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MRI IMAGING OF CERVICAL SPINE TRAUMA

Radiodiagnosis

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ABSTRACT

Cervical spine trauma is a common clinical problem and MRI is an important investigation in such cases. MRI has high sensitivity for detection of acute soft tissue, cord and ligamentous injuries. MRI has been increasingly deployed in emergency patients as need for evaluating the cord injuries in such patients is of utmost importance. In this original article we are presenting our data of MRI findings in cervical spine trauma cases.

KEYWORDS

Spinal Trauma, Mri, Spinal Cord, Hemorrhage, Ligamentous Injury

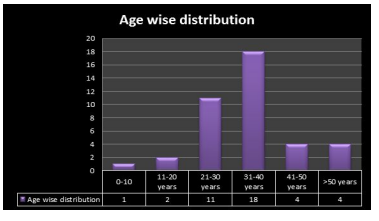
Introduction: -

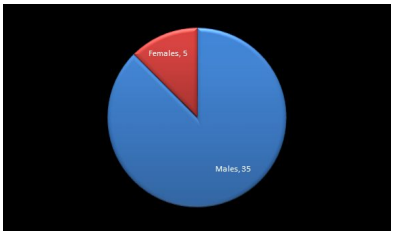
In cases of blunt trauma cervical spine injury is seen in 2.4% of individuals. Most common level of injury is C2 while maximum number of fractures are seen in last two cervical vertebrae (C6 and C7). Vertebral body is the most frequent site of fracture. [1] High risk characteristic patients prone for cervical spine trauma include high velocity blunt trauma, significant motor vehicle accident, direct cervical region injury, falls and diving injury, significant head/facial injury,altered mental status at the time of trauma, complaint of severe neck pain, thoracic and lumbar spine trauma and rigid spine. [2] Cervical trauma is commonly accompanied with other non contiguous spinal injuries. Lower cervical and upper thoracic regions are especially notorious for this. [3] But prognosis is not significantly worse than single level injuries. [4] Cervical injuries in elderly patients tend to involve more than one level with consistent clinical instability and commonly occur at Atlantoaxial complex. [5] Cervical spine injury is rare in children accounting for 1-2%. Younger children have predilection for injuries of upper cervical spine where as children in older age group in lower cervical spine. Spinal cord injuries without radiographic abnormalities (SCIWORA) is seen only in younger age group. [6] Spinal cord injury occurs with annual incidence of 15-40 cases /million worldwide. Various causes responsible are motor vehicle accidents, community violence, recreational activities and workplace related injuries. In its pathophysiology first step is primary mechanical damage that occurs within minutes as a result of mechanical Spinal Cord Injury. The second step is the secondary injury triggered by the primary damage, resulting in micro vascular damage, edema, demyelination, ischemia, excitotoxicity, electrolyte imbalances, free radical production, inflammation and late apoptotic cell death. [7] In imaging of acute injuries of cervical spine radiography, CT and MRI have role to play due to their relative merits. [8] The main indications of MRI in spinal trauma include Radiographic and/or CTscan findings suggestive of ligamentous injury, to look for epidural hematoma or disc herniation before attempting a closed reduction of cervical facet dislocations, to identify spinal cord abnormalities in patients with impaired neurological status and to exclude clinically suspected ligamentous or occult bony injuries in patients with negative radiographs and To determine the stability of the cervical spine. [9, 10, 11, 12] Denis et al has given three-column concept indicating spinal stability. He divided vertebral column into three vertical parallel columns (i.e. anterior, middle and posterior columns) for the purposes of evaluating stability [13]. Spinal injury is usually classified as unstable when two contiguous columns are affected. The anterior column consists of ALL, anterior two-thirds of the vertebral body and anterior two-thirds of the intervertebral disc. The middle column consists of posterior one-third of the vertebral body, posterior one-third of the intervertebral disc, and PLL. The posterior column consists of everything posterior to the PLL including pedicles, facet joints and articular processes, ligamentum flavum, neural arch and interconnecting ligaments [14]. The rationale of this study was to study the role of MRI imaging in patients who presented with cervical spine trauma.

Material and methods: - A prospective observational study was carried out in the Department of Radio diagnosis JNMC Sawangi over a period of two years. Inclusion criteria were patients with cervical spine trauma having stable vital parameters. Exclusion criteria included unstable patients not fit for MR examination, history of cervical spine surgery and patients having cardiac pacemakers or angioplastic stents and claustrophobic patients. Forty patients of either sex, with history of cervical spine trauma were subjected to Magnetic resonance imaging. The approval for the study was obtained from the institutional ethical committee. MRI was done on 1.5 Tesla MRI machine (BRIVO MR 355 GE make). The cervical spine was assessed on MRI for curvature, alignment, fractures, locked facets and prevertebral soft tissue. In addition to this ligament injury, traumatic disc herniation, pre and paravertebral hemorrhage, spinal cord injury, and epidural hemorrhage were noted on MRI.

Results: -

In this study, majority i.e. 72.5 % of cases fell in the age group of 21-40 years and 87.5 % were males in the study. History of fall was seen in 25 % patients but vehicle accidents was main cause seen in 65 % patients. Maximum number of patients presented with neck pain (60%), followed by limb weakness (57.5%). Associated head injury was found in 22.5% of the patients and associated fractures were seen in 7.5% of the patients. Hyper flexion injuries were seen in 25% patients followed by hyperextension in 10% patients. C5 vertebral fracture was the most common fracture and was observed in 12.5% patients. Prevertebral soft tissue edema was seen in 15% patients and locked facets were mainly seen at C5-6, C6-7 levels (12.5%). Out of the 40 patients the interspinous ligament and Supraspinous ligament was injured in 10 % patients. Herniation of the disc was most commonly seen at C4-5 disc level on MRI and is seen in 10 percent of the total patients. Simple cord edema was seen in 32.5% cases. Odontoid fractures were present in 5% patients. Associated fractures of thoraco-dorsal spine were seen in 5% patients. Fused C4-C5 vertetebra was seen in one patient. Anterior column was affected in 8 (20%) cases, middle column was affected in 8 (20%) cases and posterior column was affected in 4 (10%) cases.

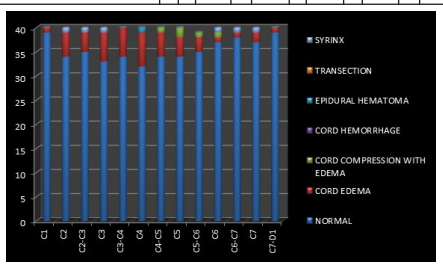




MR IMAGING FINDINGS IN SPINAL CORD

	No. of patients	Percentage	No. of levels
Cord edema	13	32.5	46
Cord compression with edema	2	5	5
Cord haemorrhage	nil	0	
Epidural hematoma	1	2.5	1
Transection	nil	0	
Syrinx	2	5	6

	C1	C2	C2-C3	C3	C3-C4	C4	C4-C5	C5	C5-C6	C6	C6-C7	C7	C7-D1
Cord Edema	1	5	4	6	6	7	5	4	3	1	1	2	1
Cord compression with edema	0	0	0	0	0	0	1	2	1	1	0	0	0
Cord haemorrhage	0	0	0	0	0	0	0	0	0	0	0	0	0
Epidural hematoma	0	0	0	0	0	1	0	0	0	0	0	0	0
Transection	0	0	0	0	0	0	0	0	0	0	0	0	0
Syrinx	0	1	1	1	0	0	0	0	0	1	1	1	0
Total	1	6	5	7	6	8	6	6	5	3	2	3	1



LIGAMENT TEARS

	No. of patients	Percentage	No. of levels
Anterior longitudinal ligament	4	10	2
Posterior longitudinal ligament	10	25	14
Flaval ligament	4	10	4
Supraspinous and interspinous ligament	4	10	12

FRACTURES

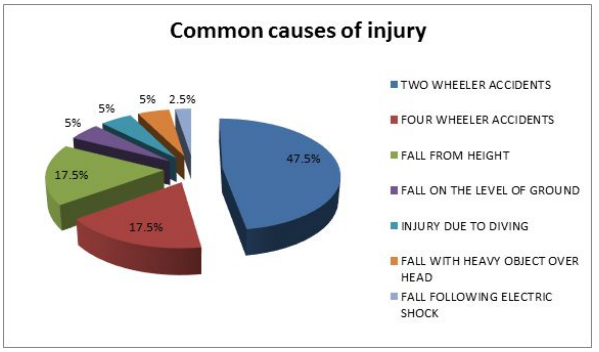
	No. of patients	Percentage
Burst fracture	2	5
Compression fracture	5	12.5
Odontoid fracture	2	5
Associated fracture of Dorsal and lumbar spine	2	5
Bone marrow edema	3	7.5
Extension tear drop fracture	2	5
Posterior elements fractures	4	10

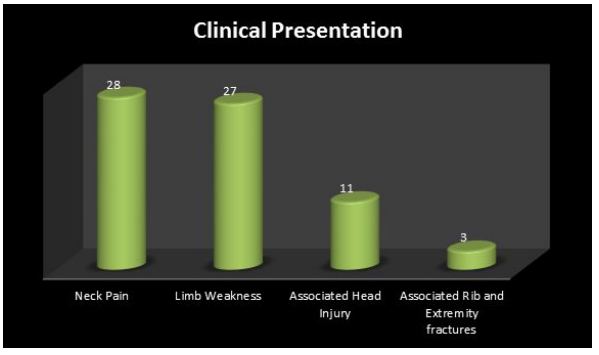
OTHER FINDINGS

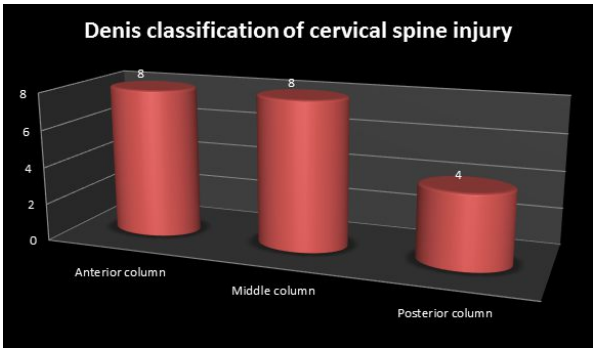
	No. of patients	Percentage	No. of levels
Prevertebral haemorrhage	6	15	47
Traumatic disc herniation	4	10	5
Anterolisthesis	1	2.5	1
Injury to vertebral artery	Nil	0	
Retro pulsed segment	2	5	3
Unilateral facetal dislocation	2	5	2
Bilateral facetal dislocation	3	7.5	3

Common causes of injury

	No. of Patients
Road traffic accidents	
Two wheeler accidents.	19
Four wheeler accidents.	7
Fall from height	7
Fall on the level of ground	2
Injury due to diving	2
Fall with heavy object over head	2
Fall following electric shock	1







Discussion: - The mean age of the study population was 36 years. The maximum number of cases fell in the age group of 21- 40 years. There was a male sex predilection owing to their increased outdoor activities. This was also noted in studies by N. Mathur, [15] and Mahnaz Yadollahi [16]. The most common mode of injury was road traffic accidents of which two wheeler accidents were predominant mode of injury. The commonest fractured vertebra was C5 vertebra. MRI was more accurate in depicting the locked facets due to sequential sagittal imaging. MRI was also superior in detecting the prevertebral soft tissue edema owing to its higher soft tissue contrast. Simple cord edema was the most common cord injury which could have been attributed to less severe form of injury and favourable prognosis. The next common injury was cord compression with edema. None of the patients had cord hemorrhage or cord transection. The interspinous ligament was the commonest ligament to be injured followed by anterior longitudinal ligament.

Conclusion: - MRI provides an accurate and non invasive modality for evaluation of patients with cervical spine trauma and can be used as an important primary modality of choice for diagnosis of various manifestations.

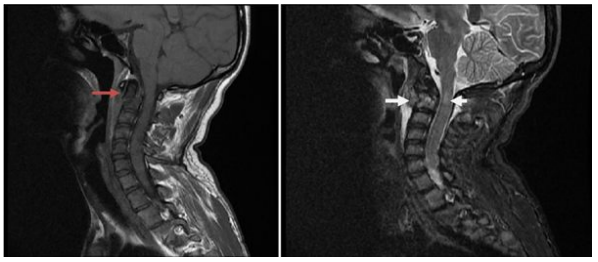


Fig 1: Displaced fracture of base of odontoid process (red arrow), Prevertebral Haemorrhage (white arrow), Non haemorrhagic cord contusion (short arrow).

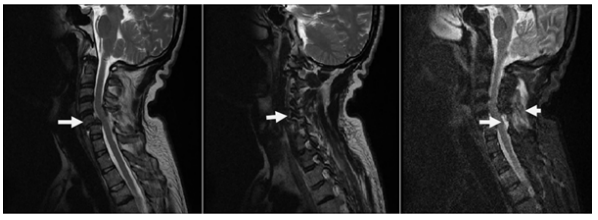


Fig 2: Grade II anterolisthesis of C5 over C6 (white arrow), Bilateral facetal dislocation, Disruption of ligamentum flavum at C6-C7 level, Sprain of interspinous and supraspinous ligament from C2 to C7 level.

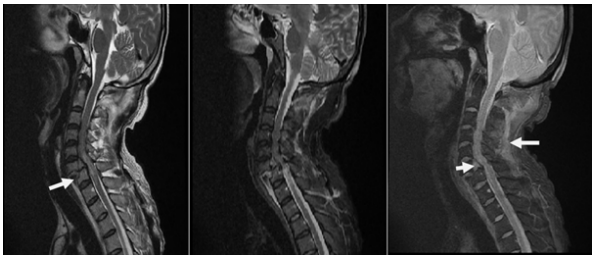


Fig 3: Extension teardrop fracture of upper end plate of C7 vertebra, Kinking of cervical spine cord, cord edema at C7 level, prevertebral haemorrhage, anterolisthesis of C6over C7, Post traumatic sprain along interspinous and supraspinous ligament, traumatic avulsion of posterior longitudinal ligament from posterior cortex.

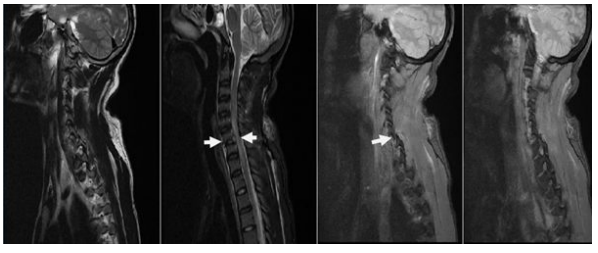


Fig 4: Unilateral locked facet, Grade I anterolisthesis C6 over C7, Bony contusion of C6 with compression fracture, tear of ligamentum flavum at C6 level, fracture of C7 vertebral body, traumatic cord edema C5-C7.

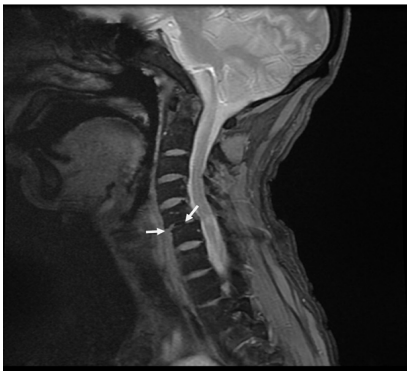


Fig 5: Disruption of anterior longitudinal ligament, contusion within the disc

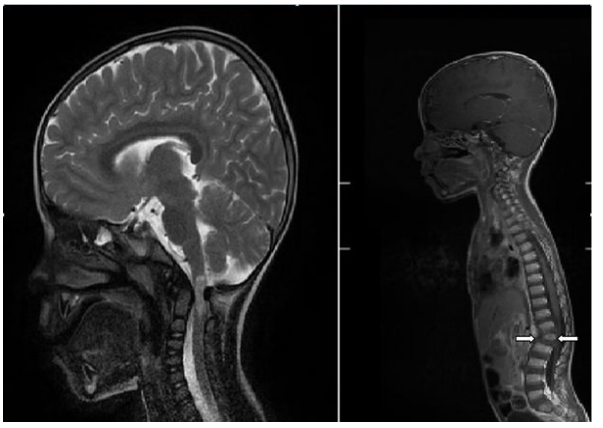


Fig 6: Cord edema at C1-C2 level, compression fracture of L1 vertebra and syrinx at D12 level.

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