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Magnetic Resonance Imaging Study in Acute Spinal Trauma

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ABSTRACT
MRI is crucial in patients with spinal trauma because it is highly sensitive in detecting lesions to the spinal cord and soft tissues. The MRI scans were examined according to the location (cervical, thoracic, lumbar, and sacral), portion of the spinal cord affected, and the extent of the injury. For trauma patients, the location and severity of the injury, spinal fracture, ligament damage, and the presence or absence of a hematoma were observed to categorize the hematoma as either subdural or extradural. Seventy patients with acute spinal trauma those were sending for MRI spine were observed by radiologist during the study period. Out of 70 patients 42 were male and 28 were female. In magnetic resonance imaging (MRI), we are able to identify lesions to the spinal cord, discs, ligaments, and fractures of the spine. It also readily detected stable and unstable spine fractures with spinal cord injury, so guiding the surgeon in managing and predicting the outcome of patients.

INTRODUCTION

X-ray and MDCT are the preferred methods of imaging for blunt spinal trauma. The incidence of SCI in developing countries is 25.5/million/year and ranges from 2.1 to 130.7/million/year. MRI has been playing an increasingly important role in the management of spinal trauma patients. MRI is the modality of choice for evaluation of ligamentous and other spinal cord, soft tissuestructures, disc, and occult osseous injuries. The purpose of MRI in assessing the acutely injured spine is to evaluate spinal cord injury, ligament damage, disc rupture, and canal narrowing[1]. MRI is crucial in patients with spinal trauma because it is highly sensitive in detecting lesions to the spinal cord and soft tissues. It is also the preferred method for assessing spinal cord injuries (both hemorrhagic and non-hemorrhagic), ligament and soft tissue structures, discs, and hidden bone lesions. X-ray and CT scan are commonly utilized imaging techniques for diagnosing spinal injury[2]. Spinal injuries can lead to death and long-lasting illness[3]. MRI in traumatic spine provides surgeons with a better understanding of injury treatment and potential consequences[4]. The reasons for imaging are pain, neurological impairment, distracting injuries, changed state of consciousness. X-ray and CT scan are the main methods used for initial screening. Magnetic resonance imaging (MRI) offers detailed information on the spinal cord, discs, ligaments, and soft tissues. Vascular damage can also be identified in connection with spinal trauma using MR angiography, CT angiogram, and conventional angiogram[5]. The objectives of the diagnostic radiologist in spinal injury are to detect and establish a connection between neurologic injury and vertebral fracture. There are a few imaging studies: Radiography -Plain X-rays are useful for screening fractures, although hairline fractures or fractures without displacement may be challenging to identify; Computed tomography (CT) scanning-CT scans can easily identify bone fractures and assist in evaluating the severity of fractures; Magnetic resonance imaging (MRI). This is typically the preferred method for assessing the severity of spinal cord injury. Magnetic resonance imaging (MRI) is a highly effective method for identifying abnormalities in brain tissue and bone. Within each group, the abnormality can be assessed using a semi-quantitative method based on the reduction in height of the vertebral body. Grade 0: typical/unbroken vertebra; Grade I: vertebral body height is more than 75% of normal value; Grade II: vertebral body height is between 50 and 75% of normal value; Grade III: vertebral body height is less than 50% of normal value. Equally crucial is to evaluate the abnormality of the spinal canal and neural foramina. In cases of spine fractures, the spinal canal is frequently constricted due to the movement and entrance of fragments from the vertebral body, which affects its height[6].

MATERIALS AND METHODS

This study was carried out on patients who were admitted and referred for MRI in the Radiology department due to acute spinal trauma. MRI scans were performed using a Siemens Magnetom Spectra 3Tesla MRI equipment. Spine MRI scans were taken based on the recommendations of the surgeon and physician. The MRI protocols included 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 a sagittal repetition time (TR) of 2580 ms, and echo time (TE) of 10ms with a 3 mm slice thickness. A sagittal Short Tau Inversion Recovery (STIR) sequence was performed with a repetition time (TR) of 3440 ms and an echo time (TE) of 44ms. The MRI scans were examined according to the location (cervical, thoracic, lumbar, and sacral), portion of the spinal cord affected, and the extent of the injury. For trauma patients, the location and severity of the injury, spinal fracture, ligament damage, and the presence or absence of a hematoma were recorded to categorize the kind of spinal hematoma as subdural or extradural. Follow up as much as feasible patients were followed up and outcome reported in situations of spinal trauma. The radiologist analyzed the assessment of spinal trauma to determine if there was involvement of the spinal cord, various types of fractures or dislocations of the vertebrae, and injuries to ligaments and soft tissues. Data that was collected was analyzed using descriptive statistical methods in SPSS-22.

RESULTS AND DISCUSSIONS

During the study period, a radiologist watched 70 patients with acute spinal injuries who were sent for an MRI of the spine. Among the 70 patients, 42 were male and 28 were female (Table 1). The average age was determined to be 51.93 ± 20.24 years. Most of the patients presented to us were fall injury, followed by RTA and hanging (Table 2).

Among 70 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 (20) followed by D12 (15) and L2 (10) (Table 3).

Table 1: Gender wise distribution of acute spinal trauma in patients (n=70)

Gender	Frequency (%)
Male	42(60)
Female	28(40)

Table 2: Mode of injury in acute spinal trauma

Mode of injury	Frequency (%)
Fall injury	47(67.1)
RTA	20(28.5)
Hanging	3 (4.2)

Table 3: Spinal region involvement in acute spinal trauma

Spinal region involvement	Frequency (%)
Cervical	6(8.5)
Thoracic	26(37.1)
Thoroco-lumbar	9(12.8)
Lumbar	29(41.4)

Table 4: Type of fracture involved in acute spinal trauma

Type of fractures	Frequency (%)
Simple compression fracture	48 (68.5)
Brust fracture	12(17.1)
Brust and compression fracture	5(7.1)
Listhesis with dislocation and subluxation	5(7.1)

Table 5: Others MRI findings in patients with acute spinal trauma

MRI Findings	Frequency (%)
Spinal Cord injury (edema, contusion)	14(20)
Intervertebral disc rupture	9(12.8)
Paravertebral edema, collection	6(8.5)
Ligament injury	4(5.7)

Most of the patients presented were having simple compression fracture (68.5%), burst (17.1%), both (7.1%) and listhesis with dislocation and subluxation (7.1%). (Table 4). Among those patients 33 patients (47.1%) only shows associated cord contusion and edema (20%) disc involvement (12.8%), prevertebral collection (8.5%) and ligament injury seen in (5.7%). (Table 5)

A study conducted on 70 patients with acute spinal injury who were referred for MRI for spinal cord damage revealed that 42 were female and 28 were male, with an average age of 51.93±20.24 years. The most frequent types of injury were falls (67.1%), road traffic accidents (28.5%), and hanging (4.2%). The most frequently occurring fracture was in the Lumbar spine (42%), with the L1 vertebra being the most commonly affected. This was followed by fractures in the Thoracic region (37.1%) and the thoraco-Lumbar spine (12.8%). The most often occurring kind of fracture was simple compression fracture (68.5%), followed by burst fracture (17.1%), burst and compression fracture (7.1%), and listhesis and subluxations (7.1%). Out of those patients, 47.1% have injuries related to the spinal cord, discs, ligaments, and soft tissues. Spinal cord bruising and swelling were observed in 20% of patients, followed by disc involvement observed in 12.8%, collection in front of the vertebrae observed in 8.5%, and ligament injury observed in 5.7%. A study conducted by Pickett GE *et al.* in Canada indicates that fall injuries were a frequent source of acute spinal trauma. The lower back is frequently affected in cases of falling, with injury to the middle back following afterwards. 60% of spinal cord injuries among patients were caused by falls[7]. Denis and colleagues discovered that a compression fracture is essentially a stress failure of the front column with an unbroken middle column. The burst fracture suggests that both the front and center parts were unable to withstand compression. In cases of fracture-dislocations, the integrity of all three columns is compromised due to stresses exerted from different directions to varying extents[8]. MRI is the sole imaging method used to evaluate spinal cord damage, determine the location and severity of the lesion, identify the degree of spinal cord compression, and detect bone marrow edema. A study conducted in a rural community of eastern Rajasthan found that 684 (76.35%) male and 212 (23.66%) female patients, with an average age of 41.74 ±16.53 years and 38.56±15.86 years respectively, were included in the study. The most frequent cause of spinal damage was falling from a height, which occurred in 350 individuals (39%)[9]. A study found that the ratio of males to females was 2.4 to 1. The most frequent cause of spinal injury was falls, accounting for 80 (78.43%) instances. The cervical region 45 (44.12%) was the most often affected area of the spine, followed by the lumbar region 7.84[10]. Spine fractures account for a large portion of musculoskeletal injuries worldwide. The Arbeitsgemeins chaftfür Osteosyn the-sefragen (AO) committee has categorized thorocolumbar spine injuries into 3 types: compression, distraction, and axial torque and rotational deformity, based on pathomorphological criteria. Each of these categories is additionally separated into 3 groups and 3 subgroups, which indicate the increasing level of morphological harm and the extent of instability. The thoracolumbar injury classification and severity score (TLICS) categorizes injury based on three clinical factors: injury shape, condition of the posterior ligamentous complex, and neurological condition of the patient. The severity score provides predictive information and is useful in making decisions about surgical or non surgical treatment[11]. Spinal injury is a common occurrence with variable levels of severity and outcomes, ranging from no symptoms to transitory neurological impairment, localized deficit, or even a deadly event. The main reasons for spinal injury are falls from high or low heights, road accidents, sports activities, and blunt force[12]. MRI can identify bone swelling, PLC damage, disk protrusion, compression of the spinal canal, and bruising of the spinal cord. MRI can detect a greater number of lesions than CT and is very helpful for diagnosing soft tissue injury[13]. MRI was better than CT for visualizing damage to discs, ligaments, and the spinal cord, but CT was better than MRI in characterizing bone injury[14].

CONCLUSION

MRI has a major function in spinal injury. In magnetic resonance imaging (MRI), we are able to identify spinal cord injuries, disc injuries, ligament injuries, and fractures of the spine. It also readily detected stable and unstable spine fractures in patients with spinal cord damage, hence assisting surgeons in managing and predicting patient outcomes.

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