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Clinical Outcomes of C3-4 Spinal Canal Injuries Due to Traumatic Herniated Nucleus Pulposus: A Case Report

Ery Satriawan[1], Syaifullah Asmiragani[1], Andhika Yudistira[1], Surya Iman Muhammad[1]

[1]Orthopaedic and Traumatology Department, Faculty of Medicine, Universitas Brawijaya – Saiful Anwar General Hospital, Malang, Indonesia

Corresponding Author: Ery Satriawan

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ABSTRACT

Introduction: Spinal canal injuries at the cervical C3-4 level represent critical concerns in orthopedics due to their potential for significant morbidity. Recent studies indicate an increasing prevalence of such injuries, largely attributed to traumatic events and degenerative conditions leading to herniation of the nucleus pulposus. This paper discusses the unique epidemiological trends surrounding C3-4 herniations, which, although less common than those at C4-5, can result in severe neurological deficits.

Case Presentation: A 56-year-old male presented with weakness in both upper and lower extremities, accompanied by numbness, following a single-motorcycle accident three days prior. Motor evaluation showed a score of 2/2 at the C5 level, while sensory assessment indicated a score of 1/1 at the C4 level. The patient's ASIA score was classified as grade C. Diagnostic imaging confirmed a herniated nucleus pulposus at C3-4. During the operation, disc herniation was identified, prompting an anterior cervical discectomy and fusion (ACDF).

Discussion: The incidence of disc herniation between C2-C3 was less than 1%, and the herniated C3-C4 disc is very rare; understanding the distinct characteristics and management strategies associated with C3-4 herniations is essential for optimizing patient outcomes. Ongoing research is vital to develop standardized protocols for the diagnosis and treatment of these injuries, ultimately improving care for affected patients.

Conclusion: ACDF proved to be a safe and effective approach, resulting in significant functional recovery.

Keywords: anterior cervical discectomy and fusion, nucleus pulposus, spinal injuries.

INTRODUCTION

Traumatic cervical spine injuries represent a significant cause of morbidity and mortality worldwide, particularly in individuals involved in high-energy trauma such as motor vehicle accidents, falls from heights, or other severe impacts.[1] The cervical spine, being a highly mobile and anatomically complex region, is particularly susceptible to both bony and soft tissue injuries, which can lead to neurological compromise and functional impairment.[2] Among the various levels of cervical spine injuries, the C3-C4 region has received relatively less attention in the literature compared to more commonly affected levels such as C4-C5 and C5-C6. However, injuries at the C3-C4 level, although rare,

pose unique diagnostic and therapeutic challenges due to their anatomical proximity to critical neurovascular structures and their potential for severe motor and sensory deficits. [3,4]

Herniated nucleus pulposus (HNP) at the C3-C4 level is an uncommon condition, particularly when caused by trauma. This condition can result in significant neurological compromise due to spinal canal compression, with symptoms ranging from localized neck pain to profound motor weakness and sensory disturbances in the upper and lower extremities. Unlike degenerative cervical disc disease, which typically occurs over time due to aging and repetitive stress, traumatic disc herniation often presents acutely and requires prompt recognition and intervention to prevent permanent deficits.[5]

The management of C3-C4 traumatic disc herniation necessitates a multidisciplinary approach involving detailed imaging studies, clinical assessments, and surgical interventions. Anterior cervical discectomy and fusion (ACDF) has emerged as the standard of care for addressing such injuries, offering the dual benefits of decompression and stabilization. Despite the established efficacy of ACDF in managing cervical spine injuries at other levels, reports on its application and outcomes in traumatic C3-C4 disc herniations remain scarce.[6]

This case report discusses the presentation, diagnostic evaluation, surgical management, and postoperative outcomes of a 56-year-old male patient who sustained a traumatic C3-C4 disc herniation following a motorcycle accident.

CASE PRESENTATION

A 56-year-old male presented to the emergency department with progressive weakness in both upper and lower extremities, accompanied by numbness and neck pain. The patient reported that the symptoms began shortly after a high-speed motorcycle accident that occurred three days prior.

On physical examination, the patient demonstrated marked motor weakness, particularly in the upper extremities, with a motor power score of 2/5 at the C5 level bilaterally. Sensory examination revealed diminished sensation to light touch and pinprick over the C4 dermatome. The patient's lower extremities also exhibited mild motor weakness, with a power score of 3/5, and reduced proprioception. The neurological examination classified the patient as grade C according to the American Spinal Injury Association (ASIA) Impairment Scale, indicating preserved motor function below the level of injury but with significant deficits.

Diagnostic imaging was promptly conducted. A cervical MRI revealed a herniated nucleus pulposus at the C3-C4 level, resulting in significant spinal canal stenosis and compression of the spinal cord as seen in Figure 1. The imaging also identified mild degenerative changes at adjacent levels, although these were not contributing to the patient's acute presentation. Additionally, a plain radiograph of the cervical spine demonstrated no evidence of vertebral fractures or dislocations, supporting the diagnosis of isolated disc herniation as the primary cause of the patient's symptoms (Figure 2).

Given the severity of the neurological compromise and the acute onset of symptoms, surgical intervention was deemed necessary to decompress the spinal cord and stabilize the affected segment. The patient underwent an anterior cervical discectomy and fusion (ACDF) at the C3-C4 level. Intraoperative findings confirmed the presence of a large herniated disc impinging on the spinal cord. The herniated disc material was excised, and a cage with bone graft material was inserted to facilitate fusion of the C3-C4 vertebrae. The procedure was completed without complications, and intraoperative neuromonitoring confirmed the preservation of spinal cord function throughout the surgery.

Figure 1. Cervical MRI

Figure 2. Cervical x-ray pre-surgery

Postoperatively, the patient was monitored. At the time of discharge, the patient demonstrated significant improvement in motor function. Motor examination improved to 3/3 from the C5 level. Sensory deficits were also markedly improved, and the patient reported reduced pain and numbness. Follow-up imaging conducted postoperatively confirmed successful decompression of the spinal canal and early signs of bone fusion at the surgical site (Figure 3).

Figure 3. Cervical x-ray post-surgery

DISCUSSION

Traumatic herniation of the nucleus pulposus at the C3-C4 level is a rare occurrence, with most reported cases of cervical disc herniation involving the C4-C5 or C5-C6 levels. [7,8] The relative rarity of C3-C4 injuries can be attributed to the biomechanical properties of the cervical spine, where the upper segments are less frequently subjected to the stress and degenerative forces seen in the lower cervical levels. Nevertheless, when such injuries occur, they can result in significant neurological compromise, as seen in this case.[9]

The patient's presentation highlights the challenges of diagnosing and managing traumatic cervical disc herniation. Symptoms such as motor weakness, sensory deficits, and reduced reflexes often overlap with other spinal injuries, emphasizing the importance of thorough neurological evaluation and advanced imaging modalities like MRI. The MRI findings in this case were pivotal in identifying the herniation and determining the extent of spinal cord compression, guiding the decision for surgical intervention.[10]

The use of anterior cervical discectomy and fusion (ACDF) in managing traumatic C3-C4 herniations has been well-documented in other cervical levels but remains less studied at C3-C4 specifically. ACDF offers several advantages, including effective decompression of the spinal canal, stabilization of the affected segment, and promotion of fusion. In this case, ACDF resulted in significant postoperative neurological improvement, reflecting its

efficacy even in less commonly affected cervical levels.[11]

This case also underscores the importance of early surgical intervention in preventing irreversible neurological deficits. Studies suggest that delayed decompression may result in poorer outcomes due to prolonged spinal cord ischemia. Additionally, intraoperative neuromonitoring played a critical role in ensuring the safety of the procedure and minimizing the risk of iatrogenic injury.[12]

CONCLUSION

This case report highlights the clinical and surgical management of a rare traumatic C3-C4 herniated nucleus pulposus, emphasizing the importance of early diagnosis and timely intervention to achieve favorable neurological outcomes. ACDF proved to be a safe and effective approach, resulting in significant functional recovery in this patient.

Declaration by Authors

Ethical Approval: This study has been approved by the Saiful Anwar General Hospital Ethic Commission with Number 400/009/CR/102.7/2025.

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Conflict of Interest: The authors declare no conflict of interest.

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