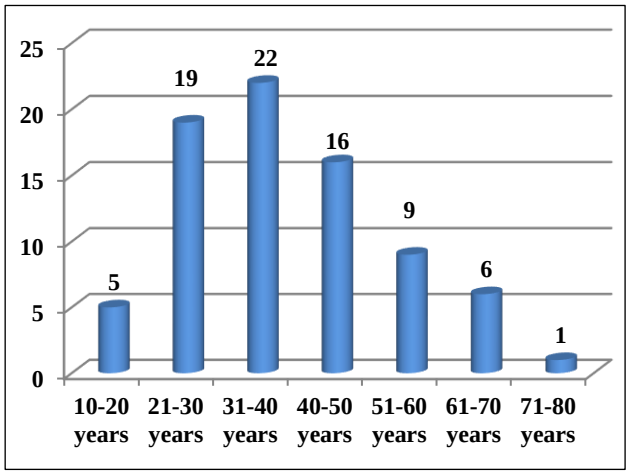

Figure 2: Age wise distribution of the patients.

Table 2: Cause of injury.

Cause	Number	Percentage
Road traffic accident	23	28.5%
Fall from height	39	50%
Fall of brick	7	10%
Blunt trauma	9	11.5%

Table 3: Site of injury.

Site	Number	Percentage
Cervical	42	53.8%
Dorsolumbar	16	20.5%
Lumbar	12	15.4%
Dorsal	7	9%
Sacral	1	1.3%

The most common severity of the trauma according to ASIA was Grade D, i.e. Motor function was preserved below the neurological level and at least half of key muscles below the neurological level have a muscle grade if 3 or more, seen in 31 patients (39.7%). 28 (35.9%) showed grade A type i.e. No sensory and motor function in sacral segments S4-S5, followed by 12 (15.4%) with Grade C type of severity i.e. Motor function was preserved below the neurological level and more than half of key muscles below the neurological level have a muscle grade less than 3 (Figure 3).

Of the osseous fracture injuries, vertebral fracture was observed in 37 (47.4%) of the patients, posterior elements fracture was observed in 5 (6.4%) patients and dislocation was observed in 21 (26.9%) of the patients. Intervertebral injuries were observed in 22 (28.2%) of the patients. Among the ligament disruption, anterior longitudinal and posterior longitudinal injuries were observed in 30 (38.5%) and 34 (43.6%) of the patients respectively. Paraspinal soft tissue changes were seen in 19 (24.4%) of the patients (Table 4).

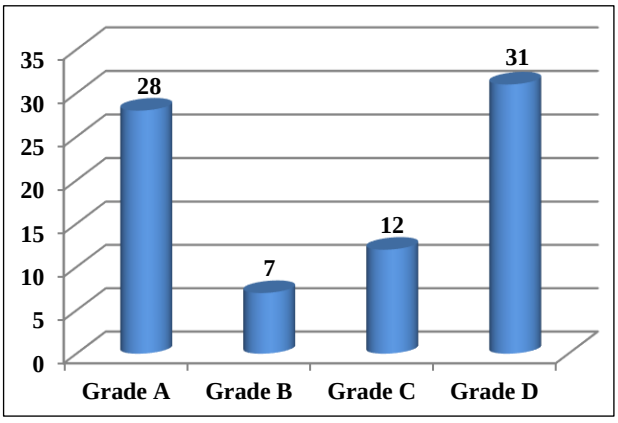

Figure 3: Severity of injury.

Table 4: MRI features in spinal trauma patients.

MR Findings	Number	%
Osseous injury		
Vertebral fracture	37	47.4
Posterior elements fracture	5	6.4
Dislocation	21	26.9
Intervertebral disc injury	22	28.2
Ligament disruption		
Anterior longitudinal	30	38.5
Posterior longitudinal	34	43.6
Ligamentum and interspinous	21	26.9
Paraspinal soft tissue changes	19	24.4
Spinal cord injury		
Trauma with edema	27	34.6
Hemorrhage	5	6.4
Edema with hemorrhage	9	11.5
Compression	11	14.1

DISCUSSION

It was important to classify the acute spinal injuries so that MRI abnormalities can be identified and the treatment can be started at the earliest. He most common sex to be affected was males in the present study. In a study by Rahman ML et al, the male to female ratio was 5:1, which was in accordance to this study.[9] In a study by Nagvekar RA et al, 71% of the patients were males and a higher patient load of males was seen in another study by Lenehan B et al.[10,11]

The most common age group to be affected was 31-40years (28.2%) followed by 24.4% in the 21-30year age group. 20.5% affected patients were in the 41-50year age group. In the study by Rahman ML et al, 56% of the patients were between 21 and 40years of age and a study by Lenehan et al, reported 60% of the injuries in patients

under 40years of age. Nagvekar RA et al, reported 81% of the patients to be between 21-60years of age. Fall from height was the most common cause of injury in the present study. This was in accordance to a study by Gupta N et al, where in fall from heights was observed in 25% of the cases.[12] 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.[13] In a study by Nagvekar RA et al, 62% was due to fall from heights and 37% due to road accidents.[10] In the present study the most common site of injury was cervical (53.8%), followed by dorsolumbar (20.5%), lumbar (15.4%), dorsal (9%), sacral (1.3%). Similar results were observed by other authors.[9-11] Severity of injury according to ASIA in present study was grade D (39.7%), grade A (35.9%), grade C (15.4%) and grade B (9%). In a study by Bozzo A et al, 40% of the patients had grade A severity, 34% had grade D, 33% had grade C, 22% had grade B and 11% had normal cord i.e., Grade E.[14] A study by Andreoli C et al, reported 42% ASIA Grade A, 32% Grade B, 42% grade C and 26% grade D.[15] Incidence of higher grade A was seen in studies by Ramon S et al, and Bondurant FJ et al, with 51% and 43% respectively.[16,17] However, a study by Shimada K et al, reported a higher Grade C (40%) compared to the other severity grades.[18]

Of the osseous fracture injuries, vertebral fracture was observed in 47.4% of the patients, posterior elements fracture was observed in 6.4% patients and dislocation was observed in 26.9% of the patients. Intervertebral injuries were observed in 28.2% of the patients. Among the ligament disruption, anterior longitudinal and posterior longitudinal injuries were observed in 38.5% and 43.6% of the patients respectively. Paraspinal soft tissue changes were seen in 24.4% of the patients. Similar results were observed by Nagvekar RA et al.[10] 26% of the patients in a study by Parbhoo AH et al, showed vertebral artery injury, while in studies by Tanechi H et al, and Kral T et al, it was 17% and 14%.[19-21] A study by Martinez-Perez reported 52.8% anterior longitudinal and 58.3% posterior longitudinal injuries, 57.4%-disc injuries.

CONCLUSION

Being noninvasive procedure with high specificity and sensitivity, MRI is a preferred diagnostic tool to assess the spinal cord injuries. Author were able to identify osseous fractures, ligament disruption, soft tissue injuries with high precision and accuracy. However, it was difficult to identify the smaller posterior element fractures and incapacity of MRI in case of patients with pacemakers and other implants. Moreover, the number of patients were limited in this study to accurately evaluate the effectivity of MRI in neurological prognosis.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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