

A Review on Diagnosis and Management of Cervical Spondylosis

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Received on: 22 February 2024; Accepted on: 15 April 2024; Published on: 26 February 2025

ABSTRACT

Cervical spondylosis is a common degenerative disorder affecting the cervical spine, often associated with aging. This condition can lead to a range of symptoms, including neck pain, stiffness, radiculopathy, and, in advanced cases, myelopathy. Diagnosis typically involves a combination of clinical examination and imaging techniques, with magnetic resonance imaging (MRI) offering detailed insights into soft tissue and nerve involvement. Management approaches vary according to symptom severity, encompassing conservative treatments such as medication, physical therapy, and lifestyle modifications, as well as surgical interventions for cases with significant neurological impairment. Recent advancements in minimally invasive techniques, regenerative therapies, and artificial intelligence (AI)-driven diagnostic tools offer promising future directions for treatment. This review aims to summarize the current diagnostic approaches and management strategies for cervical spondylosis and highlights the need for a multimodal and personalized approach to enhance patient outcomes and quality of life.

Keywords: Artificial intelligence, Cervical spondylosis, Diagnosis, Management, Minimally invasive techniques, Magnetic resonance imaging, Personalized treatment, Regenerative therapy.

Archives of CraniOrofacial Sciences (2024): 10.5005/acofs-11029-0001

INTRODUCTION

Cervical spondylosis, commonly known as neck arthritis or cervical osteoarthritis, is a degenerative condition characterized by progressive changes in the cervical vertebrae, intervertebral discs, and surrounding ligaments. This degeneration can lead to symptoms such as neck pain, stiffness, radiculopathy, and in severe cases, myelopathy due to spinal cord compression.¹ The condition is widespread, with studies indicating that approximately 85% of people over 60 years exhibit radiographic evidence of cervical spondylosis, making it one of the most prevalent degenerative spinal disorders.²

Early diagnosis is essential, as timely intervention can prevent the progression of neurological symptoms and reduce long-term disability. Effective management plays a crucial role in improving patients' quality of life and minimizing the impact of the disease on their daily activities.³ Delays in diagnosis or inadequate management may lead to chronic pain, functional limitations, and decreased productivity, particularly among the elderly population, who are at higher risk.^{2,3} The objective of this review is to analyze and summarize the current diagnostic methods and management strategies for cervical spondylosis. By evaluating a range of diagnostic techniques, from physical examination to advanced imaging, and exploring various treatment modalities, including conservative approaches, minimally invasive procedures, and surgical interventions. This review aims to provide a comprehensive overview for clinicians in making informed, evidence-based decisions for their patients.⁴

CLINICAL PRESENTATION

Cervical spondylosis presents with a variety of symptoms, the most common being chronic neck pain and stiffness. Patients often experience a limited range of motion in the cervical spine, which can significantly impair daily activities.¹ In addition to mechanical neck pain, some patients may develop radiculopathy, a condition marked

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How to cite this article: Tomar SS, Kumar A. A Review on Diagnosis and Management of Cervical Spondylosis. *Arch Craniofac Sci* 2024;7(1): 20–23.

Source of support: Nil

Conflict of interest: None

by pain, numbness, and weakness radiating to the shoulders, arms, or hands due to nerve root compression.^{1,2} Myelopathy, a more severe manifestation resulting from spinal cord compression, can lead to gait instability, loss of fine motor skills, and, in advanced cases, bladder dysfunction.^{3,4} The severity of cervical spondylosis varies widely among patients. While some individuals remain asymptomatic despite radiographic evidence of degenerative changes, others may develop progressive neurological deficits that severely impact their quality of life.⁵ Studies indicate that pain, reduced mobility, and neurological symptoms often result in diminished physical functionality and increased psychological distress, leading to poorer quality of life.⁶ Given the chronic and potentially debilitating nature of cervical spondylosis, its impact on quality of life underscores the importance of timely diagnosis and appropriate management to mitigate long-term effects and improve patient outcomes.^{5,6}

DIAGNOSTIC APPROACHES

Effective diagnosis of cervical spondylosis begins with a thorough history and physical examination. A detailed patient history

is crucial, as it helps identify the onset, duration, and progression of symptoms, including neck pain, stiffness, and any neurological complaints such as radiating arm pain or weakness. This information provides valuable context for interpreting clinical findings and selecting appropriate imaging or further diagnostic tests.^{1,2,4} A neurological examination is essential for assessing the extent of the condition. Clinical signs, such as reduced reflexes, sensory deficits, and motor weakness, can indicate nerve root or spinal cord compression.^{2,4} These findings guide clinicians in determining the severity of cervical spondylosis and in differentiating it from other conditions presenting with similar symptoms. Imaging techniques are integral to diagnosing cervical spondylosis and visualizing degenerative changes. X-rays are often used in the initial assessment to identify osteophytes, disc space narrowing, and other structural abnormalities indicative of degenerative changes.^{6,7} Magnetic resonance imaging (MRI) is generally preferred for its superior soft tissue contrast, allowing for detailed visualization of the spinal cord, nerve roots, and intervertebral discs. Magnetic resonance imaging is particularly useful in detecting spinal cord compression and differentiating cervical spondylosis from other soft tissue pathologies.⁷⁻⁹ Computed tomography (CT) scans, on the other hand, are more effective for assessing bony abnormalities and detecting fractures, providing a complementary perspective to MRI in complex cases.^{8,9}

In certain cases, advanced imaging techniques, such as myelography, may be employed. Myelography involves the injection of contrast dye into the spinal canal, enhancing visualization of the spinal cord and nerve roots, particularly when MRI results are inconclusive.⁶ Electrodiagnostic testing plays a role in the differential diagnosis, especially in distinguishing cervical spondylosis from other neuropathic conditions. Electromyography and nerve conduction studies are useful in evaluating the function of peripheral nerves and muscle response, helping to identify nerve root involvement and rule out peripheral neuropathies.⁴ These tests provide insights into nerve function, adding valuable information for a comprehensive diagnosis.

MANAGEMENT STRATEGIES

Management of cervical spondylosis typically begins with non-surgical approaches and progresses to more invasive interventions if conservative treatments prove ineffective. Non-surgical approaches form the first line of treatment. Medications, such as non-steroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, and neuropathic pain medications, are commonly prescribed to manage pain and inflammation.¹⁻⁴ Non-steroidal anti-inflammatory drugs reduce inflammation and alleviate pain, while muscle relaxants help relieve spasms. For patients experiencing radicular symptoms, neuropathic pain medications like gabapentin may be beneficial.^{3,5,8} Physical therapy is another corner stone of conservative management, focusing on strengthening exercises, stretching routines, and postural corrections. Strengthening the neck muscles and improving flexibility can enhance stability and reduce pain, while postural corrections aim to relieve pressure on the cervical spine during daily activities.^{2,3} Additionally, lifestyle modifications, including ergonomic adjustments at work and avoiding activities that strain the neck, play a vital role in managing symptoms and preventing exacerbations.^{3,4} Alternative therapies, such as acupuncture and chiropractic interventions, have shown promise for some patients.

Acupuncture may provide temporary pain relief, and chiropractic manipulation can improve mobility; however, their effectiveness varies, and they should be used with caution, especially in severe cases.^{4,5} Minimally invasive interventions are considered when conservative treatments are insufficient. Epidural steroid injections and nerve blocks are common options, especially for patients with nerve root compression or persistent pain. These interventions aim to reduce pain and symptoms for a limited period of time.

COMPARATIVE EFFECTIVENESS OF TREATMENT APPROACHES

When managing cervical spondylosis, a comparison between conservative and surgical treatment approaches highlight significant differences in outcomes and patient quality of life. Evidence suggests that while conservative treatments, including medication, physical therapy, and lifestyle adjustments, are effective for managing mild to moderate symptoms, they may not fully address severe cases with neurological involvement.^{2,3} In cases of advanced disease or persistent symptoms, surgical intervention often becomes necessary to achieve substantial pain relief and neurological recovery.²⁻⁵

Short-term vs Long-term Outcomes

Studies indicate that conservative management tends to be effective in the short term, providing symptom relief and functional improvement within weeks to months of treatment initiation.^{4,5} However, for patients with progressive cervical myelopathy or severe radiculopathy, surgical options like anterior cervical discectomy and fusion (ACDF) yield better long-term results. Surgical treatment has been shown to not only alleviate symptoms more effectively but also reduce recurrence rates in the long term.⁴

Quality of Life and Functional Recovery

Both conservative and surgical approaches impact quality of life, though in different ways. Conservative treatment focuses on symptom management and maintaining function, while surgical options aim for more definitive relief from pain and neurological symptoms. Evidence shows that surgical intervention in appropriately selected cases significantly improves functional recovery and quality of life by addressing the underlying structural issues causing symptoms.⁴⁻⁶ While conservative treatment is often preferred due to its non-invasive nature, surgical treatment is associated with more substantial functional recovery and enhanced quality of life, especially for patients experiencing considerable neurological impairment.^{5,6}

CHALLENGES IN DIAGNOSIS AND MANAGEMENT

The diagnosis and management of cervical spondylosis present several challenges, stemming from variability in patient response, risk of complications, and limitations in diagnostic tools. Variability in Patient Response to Treatment is a significant challenge in managing cervical spondylosis. Individual factors such as age, comorbidities, and the extent of spinal degeneration can lead to different responses to similar treatment approaches. While some patients achieve substantial symptom relief with conservative management, others require surgical intervention to manage persistent pain and neurological deficits.^{6,7} This variability

complicates the standardization of treatment protocols and emphasizes the importance of patient-specific strategies.⁴⁻⁶ Complications and Recurrence of Symptoms also pose major hurdles. Even after successful treatment, recurrence of symptoms, such as neck pain or radiculopathy, can occur, especially if underlying degenerative processes continue to progress. Surgical interventions, though often effective, come with their own risks, including infection, adjacent segment degeneration, and potential hardware failure. These complications can impact recovery and lead to further interventions, making long-term management a continuous challenge for both patients and clinicians.⁵⁻⁷

Diagnostic Limitations and the Need for Individualized Treatment Plans

Although advanced imaging modalities such as MRI and CT scans have improved diagnostic accuracy, they do not always correlate with clinical symptoms. For instance, asymptomatic patients may show significant radiographic degeneration, while some symptomatic patients have minimal detectable changes.^{8,9} Additionally, nerve conduction studies may not definitively differentiate cervical spondylosis from other neuropathies, creating diagnostic confusion.

FUTURE DIRECTIONS IN DIAGNOSIS AND MANAGEMENT

The future of cervical spondylosis diagnosis and management lies in harnessing advanced technologies and individualized treatment approaches.

Emerging Diagnostic Techniques

One promising area is the application of artificial intelligence (AI) in imaging analysis. AI-driven tools can enhance the precision of radiographic interpretation by identifying subtle degenerative changes and patterns that might be missed by human analysis. AI algorithms are being developed to assess spinal degeneration and predict progression, which could aid clinicians in making more accurate, data-driven decisions.²⁻⁶ Additionally, AI could assist in differentiating cervical spondylosis from similar conditions, potentially streamlining the diagnostic process and reducing diagnostic uncertainty.⁸⁻¹⁰

Advancements in Minimally Invasive and Regenerative Therapies

Minimally invasive surgical techniques, such as endoscopic discectomy and percutaneous spinal interventions, are reducing recovery times and associated risks for patients requiring surgical intervention. These techniques allow targeted decompression and stabilization with minimal disruption to surrounding tissues.^{10,11} Furthermore, regenerative therapies, including stem cell injections and platelet-rich plasma (PRP) therapy, are under investigation for their potential to promote disc regeneration and slow the degenerative process. Although still in the early stages of research, these approaches hold promise as alternatives to traditional surgery for selected patients.¹¹

Potential for Personalized Treatment Approaches

The growing understanding of patient-specific factors in cervical spondylosis management underscores the need for personalized treatment plans. Factors such as genetic predispositions, lifestyle,

and individual anatomical variation also contribute to the outcome and prognosis of disease.

CONCLUSION

In summary, the diagnosis and management of cervical spondylosis require a nuanced approach due to the condition's complex presentation and variability in patient outcomes. Key findings highlight the importance of combining patient history, neurological examination, and imaging techniques to achieve an accurate diagnosis, with MRI being especially valuable for detecting spinal cord and nerve root involvement. While non-surgical treatments, including medication, physical therapy, and lifestyle modifications, are often effective in managing mild to moderate symptoms, surgical intervention remains a critical option for patients with severe or progressive neurological deficits. Evidence indicates that a multimodal approach, integrating conservative therapies with minimally invasive techniques or surgery as needed, can optimize outcomes and enhance patient quality of life. The need for ongoing research is evident, especially in areas such as AI-driven diagnostic tools, minimally invasive surgical advancements, and regenerative therapies, which hold promise for improving both diagnostic accuracy and treatment effectiveness. Clinicians are encouraged to adopt personalized treatment plans based on individual patient profiles and to remain adaptable, integrating new evidence-based practices as they emerge.

These recommendations underscore the importance of a patient-centered, multimodal approach to cervical spondylosis, ensuring that treatment strategies are both effective and aligned with the latest advancements in medical science.

REFERENCES

1. Kazeminasab S, Nejadghaderi SA, Amiri P, et al. Neck pain: Global epidemiology, trends and risk factors. *BMC Musculoskelet Disord* 2022;23:26. DOI: 10.1186/s12891-021-04957-4.
2. Macedo LG, Hum A, Kuleba L, et al. Physical therapy interventions for degenerative lumbar spinal stenosis: A systematic review. *Phys Ther* 2013;93(12):1646-1660. DOI: 10.2522/ptj.20120379.
3. Kenichiro S, Toshitaka Y, Yoshiyasu A, et al. A comparative study of surgical outcomes between anterior cervical discectomy with fusion and selective laminoplasty for cervical spondylotic myelopathy. *Journal of Orthopaedic Science*, 2022;27(6):1228-1233. DOI: 10.1016/j.jos.2021.08.012. ISSN 0949-2658.
4. Feng S, Zheng B, Zhang L, et al. A systematic review and meta-analysis compare surgical treatment and conservative treatment in patients with cervical spondylotic myelopathy. *Ann Palliat Med*. 2021;10(7):7671-7680. DOI: 10.21037/apm-21-1365.
5. Kuo DT, Tadi P. Cervical Spondylosis. [Updated 2023 May 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK551557/>.
6. Wei X, Wang S, Li J, et al. Complementary and Alternative Medicine for the Management of Cervical Radiculopathy: An Overview of Systematic Reviews. *Evid Based Complement Alternat Med*. 2015;2015:793649. DOI: 10.1155/2015/793649.
7. Cohen SP, Hayek S, Semenov Y, et al. Epidural steroid injections, conservative treatment, or combination treatment for cervical radicular pain: A multicenter, randomized, comparative-effectiveness study. *Anesthesiology*. 2014;121(5):1045-1055. DOI: 10.1097/ALN.0000000000000409.
8. Sono T, Shima K, Shimizu T, et al. Regenerative therapies for lumbar degenerative disc diseases: A literature review. *Front Bioeng Biotechnol*. 2024;12:1417600. DOI: 10.3389/fbioe.2024.1417600.
9. Williams C, Jerome M, Fausel C, et al. Regenerative injection treatments utilizing platelet products and prolotherapy for

- cervical spine pain: A functional spinal unit approach. *Cureus*. 2021;13(10):e18608. Published 2021. DOI: 10.7759/cureus.18608.
10. Edwards CC, Riew KD, Anderson PA, et al. Cervical myelopathy. Current diagnostic and treatment strategies. *Spine J*. 2003;3(1):68–81. DOI: 10.1016/s1529-9430(02)00566-1.
 11. Yahanda AT, Joseph K, Bui T, et al. Current applications and future implications of artificial intelligence in spine surgery and research: A narrative review and commentary. *Global Spine Journal*. 2024. DOI: 10.1177/21925682241290752.