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MRI & MDCT EVALUATION OF POST TRAUMATIC ACUTE AND SUBACUTE SPINAL CORD INJURY IN TERTIARY CARE HOSPITAL IN SOUTH INDIA

Radiology

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ABSTRACT

AIM AND OBJECTIVES : The aim of this work is to assess the role of magnetic resonance imaging and multi-detector computed tomography (MDCT) in the evaluation of spinal trauma.

MATERIALS AND METHODS: 60 patients with acute spinal injury were taken up for evaluation with CT and MRI in department of Radiology in PES Hospital from January 2020 to May 2021.

RESULTS: There were a total of 60 patients out of which 36 were male and 24 were female patients. Most of spinal trauma patients were between age groups 21-30 & 41-50. The main causative agents of spinal injury were motorcycle accidents (41.8%), falls from height (28.6%), motorvehicle accidents (19.4%), sports (6.1%), and others (4.1%).

45 patients had fractures, 35 patients had thecal sac compression, 16 had cord involvement like contusion/edema,10 had ligament injury and 11 had hematoma.MRI was useful for the evaluation of the supporting ligaments and the spinal cord after the patient has been stabilized.

CONCLUSION : Traumatic injury to the spine and spinal cord could be probably devastating.

Considering the severity of the trauma, CT shows correct and quicker ways to evaluate spinal trauma. The bone anatomy is best visualized in CT. MRI is an ideal choice of modality in detecting spinal cord compression. Also helps in diagnosing bone marrow edema, posterior ligament complex injuries, and disc-related pathologies.

So CT and magnetic resonance imaging are complementary to each other in analysis of spine injuries.

KEYWORDS

Computed tomography, Vertebral fractures, Magnetic resonance imaging, Spine trauma

INTRODUCTION

Traumatic injury to the spine and spinal cord could be probably devastating[1].

Imaging plays a vital role in the identification of acute spinal trauma and helps in initiating prompt and correct treatment in these patients. Typical radiographs and computerized tomography are the initial imaging modalities utilized in the identification of most cases of spinal injuries [2]. The bone anatomy is best visualized in CT and helps in better detection of fractures.

The role of magnetic resonance imaging in evaluating the injured spine is well-established and contributes to the assessment of cord compression, ligamentous disruption, bone injury and disc protrusion. The presence of cord edema provides data concerning the severity and extent of the injury and these options could facilitate clinicians to predict clinical recovery.

MATERIALS AND METHODS:

MRI was done using GE Signa explorer 1.5 T and limited CT sections was done at fracture level using 16 slice GE Brightspeed .

60 patients with spinal injury was taken up for evaluation with MRI done using GE Signa explorer 1.5 T and limited CT sections was done at fracture level using 16 slice GE Brightspeed in the Department of Radiology in PESIMSR, Kuppam Hospital from January 2020 to June 2021. MR imaging of spine was done using separate spine coils. MRI sequences include Axial T2, Sagittal T1 and T2, Coronal and sagittal Short T1 Inversion Recovery (STIR).

CT protocol includes High resolution with 1mm thin section obtained in axial sections and Coronal and Sagittal Reconstruction images were taken.

The results were tabulated in Microsoft Excel. The statistical analysis was done using Statistical Package for the Social Sciences (SPSS).

INCLUSION CRITERIA

Patients with spinal trauma

EXCLUSION CRITERIA

1.Degenerative and infective conditions of spine.

2.Patients with ferric metallic implants in MRI.

RESULTS:

There were a total of 60 patients out of which 36 were male and 24 were female patients (Figure 1).

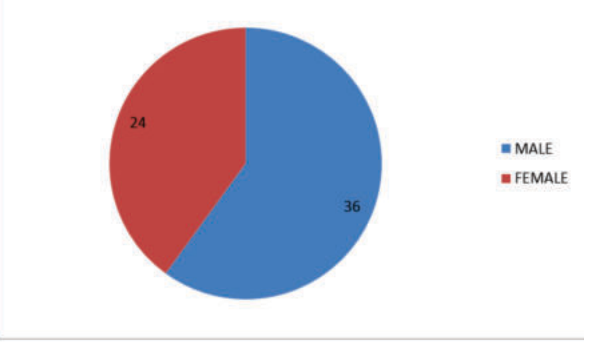

Figure 1 representing sex distribution

Most of spinal trauma patients were between age groups 41-50 years followed by 21-30 years (Chart 1).

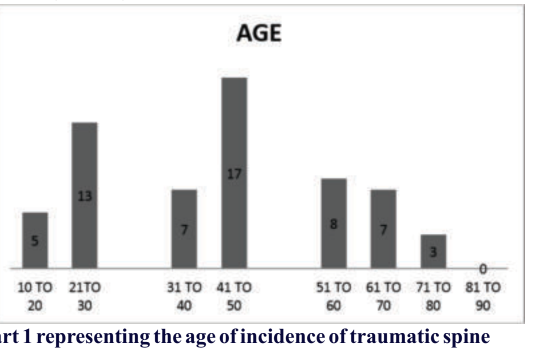

Chart 1 representing the age of incidence of traumatic spine

The main causative agents of spinal injury were motorcycle accidents (41.8%), falls from height (28.6%), motorvehicle accidents (19.4%), sports (6.1%), and others (4.1%).

Most commonly involved vertebra was dorsal vertebra, 33 patients (55%) followed by lumbar vertebra, 23 patients (38%) and cervical vertebrae, 9 patients(15%) (Figure 2).

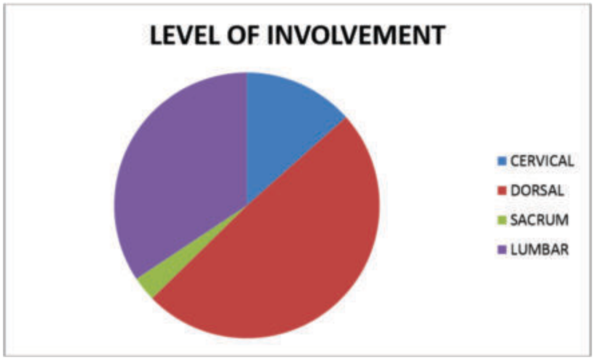

Figure 2 representing the level of spinal cord trauma

Of the 60 patients, 35 had thecal sac compression, 16 had cord involvement like contusion/edema, 25 patients had cord compression, 10 had ligament injury and 11 had extradural hematoma, 9 had pre and paravertebral hematoma and 2 had complete cord transaction (Chart 2).MRI was useful for the evaluation of the supporting ligaments and the spinal cord after the patient has been stabilized .

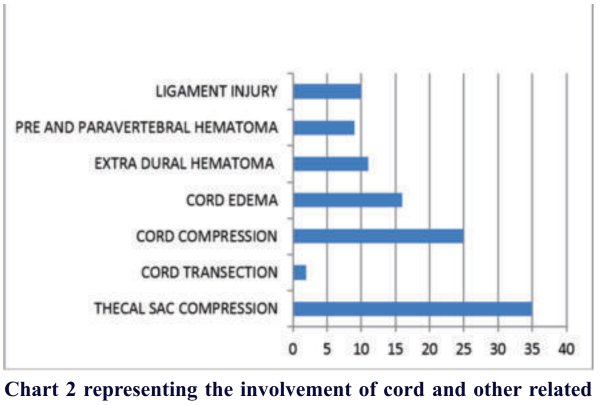

Chart 2 representing the involvement of cord and other related injuries

There were a total of 80 fractures, out of which most common fractures were wedge compression fracures 37, followed by burst fractures 22, neural arch fractures were 13 and sacral fractures were 2, and rotation-dislocation fractures were 2 (Chart 3).

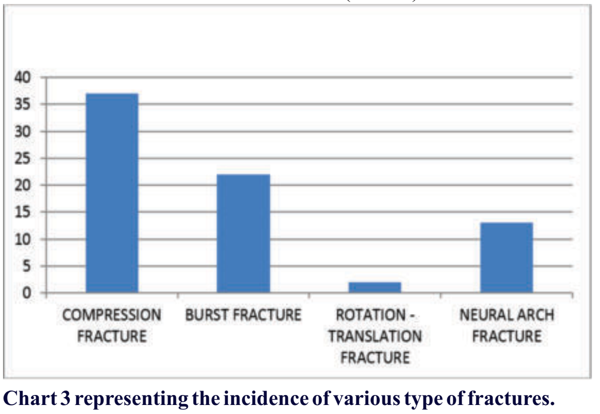

Chart 3 representing the incidence of various type of fractures.

Flexion-compression mechanism (wedge or compression fracture)
It is typically caused by combination of flexion and compression forces. There are three subtypes.

Type I : anterior column is involved (Stable fracture) and the loss of vertebral body height is < 50 %.

Type II : There is an anterior column involvement and posterior column ligamentous failure (potentially unstable fracture). The loss of vertebral body height is usually greater than 50%.

Type III : There is failure of all three columns (unstable fracture). Imaging studies demonstrate anterior wedging and posterior vertebral body disruption.

Axial-compression mechanism (burst fracture)
Burst compression fracture is caused by high energy trauma. It is most commonly found at dorsolumbar junction and between D5 and D8 vertebral levels. There is loss of vertebral height and involves anterior and middle columns; however posterior column involvement tells us whether the fracture is stable or unstable.

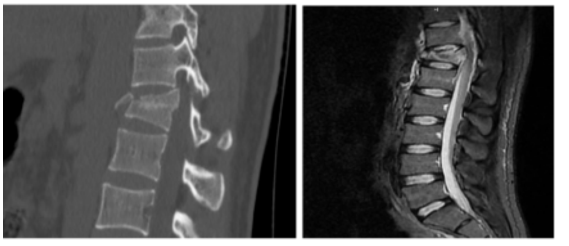

Fig 3 Sagittal CT showing anterior wedge compression fracture of D12 vertebra and

Fig 4 showing sagittal STIR imaging demonstrating STIR hyperintense signal change in vertebral body indicating edema.

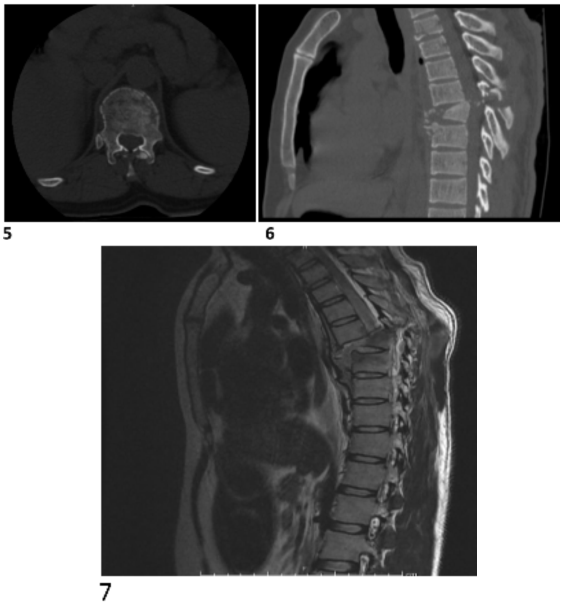

Figure 5, 6 & 7 showing burst compression fracture of D7 vertebra on both CT and MRI. On CT fracture of D8, spinous process of D6, fracture of anteroinferior portion of D3 vertebra is also seen.

Rotational fracture-dislocation mechanism
The precise mechanism of this fracture is a combination of lateral flexion and rotation with or without a component of posterior-anteriorly directed force.

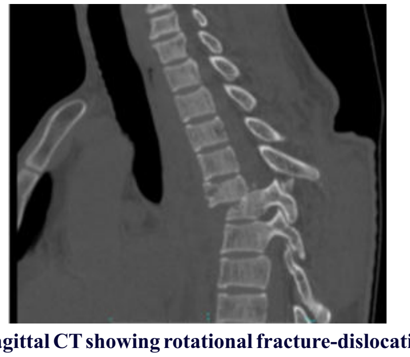

Figure 8 Sagittal CT showing rotational fracture-dislocation

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Jefferson fracture is a rare fracture of the atlas, defined by concomitant fractures of its anterior and posterior arches, leading to a burst of the atlas ring.

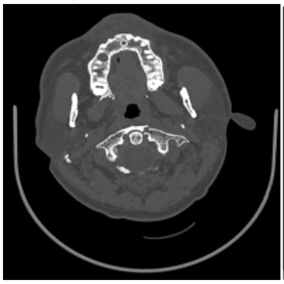

Figure 9 showing fracture of anterior arches of C1 vertebra.
Figure 10 Non enhanced CT Coronal reformatted plane showing fracture of anterior arch.

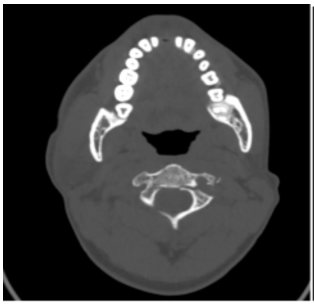

Figure 11 & 12 showing fracture of posterior body and left transverse process of C2.

DISCUSSION

Acute Cord Injury

There is a spectrum of changes of acute traumatic spine on magnetic resonance imaging from concussion, that is invisible on imaging to cord edema, cord contusion and cord transection.

Cord compression:

There is an instantaneous relation between the degree of most cord compression, acute neurologic deficit. Estimation of proportion of compression is calculated by comparison with sections higher than and below the injured segment. There's smart correlation with measurement between T1W and T2W sequences despite potential limitations with T2W pictures from bodily fluid (CSF) flow artefact, Gibbus artefact and chemical shift[13].

Figure 13 : T2 weighted sagittal image showing fracture of L3 vertebra and fracture fragment causing compression on thecal sac and cord.

Cord oedema :

Cord oedema is detected as high T2 signal and normal/low T1 signal within the cord (Figure 12). It can also be associated with swelling of the cord (Figure 14).

Cord oedema is not static and changes significantly within the first two weeks following injury [7].

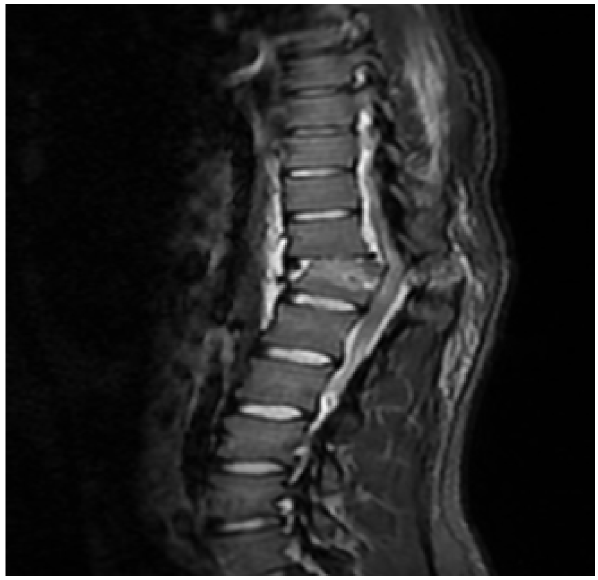

Figure 14 : T2 Sagittal STIR showing cord compression and edema at the site of fracture of vertebra and adjacent vertebral levels.

Ligamentous injury :

Spinal ligaments are important to keep up the normal alignment between bone segments normal a physiologic load. Normal ligaments of the spine appear as low signal intensity bands on all the sequences. [8].

Ligamentous tears are either partial or complete. Partial tears are seen as high signal areas on STIR pictures associated with oedema and hemorrhage with variable degrees of intact fibers. Complete tears are seen as complete lack of intact fibers with high signal intensity on STIR pictures because of associated oedema and hemorrhage[9]

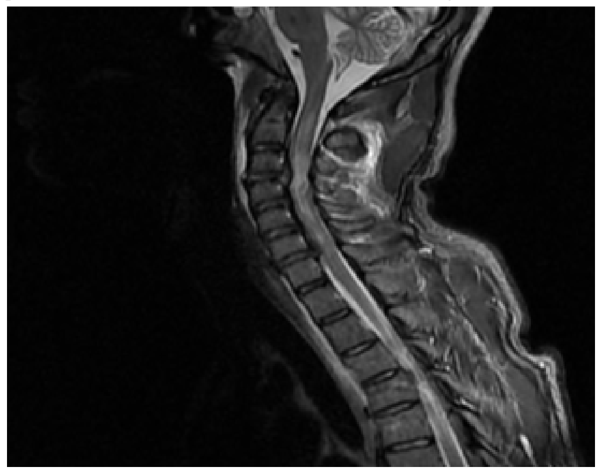

Figure 15 : STIR Sagittal sequence showing hyperintensity along interspinous region – Suggestive of interspinous ligament tear

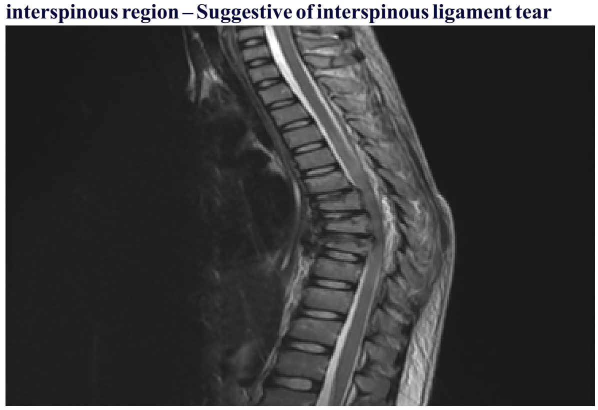

Fig 16 : Sagittal T2 showing prevertebral collection along the anterior aspect of dorsal vertebrae – Hematoma

Fig 17 showing STIR sagittal sequence showing anterior epidural collection from C6 to T1 vertebra with edematous cord with supraspinatus and interspinous hyperintensities.

Chronic fractures can show fatty marrow as high signal on T1W and T2W pictures while not marrow oedema[10][11].

Benign osteoporotic fracture vs malignant fracture

Diagnostic challenges sometimes arise in discriminating osteoporotic fracture from malignant fractures.

Findings in favour of acute osteoporotic compression fractures includes horizontal band of abnormal signal intensity separated by a line from the traditional fatty marrow, relative lack of involvement of posterior components, and angulated and concave look of the posterior vertebral margin [12].

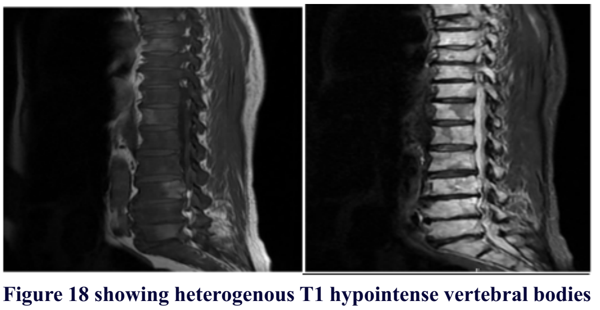

Figure 18 showing heterogenous T1 hypointense vertebral bodies signal changes and Figure 19 showing STIR hyperintense vertebral bodies signal changes.

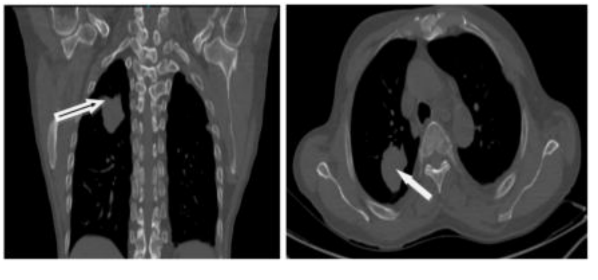

Figure 20 & 21 : Coronal and Axial CT showing isodense mass in right upper segment.

CONCLUSION

Considering the severity of the trauma, CT shows correct and quicker ways to evaluate spinal trauma. It is additionally the most cost-effective. The bone anatomy is best envisioned in CT.

In trauma patients, spinal cord lesions have a serious concern. MRI is an ideal choice of modality in diagnosing, detecting, and determinative the explanation for spinal cord compression. Also helps in diagnosing bone marrow edema, posterior ligament complex injuries, and disc-related pathologies.

MRI ought to be done whenever a spinal cord lesion is suspected and it's more sensitive in assessing soft tissue and spinal cord injuries than the other modalities. So it's recommended that CT and magnetic resonance imaging are complementary to each other in analysis of spine injuries.

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