

MRI Evaluation in Acute Spinal Trauma in Tertiary Center of Nepal

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ABSTRACT

Introduction

Spine injury is one of the leading causes for disability in Nepal. Patients with trauma related spine injury leads to neurological dysfunction, focal deficits and even fatal life threatening events. The timely intervention in acute spinal trauma injury could save the patients from disability and mortality risk. Imaging modalities like Xray, CT Scan and MRI helps in diagnosis and management of spinal trauma. MRI plays crucial role in detection of spinal cord and soft tissue injuries. It is superior than CT scan in evaluation of spinal cord injuries, ligament, soft tissue structures, disc, and occult osseous injuries. The objective of this research is to evaluate MRI in acute spinal trauma in tertiary center of Nepal.

Methods

This is descriptive hospital based observational study in those patients who were admitted and referred in hospital for MRI with acute spinal trauma injury. Data were analysed by SPSS 2022

Results

Acute spinal trauma is most common in male with ratio of 1.7 with the mean±SD of age was found to be 50.98±19.26 years. Most common mode of injury were fall injury (76%). Most common spinal region involved were lumbar (42%) followed by thoracic (36%), dorso-lumbar (14%) and cervical (8%) region respectively. Spinal cord contusion with edema, disc rupture, paravertebral collection and ligament injury were seen. Most common type of fractures were simple compression fracture (72%), followed by burst fracture (16%), both (6%) and listhesis and sub/dislocations (6%). Spinal cord injury were seen in 22%, followed by disc rupture, paravertebral collection and ligament injury.

Conclusions

MRI helps in evaluating vertebrae, spinal cord, ligament and disc injuries. We can assess the cord contusion, edema and canal compression. It provides involvement, extension and severity of cord injury. It endowed about outcome of surgery as well as conservative management in patient of spinal injury.

Keywords: Fall injury; MRI; spinal cord; spine; trauma.

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INTRODUCTION

Spine injury is one of the most feared trauma and spinal cord injury is major cause of paralysis and disability in human kind. Each year in USA approximately 10000 cervical spine fractures, followed by 4000 thoraco-lumbar fractures are diagnosed. Almost one out of 1000 are having partial or complete paralysis. X ray and MDCT is preferred primary imaging modality in blunt spinal trauma.¹ Role of MRI in evaluating the acutely injured spine is for assessment of spinal cord injury, ligamentous disruption, disc rupture, canal stenosis.² MRI plays an important role in the spinal trauma patients due to high sensitivity for detection of spinal cord and soft tissue injuries.

It is also modality of choice in evaluation of spinal cord (hemorrhagic and non-hemorrhagic cord injuries), ligament, soft tissue structures, disc, and occult osseous injuries. X ray and CT scan are initial imaging modalities used for diagnosis in spinal injuries.³ Traumatic injury of the spine result in mortality and prolonged morbidity.⁴ MRI in traumatic spine provide greater idea to surgeon about management and complications of injury.⁵ The indications for imaging are pain, neurologic defect, distracting injuries, altered consciousness. X ray, CT scan are primary screening modality. MR imaging provides spinal cord, disc, ligaments and soft tissue details. Vascular injuries can also be recognized in association with spinal trauma with help of MR angiogram, CT angiogram and conventional angiogram.⁶

METHODS

A descriptive cross sectional study was conducted among 50 patients in department of Radiology, College of Medical Science and Teaching Hospital Bharatpur, Chitwan. Ethical approval taken from Institutional Review Committee of College of Medical Science and Teaching Hospital. This study was conducted among those patients who are admitted and referred for MRI in Radiology department with

acute spinal trauma. MRI were conducted on siemens magnetom spectra 3Tesla MRI system. Spine MRI were obtained according to the region advised by the surgeon and physician with MRI protocols including Sagittal T1 weighted imaging with a repetition time (TR) of 789 ms and echo time (TE) of 11 ms, sagittal and axial T2 weighted imaging with sagittal repetition time (TR) of 2580 ms, and echo time (TE) of 10ms with 3 mm slice thickness. Short Tau Inversion Recovery (STIR) sequence was taken in sagittal with repetition time (TR) of 3440 ms and echo time (TE) 44ms.

Assessment of spinal trauma were interpreted by radiologist to identify the spinal cord involvement, different types of vertebral fractures or dislocation, ligaments and soft tissues injuries. Collected data were analyzed by using descriptive statistical tools in SPSS-22.

RESULTS

Fifty patients with acute spinal trauma those were send for MRI spine were observed by radiologist during the study period. Out of 50 patients 32 were male and 18 were female (Table 1). The mean±SD of age was found to be 50.98±19.26 years.

Table 1. Gender wise distribution of acute spinal trauma in patients (n=50).

Gender	Frequency (%)
Male	32(61.53)
Female	18(38.46)

Table 2. Mode of injury in acute spinal trauma.

Mode of injury	Frequency (%)
Fall injury	38(76%)
RTA	11(22%)
Hanging	1 (2%)

Most of the patients presented to us were fall injury, followed by RTA and hanging (Table 2).

Table 3. Spinal region involvement in acute spinal trauma.	
Spinal region involvement	Frequency (%)
Cervical	4(8%)
Thoracic	18(36%)
Thoroco-lumbar	7(14%)
Lumbar	21(42%)

Among 50 patients presented with spinal trauma, most common injury site is lumbar, followed by dorsal and dorso-lumbar spine respectively. In lumbar most common fracture is L1 vertebra(19) followed by D12(14) and L2(9) (Table 3).

Table 4. Type of fracture involved in acute spinal trauma.	
Type of fractures	Frequency (%)
Simple compression fracture	36(72%)
Burst fracture	8(16%)
Burst and compression fracture	3(6%)
Listhesis with dislocation and subluxation	3(6%)

Most of the patients presented were having simple compression fracture(72%), burst(16%), both(6%) and listhesis with dislocation and subluxation(6%) (Table 4).

Table 5. Others MRI findings in patients with acute spinal trauma.	
MRI Findings	Frequency (%)
Spinal Cord injury (edema, contusion)	11(22%)
Intervertebral disc rupture	6(12%)
Paravertebral edema, collection	4(8%)
Ligament injury	2(4%)

Among those patients 23 patients (46%) only shows associated cord contusion and edema (22%) disc involvement (12%), prevertebral collection (8%) and ligament injury seen in (4%) (Table 5).



Figure 1. T2WI and STIR images showing simple compression fracture with marrow edema.



Figure 2. T2WI and STIR images showing L1 vertebra burst fracture with contusion, edema and compression of distal cord and cauda equina.

DISCUSSION

Research among 50 patients with acute spinal injury patients who were referred for MRI for spinal cord injury showed that 32 were female and 18 were male with mean±SD as 50.98±19.26 years.

Most common type of injury were fall injury (76%), RTA(22%) and hanging(2%). Most common fracture were Lumbar spine (42%) in which L1 vertebra is common, followed by Thoracic (36%) and thoroco-Lumbar spine(14%). Most common type of fracture were simple compression fracture (72%) followed by burst fracture (16%), burst and compression fracture (6%) and listhesis and subluxations (6%). Among those patients 46% of patient have associated spinal cord, disc, ligament and soft tissues injuries. Spinal cord contusion and edema were seen in 22% of cases, followed by

disc involvement seen in 12%, prevertebral collection seen in 8% and ligament injury seen in 4%.

A research conducted by Pickett GE et al in Canada shows that the fall injury were common cause for acute spinal trauma. Lumbar spine is commonly involved in fall injury, followed by thoracic spine injury. Fall injury were responsible for 63% of SCI among patients.⁷

Denis f et al revealed that compression fracture is basically stress failure of the anterior column with an intact middle column. The burst fracture indicates failure under compression of both the anterior and middle columns. In fracture-dislocations, the structure of all three columns fails from forces acting to various degrees from one or another direction⁸.

Research conducted in China form 20001-2007 to determine the epidemiological characteristics of spinal trauma revealed spinal cord injuries and fracture-dislocations accounted for 16.87% and 7.17% of spinal trauma. Finding showed that male-to-female ratio was 2.33:1. About 79.32% of spinal trauma occurred in patients between 20 and 60 years of age. Motor vehicle accidents identified as the leading etiological factor (33.61%), followed by high falls (31.25%) and trivial falls (23.23%). Lumbar spine was most frequently involved (56.09%), followed by thoracic spine (23.77%), cervical spine (17.75%), and sacrococcygeal vertebrae (2.39%). Fracture-dislocation occurred most frequently in the cervical and lumbar spines, whereas spinal cord injury occurred most frequently in the cervical and thoracic spines.⁹

Aleem IS et al in india conducted a study to find the burden of spine fractures revealed that most patients were middle-aged (mean age = 51.0 years; median age = 55.5 years; range = 18.0 to 72.0 years), male (60.4%) were injured from falls (72.4%). Fractures in the lumbar region (51.0%) were most common, followed by thoracic (30.7%) and cervical (18.2%).¹⁰

Birua G in North East India conducted a study to know the epidemiology of spinal injury revealed that out of total 57 patients, 46 (81%) were male and 11 (19%) were female. The most common mode of injury was fall from height (59.64%) followed by RTA (35.08%). Most common affected age group in this study was 20-39 years followed by 50-59 years age group. Cervical spine injury was the most common (52.63%) followed by thoracic (19.29%) spine. Most common injury found was fracture dislocation of C5-C6 level.¹¹

A descriptive study conducted by Groves C et.al, in Nepal on 2015 among Earthquake-related spinal cord injury showed that female-to-male ratio was 1.3:1, (92%) sustained vertebral fracture and/or dislocation. The Nepal earthquakes resulted in a significant number of SCIs, the majority occurring in women. Incomplete paraplegia was the most common presentation.¹²

A clinico-epidemiological study conducted in rural population of eastern Nepal showed that 684 (76.35%) male and 212 (23.66%) female patients with mean age of 41.74 ± 16.53 years and 38.56 ± 15.86 years respectively were studied. Fall from height 350 (39%) patients was the commonest mode of spinal injury.¹³

Poudel et al study revealed male-female ratio was 2.4:1. The most common mode of spinal injury was due to falls in 80 (78.43%) cases. The cervical region 45 (44.12%) was the most common spinal region involved and followed by the lumbar region 7.84.¹⁴

Spine fractures account for a large portion of musculoskeletal injuries worldwide. Arbeitsgemeinschaft für Osteosynthesefragen (AO) committee has classified thorocolumbar spine injuries based on the pathomorphological criteria into 3 types, compression, distraction and axial torque and rotational deformity. Each of these types is further divided into 3 groups and 3 subgroups reflecting progressive scale of morphological damage and the degree of instability.

The thoracolumbar injury classification and severity score (TLICS) defines injury based on three clinical characteristics: injury morphology, integrity of the posterior ligamentous complex, and neurologic status of the patient. The severity score offers prognostic information and is helpful in decision making about surgical vs nonsurgical management.¹⁵

Spinal trauma is very frequent injury with different severity and prognosis varying from asymptomatic condition to temporary neurological dysfunction, focal deficit or fatal event. The major causes of spinal trauma are high- and low-energy fall, traffic accident, sport and blunt impact.¹⁶

MRI can detect bone edema, PLC injury, disk herniation, spinal canal compression, spinal cord contusion. MRI can identify larger number of lesions than CT and is highly useful for the diagnosis of soft tissue injury.¹⁷ MRI were superior to CT for visualizing injuries to discs,

ligaments, and the spinal cord, while CT was superior to MRI in characterizing bony injury.¹⁸

Limitations

MRI shows poor visualization of posterior elements compare to CT scan. MRI shows artifacts in unstable and implant patients. In this study limited population were only observed who present in acute traumatic stage. Follow up of patients, management and outcome could not be described.

CONCLUSIONS

MRI plays significant role in spinal injuries. In MRI we can recognize spinal cord injuries, disc, ligament injuries and spine fractures. It also easily identified stable and unstable spine fractures with spinal cord injury, thus guide surgeon for management and outcome of patients.

Conflict of interest: None

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