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To Study Spinal Cord Injury without Radiolographical Abnormality in Tertiary Care Centre in Central India

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Abstract: ***Spinal Cord Injury Without Radiographic Abnormality (SCIWORA) is characterized by significant spinal cord injury symptoms despite normal findings on traditional radiographic imaging. This study aims to elucidate the epidemiology, risk factors, and clinical manifestations of SCIWORA, with a focus on diagnostic challenges and outcomes. A retrospective analysis was conducted on 24 participants diagnosed with SCIWORA. Demographic data, clinical presentation, imaging results, and associated factors were reviewed. Statistical analysis was performed to determine the distribution of findings and correlations with outcomes. The mean age of participants was 45.71±14.40 years, with a significant male predominance (83.3%). The most common occupation was farming (33.3%). Clinical presentation included pain during movement (95.8%), bilateral limb weakness (83.3%), and varying Glasgow Coma Scale (GCS) scores. Imaging revealed spinal cord contusion with edema in the majority of participants (66.7%), and traumatic disc herniation in 25%. Pre - existing spondylodegenerative changes were present in 45.8% of cases. SCIWORA poses significant diagnostic and management challenges due to its subtle presentation on standard imaging. MRI remains crucial for diagnosis but may not detect all cases. Enhanced clinical vigilance and a multidisciplinary approach are essential for effective management. Further research is needed to refine diagnostic strategies and treatment protocols.***

Keywords: Spinal Cord Injury Without Radiographic Abnormality, SCIWORA, MRI, spinal cord contusion, diagnostic challenges

1. Introduction

Spinal cord injury without radiographical abnormality (SCIWORA) is a distinct clinical entity defined by the presence of neurological deficits following spinal trauma, despite the absence of abnormalities on conventional radiographic imaging modalities such as X - rays and computed tomography (CT) scans. Originally identified in pediatric populations in the 1980s, SCIWORA has since been acknowledged in adults, broadening the scope of its clinical implications. The incongruity between significant neurological impairment and normal radiographic findings presents a substantial diagnostic and therapeutic challenge. [1, 2]

The pathophysiology of SCIWORA remains a topic of ongoing research and debate. The condition is often attributed to the elasticity and flexibility of the spinal column in children, which can lead to transient deformities that injure the spinal cord without leaving permanent osseous or ligamentous damage detectable on standard imaging. [3] In adults, similar mechanisms may apply, although factors such as degenerative changes and pre - existing spinal conditions can also play a role. Magnetic resonance imaging (MRI) has become an invaluable tool in the diagnosis of SCIWORA, often revealing underlying soft tissue, ligamentous, or spinal cord abnormalities that are not visible on X - rays or CT scans. [4, 5]

Clinically, SCIWORA can manifest with a range of symptoms, from transient paresthesia and motor weakness to complete paralysis. (6) The variability in presentation necessitates a high index of suspicion, particularly in the context of appropriate trauma history. The initial absence of radiographic findings can lead to underestimation of injury severity, delaying appropriate management and potentially worsening outcomes. [7, 8]

Effective management of SCIWORA involves early recognition, appropriate imaging, and a multidisciplinary approach to treatment. While there is no consensus on the optimal therapeutic strategy, current practices include immobilization, corticosteroid therapy, and surgical intervention in selected cases. The role of rehabilitation and long - term follow - up is critical in maximizing functional recovery and quality of life for affected individuals. [9, 10]

2. Review of Literature

Recent studies on Spinal Cord Injury Without Radiographic Abnormality (SCIWORA) highlight its complexity and varied presentation:

KivancAtesok et al. (2018) - . Found that it is most common in children, especially those with a preference for the cervical spinal cord due to its increased mobility and large head - to - body ratio. However, it can also affect adults and the thoracolumbar spinal cord. Magnetic resonance imaging

(MRI) is a valuable diagnostic tool for SCIWORA due to its ability to identify soft tissue lesions like cord edema, hematomas, transections, and discoligamentous injuries. Treatment for SCIWORA mainly involves nonoperative management, including steroid therapy, immobilization, and avoiding activities that may increase the risk of exacerbation or recurrent injury. (11)

Kavin Khatri et al. (2014). Found that SCIWORA is a rare condition involving the cervical spine, with thoracic spine involvement being rare due to rib cage stability. The cause and pathophysiology of SCIWORA are still debatable. A case study presents an adult male with paraplegia after a road traffic accident. Initial radiological investigations were normal, but magnetic resonance imaging revealed spinal cord contusion without vertebral column disruption. The patient partially recovered with conservative treatment. Spinal trauma patients with neurological deficits should be treated as SCIWORA cases. (12)

Nicola Morelli et al. (2023). found that SCIWORA is a rare post - traumatic myelopathy, more common in pediatrics and elderly patients. It can cause transient paraesthesia to quadriplegia, making it a challenge for emergency physicians. Early diagnosis and intervention are crucial for avoiding permanent neurological deficits. Magnetic resonance imaging (MRI) is the gold standard technique for identifying spinal cord injuries. A 53 - year - old woman presented to the emergency department with a minor head injury after a forward fall. In - depth neurological examination and early diagnosis are crucial for a patient's prognosis. (13)

3. Subjects and Methods

It was an observational descriptive study which was commenced after taking permission from institutional ethical committee. Informed consent was taken from all participants before inclusion in the study. After admission to the hospital, a detailed clinical history along with thorough clinical examination of the patient was done. MRI was done for all patients whose X - ray/CT was normal and still patient was suspicious of spinal cord injury. SIEMENS 3 TESLA Magnetom vida was used to scan the patients. All patients of spinal cord injury with CT and /or x - ray normal and giving consent for the study were included in study. All patients of spinal cord injury with CT and /x - ray abnormal, patients with MRI incompatible implants, those who denied consent for the study and those having claustrophobia were excluded from study. Demographic data, clinical presentation, imaging results, and associated factors were reviewed. Statistical analysis was performed to determine the distribution of findings and correlations with outcomes. The results are presented with appropriate tables and diagrams. Statistical significance was assessed using the chi - square test ($p \leq 0.05$).

4. Results and Observation

This study reviewed SCIWORA, focusing on its epidemiology, risk factors, and clinical features. Key findings include:

Demographics: Most participants were aged 20 - 40 years (45.8%) with a mean age of 45.71 years. There was a significant male predominance (20 males vs.4 females).

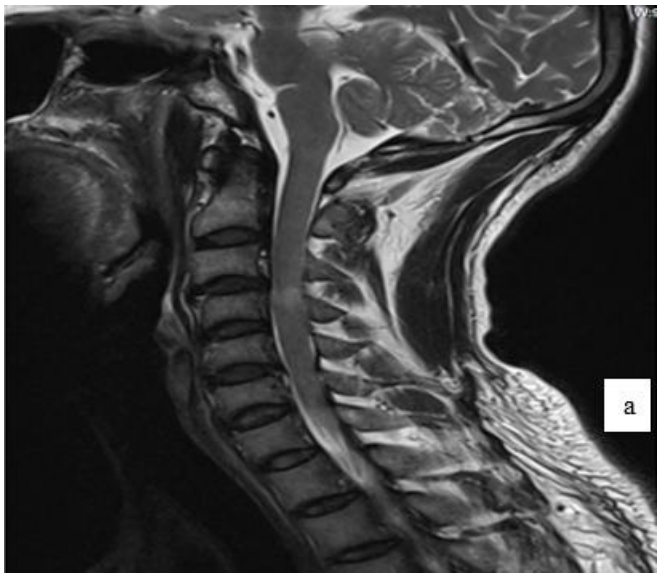
Occupations: Farming was the most common occupation (33.3%), followed by clerks and shop owners (12.5% each).

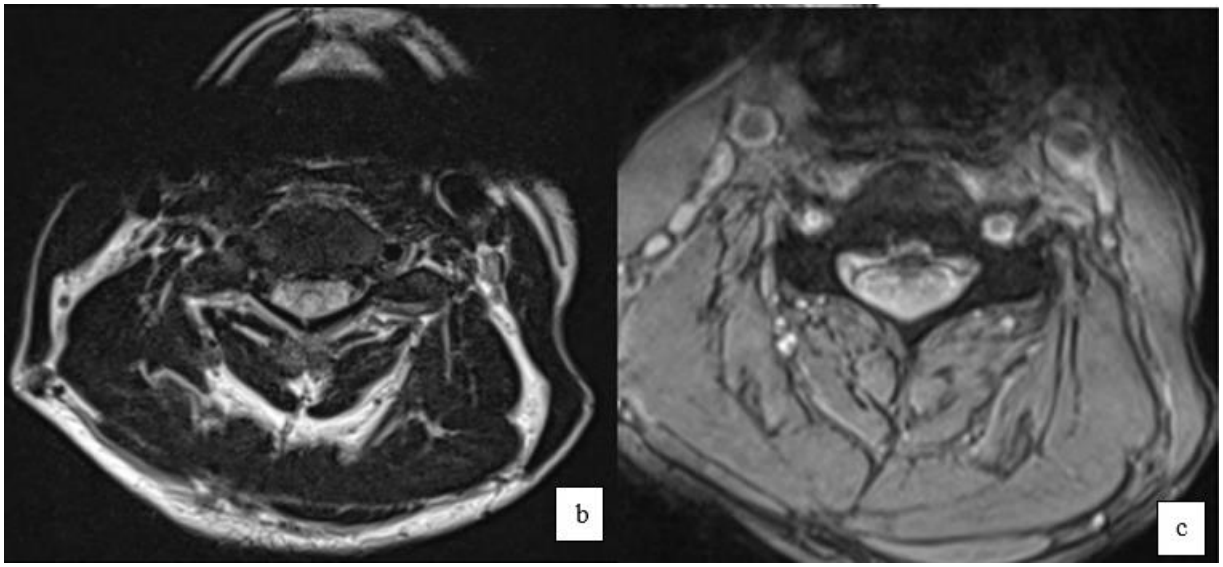
Symptoms: 95.8% of participants experienced pain during movement. Bilateral upper and lower limb weakness was noted in 20/24 participants, with 3 having only lower limb weakness and 1 experiencing tingling sensations in all limbs.

Causes: Half of the participants had a history of falls from a height with head injury, and 41.6% were involved in road traffic accidents.

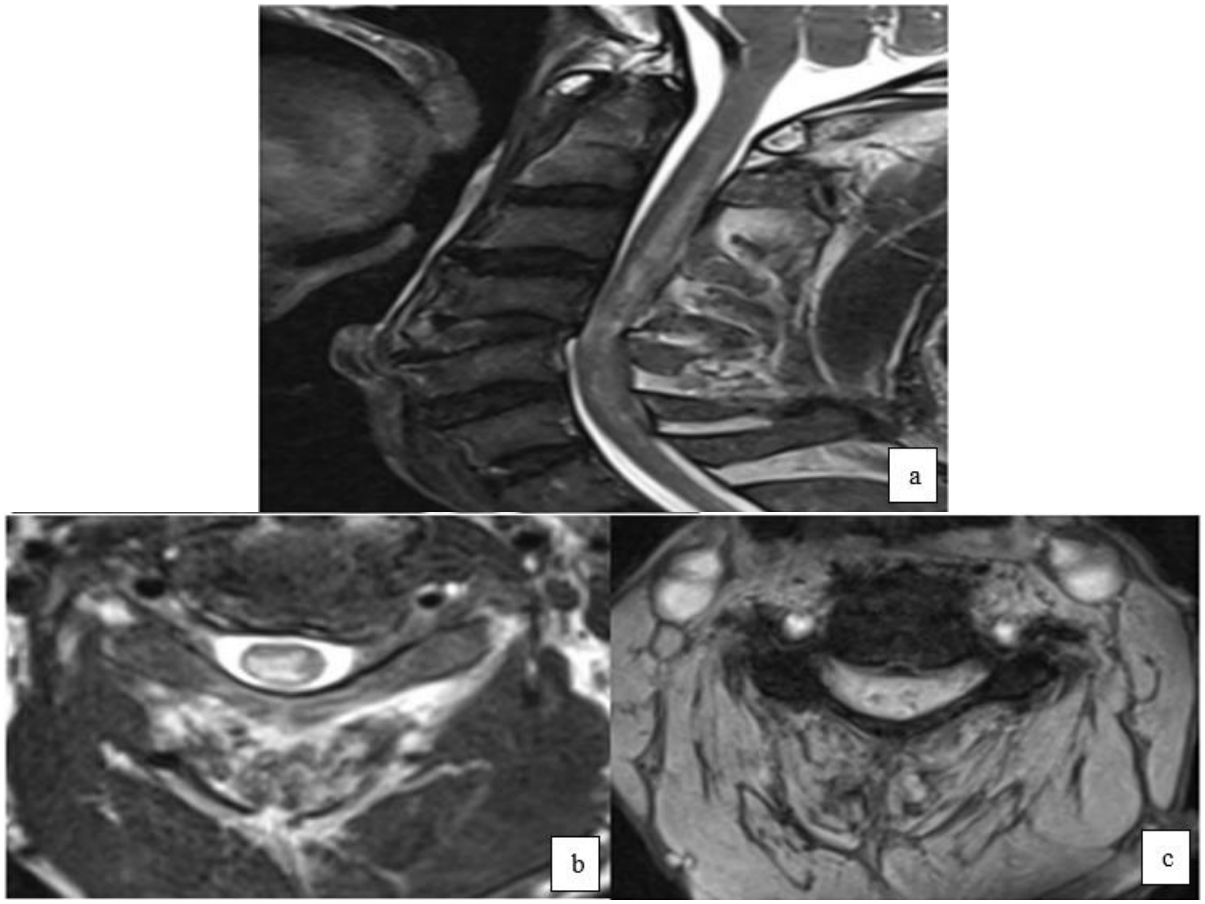
Medical History: Few participants had significant personal medical histories; diabetes mellitus was reported in 2/24, with 1 each for alcoholism and ischemic heart disease.

Imaging Findings: Most common abnormalities included spinal cord contusion with edema (16/24), traumatic disc herniation (6/24), and pre - existing spondylodegenerative changes (11/24). Most common part of spinal cord involved was cervical cord. (19/24)





Short segment intramedullary T2/STIR hyperintensity from inferior endplate of C3 to inferior end plate of C4 (fig. a & b) with mild cord expansion however no foci of blooming seen on medic sequence (fig.c) these features are suggestive of cord edema.



Long segment intramedullary T2/STIR hyperintensity from mid body of C2 to superior end plate of C7 (fig.a&b)with few foci of blooming seen on medic sequence (fig.c)these features are suggestive of traumatic cord contusion with edema with compressive myelopathy. Focal T2/STIR hyperintensity seen at C4-C6 intervertebral level in interspinous and supraspinous ligament suggestive of posterior ligamentous injury.

5. Summary and Conclusion

Spinal Cord Injury Without Radiographic Abnormality (SCIWORA) involves clinical signs of spinal cord damage—such as motor weakness, sensory disturbances, or paralysis—despite normal X - rays and CT scans. It is notably prevalent in children due to their flexible spines, but can also occur in adults, particularly those with spinal degeneration. Diagnosing SCIWORA is challenging as standard X - rays and CT scans detect only bony injuries, leaving subtle spinal

cord damage undetected. MRI is more effective at identifying such injuries but may still miss some abnormalities, leading to potential delays in treatment. This delay is concerning because the condition may worsen over time, making early diagnosis and treatment crucial. In our study of 24 participants, most were aged 20 - 40 years (45.8%), with a mean age of 45.71 years, and there was a significant male predominance (20 males vs.4 females). The leading causes of injury were falls (50%) and road traffic accidents (41.6%).

Jeffrey Knox et al. noted a male predominance across all age groups in their study of 297 patients. Most common causes were sports injuries and motor vehicle accidents. Franck Launay et al. reported motor vehicle accidents and falls as the main causes in pediatric cases. Our findings revealed that 95.8% of participants experienced pain during movement. The majority had cervical spinal cord involvement, with various degrees of limb weakness and Glasgow Coma Scale scores indicating generally mild to moderate impairment. MRI showed spinal cord contusion with edema in most participants, and some had traumatic disc herniation or spondylode generative changes.

SCIWORA, marked by spinal cord injury symptoms without visible abnormalities on X - rays or CT scans, remains a diagnostic challenge. Despite advances in MRI, some cases remain undetected, leading to potential treatment delays. Early and comprehensive assessment, including advanced imaging, is critical for improving patient outcomes. Continued research is needed to enhance diagnostic and treatment strategies for SCIWORA.

Declarations

Ethics Statement -
Institutional Review Board approval was waived for this study. Informed consent for publication of this report was obtained from the patient. All measures to not disclose the identity of the patient were taken.

Conflicts of Interest
The authors have no conflicts to disclose.

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