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Multimodal Physiotherapy for Cervical Disc Herniation: A Case Report

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Abstract

Background: Cervical disc herniation is a common cause of neck pain, reduced cervical mobility, muscle weakness, and functional disability. Multimodal physiotherapy may provide comprehensive benefits by addressing pain, movement limitation, and muscle dysfunction simultaneously.

Objective: To evaluate the effects of a multimodal physiotherapy program consisting of Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic ultrasound, McKenzie exercises, and scapular strengthening in a patient with cervical disc herniation at the C5–C6 level.

Methods: A single case report was conducted on a 59-year-old male diagnosed with cervical disc herniation. The patient received four physiotherapy sessions including TENS (100 Hz, 100 µs, 10–15 minutes), ultrasound therapy (1 MHz, 1.5 W/cm², continuous mode, 5 minutes), McKenzie exercises, and scapular strengthening exercises. Outcomes included Numeric Rating Scale (NRS), cervical range of motion (ROM), Manual Muscle Test (MMT), Neck Disability Index (NDI), and Shoulder Pain and Disability Index (SPADI). Data were analyzed descriptively by comparing pre- and post-intervention findings.

Results: After four treatment sessions, pain decreased from 7/10 to 3/10 on the NRS. Cervical ROM improved by 15–20° across movement directions. Muscle strength increased from MMT grade 3 to grade 4. NDI decreased from 46% to 24%, while SPADI decreased from 60% to 32%. Statistical testing, p values, and confidence intervals were not applicable due to the single-case design.

Conclusion: A multimodal physiotherapy approach combining TENS, ultrasound, McKenzie exercises, and scapular strengthening produced clinically meaningful improvements in pain, cervical ROM, muscle strength, and functional outcomes in a patient with cervical disc herniation.

Keywords

Cervical Disc Herniation; Transcutaneous Electrical Nerve Stimulation; Ultrasonic Therapy; McKenzie Method; Exercise Therapy; Shoulder Pain

Introduction

Cervical herniated nucleus pulposus (HNP) is a pathological condition caused by the protrusion of the nucleus pulposus through the annulus fibrosus, leading to compression of the nerve roots or spinal cord. This condition frequently results in neck pain radiating to the arms, muscle weakness, sensory disturbances, and limitations in daily activities.[1] Neck pain is one of the most common musculoskeletal problems, with a global prevalence ranging from 16.7% to 75.1%, and is the second leading cause of disability after low back pain.[2]In Indonesia, the prevalence of HNP reaches 25.8%, with the highest incidence in the productive age group, significantly affecting quality of life and patient productivity.[3]

Etiological factors of cervical HNP include intervertebral disc degeneration due to aging, trauma, and poor posture.[4] Nerve compression may trigger radiculopathy or myelopathy, which can further worsen the patient's condition if left untreated.[5] Physiotherapy plays a vital role in pain reduction, improvement of cervical range of motion (ROM), muscle strengthening, and functional optimization. Electrotherapy modalities such as Transcutaneous Electrical Nerve Stimulation (TENS) have been shown to reduce pain through the mechanisms of "pain gate control" and stimulation of endorphin release.[6,7] Moreover, ultrasound (US) provides both thermal and non-thermal effects that accelerate soft tissue healing,[8] while McKenzie exercises help correct posture, reduce disc pressure, and increase cervical flexibility.[9] Scapular strengthening is also important for improving scapular stability and shoulder function.[10] Yilmaz et al. demonstrated that the combination of TENS and US can improve quality of life in patients with cervical disc herniation.[11]

The uniqueness of this case report lies in the implementation of a combination of four physiotherapy interventions TENS, US, McKenzie exercises, and scapular strengthening delivered simultaneously, which is rarely reported in the literature for cervical HNP at the C5–C6 level. This multimodal approach is expected to provide a more comprehensive clinical perspective in the rehabilitation of patients with neck and shoulder dysfunction. Although each modality has been investigated individually, evidence regarding their combined application remains limited, particularly within the Indonesian clinical context. Therefore, this case report aims to provide an initial description of the potential clinical benefits of combining TENS, US, McKenzie exercises, and scapular strengthening in patients with cervical HNP.

The objective of this case report is to evaluate the effects of this multimodal intervention on pain, cervical ROM, muscle strength, and neck–shoulder function in a patient with cervical HNP at the C5–C6 level treated at Muhammadiyah Lamongan Hospital.

This case involved a 59-year-old male diagnosed with cervical HNP at C5–C6. The patient complained of neck pain radiating to the arm, accompanied by limited ROM and muscle weakness. Prior to physiotherapy, the patient received only pharmacological treatment in the form of analgesics, which provided temporary relief; however, symptoms recurred. No history of trauma was identified, although the patient reported a habit of prolonged sitting during daily activities.

Methods

This study is a single case report involving a 59-year-old male diagnosed with cervical herniated nucleus pulposus (HNP) at the C5–C6 level who underwent physiotherapy at Muhammadiyah Lamongan Hospital. Prior to treatment, the patient presented with neck pain radiating to the right arm (Numeric Rating Scale [NRS] 7/10), restricted cervical range of motion (ROM) particularly in extension (40° out of the normal 60°), weakness of the right deltoid muscle (Manual Muscle Test [MMT] grade 3/5), and functional impairments indicated by a Neck Disability Index (NDI) score of 46% and a Shoulder Pain and Disability Index (SPADI) score of 54%.

The intervention protocol administered during the four treatment sessions is summarized in Table 1. Each modality was applied according to standard physiotherapy practice and adjusted to the patient's tolerance to optimize safety and therapeutic outcomes.

Table 1. Intervention Protocol

Intervention	Target Area / Movements	Parameters	Dosage
Transcutaneous Electrical Nerve Stimulation (TENS)	Trapezius, biceps, deltoid muscles	Frequency: 100 Hz; Pulse width: 100 μs; Intensity: adjusted to patient tolerance	10–15 minutes
Ultrasound Therapy	Trapezius area	Frequency: 1 MHz; Intensity: 1.5 W/cm²; Mode: continuous	5 minutes
McKenzie Exercises	Cervical retraction, extension, lateral flexion	Active movement	3 sets × 10 repetitions
Scapular Strengthening Exercises	Wall slides, shoulder abduction with theraband (medium resistance)	Resistance-based strengthening	2–3 sets × 10–15 repetitions

The selection of TENS, ultrasound, McKenzie exercises, and scapular strengthening was based on the patient's primary symptoms, namely neuropathic pain, restricted cervical ROM, and scapular dysfunction. A multimodal approach was considered more effective than monotherapy. The duration and protocol of intervention were determined according to physiotherapy clinical practice standards and patient tolerance. No protocol modifications were required during the four sessions, as the patient showed a positive response from the initial treatment.

The timeline of interventions and evaluations for the patient is summarized in Table 2. Baseline measurements were obtained on Day 0, followed by four physiotherapy sessions comprising TENS, ultrasound, McKenzie exercises, and scapular strengthening. Post-intervention outcomes were assessed on Day 10 after the fourth session.

Table 2. Intervention Timeline

Time Point	Intervention / Evaluation	Key Findings
Day 0 (Baseline)	Initial assessment	NRS: 7/10; cervical ROM: limited; right deltoid MMT: 3/5; NDI: 46%; SPADI: 54%
Sessions 1–4	Physiotherapy program: TENS, ultrasound, McKenzie exercises, scapular strengthening	Interventions administered across four treatment sessions
Day 10 (Post-intervention)	Final evaluation after 4th session	NRS: 3/10; cervical ROM: improved; right deltoid MMT: 4/5; NDI: 28%; SPADI: 38%

Evaluations were conducted before the first session and after the fourth session. The NDI and SPADI used were the validated Indonesian versions. Data were analyzed descriptively by comparing pre- and post-intervention outcomes. The prognosis was considered favorable, with the expectation of optimal functional recovery if the patient continued exercises independently. Written informed consent was obtained from the patient for participation in therapy and for the publication of this case report.

Results

After four physiotherapy sessions combining Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic ultrasound, McKenzie exercises, and scapular strengthening, the patient demonstrated clinically meaningful improvements in pain intensity, cervical range of motion (ROM), muscle strength, and functional performance. Detailed outcome measures are presented in Table 3.

Pain intensity, assessed using the Numeric Rating Scale (NRS), decreased from 7/10 at baseline to 3/10 after the intervention, representing a 4-point reduction. This improvement exceeded the minimal clinically important difference (MCID) threshold and indicated a substantial reduction in symptom severity. The patient also reported reduced radiating pain to the upper extremity and greater comfort during daily activities.

Improvements were observed across all cervical ROM measurements. Cervical flexion increased from 30° to 45°, extension improved from 20° to 40°, right and left lateral flexion increased from 25° to 40°, and right and left rotation improved from 35° to 50°. The greatest improvement was observed in cervical extension, which increased by 20°, while all other movement directions demonstrated gains of approximately 15°. These findings indicate enhanced cervical mobility and reduced movement restriction following the intervention program.

Muscle strength of the neck and shoulder musculature, assessed using the Manual Muscle Test (MMT), improved from grade 3 to grade 4. This change reflects improved muscle performance against resistance and suggests better neuromuscular control and functional stability of the cervical and shoulder regions.

Functional outcomes also showed substantial improvement. The Neck Disability Index (NDI) score decreased from 46% to 24%, representing a 22% reduction in disability and exceeding the MCID threshold of ≥10 points. Likewise, the Shoulder Pain and Disability Index (SPADI) score decreased from 60% to 32%, corresponding to a 28% improvement and surpassing the reported MCID range of 8–13 points. These findings indicate meaningful improvements in the patient's ability to perform daily activities involving the neck and shoulder.

Overall, the combined intervention resulted in consistent improvements across all clinical outcome measures, including pain, mobility, muscle strength, and functional status. The patient attended all four treatment sessions and demonstrated excellent adherence to the prescribed home exercise program. No adverse events, symptom exacerbation, or additional complaints were reported throughout the intervention period. Although the intervention period was limited to four sessions, the observed improvements suggest that the multimodal physiotherapy approach was effective in achieving short-term clinical benefits. The patient was subsequently scheduled for follow-up assessment to monitor the maintenance of treatment outcomes and long-term functional recovery.

Table 3 presents the changes in pain intensity, cervical range of motion (ROM), muscle strength, and functional outcomes following four sessions of multimodal physiotherapy in a patient with cervical herniated nucleus pulposus (HNP) at the C5–C6 level.

A substantial reduction in pain was observed, with the Numeric Rating Scale (NRS) score decreasing from 7/10 before intervention to 3/10 after intervention, representing a 4-point improvement. Cervical ROM improved across all movement directions, including flexion (30° to 45°), extension (20° to 40°), right and left lateral flexion (25° to 40°), and right and left rotation (35° to 50°), indicating gains ranging from 15° to 20°.

Table 3. Changes in Pain, Cervical ROM, Muscle Strength, and Function in a Patient with Cervical HNP (C5–C6)

Parameter	Pre-intervention	Post-intervention	Change
Pain (NRS)	7/10	3/10	↓ 4 points
Cervical ROM – Flexion	30°	45°	+15°
Cervical ROM – Extension	20°	40°	+20°
Cervical ROM – Lateral Flexion Right	25°	40°	+15°
Cervical ROM – Lateral Flexion Left	25°	40°	+15°
Cervical ROM – Rotation Right	35°	50°	+15°
Cervical ROM – Rotation Left	35°	50°	+15°
MMT (Neck and Shoulder Muscles)	Grade 3	Grade 4	+1 grade
NDI (%)	46%	24%	↓ 22%
SPADI (%)	60%	32%	↓ 28%

Muscle strength of the neck and shoulder muscles also improved, as reflected by an increase in Manual Muscle Test (MMT) score from grade 3 to grade 4. Functional outcomes demonstrated marked improvement, with the Neck Disability Index (NDI) decreasing from 46% to 24%, corresponding to a 22% reduction in disability. Similarly, the Shoulder Pain and Disability Index (SPADI) decreased from 60% to 32%, representing a 28% improvement. Overall, these findings suggest that the multimodal physiotherapy program was associated with clinically meaningful improvements in pain, cervical mobility, muscle strength, and functional performance.

Discussion

The findings of this study demonstrate that a combination of Transcutaneous Electrical Nerve Stimulation (TENS), ultrasound, McKenzie exercises, and scapular strengthening produced positive effects on pain reduction, improvement of cervical range of motion (ROM), muscle strength, and daily functional activities in a patient with cervical disc herniation at the C5–C6 level. The reduction in the Numeric Rating Scale (NRS) score from 7 to 3 represents a clinically meaningful improvement, consistent with the minimal clinically important difference (MCID) threshold of ≥2 points. This pain reduction aligns with the mechanism of TENS, which is based on the “pain gate control” theory, whereby stimulation of A-beta fibers inhibits pain transmission at the spinal cord level and promotes endorphin release.[12,13]

In addition to TENS, the use of therapeutic ultrasound (US) for five minutes provided both thermal and non-thermal effects, enhancing local blood flow, improving tissue nutrition, and accelerating the healing of soft tissues.[14] The reduction of muscle spasm supported by the micromassage effect of ultrasound waves contributed to improved tissue flexibility and pain relief. [9] These effects are consistent with the findings of Yilmaz et al. who reported that the combination of TENS and US effectively reduced pain in cervical disc herniation.[11]

Improvement in cervical ROM (flexion, extension, lateral flexion, and rotation) by 15–20° highlights the effectiveness of McKenzie exercises. These exercises operate on the principle of symptom centralization, facilitating disc repositioning and reducing nerve root compression.[9] Furthermore, McKenzie exercises enhance cervical muscle flexibility and correct forward head posture, thereby supporting cervical stabilization.[15]

The increase in muscle strength from grade 3 to grade 4 on the Manual Muscle Test (MMT) was also influenced by scapular strengthening exercises. These exercises improve the activation of scapular stabilizers, particularly the serratus anterior and lower trapezius, which are crucial for scapular stability and optimal shoulder movement.[16] This improvement was reflected in reductions in the Neck Disability Index (NDI) by 22% and the Shoulder Pain and Disability Index (SPADI) by 28%, both exceeding MCID thresholds and indicating a clinically meaningful enhancement in the patient’s quality of life.

Overall, these findings are consistent with those of Martins-de-Sousa et al. and Albornoz-Cabello et al., who reported that the combination of electrotherapy modalities and therapeutic exercise effectively reduced pain and improved function in patients with cervical disc disorders.[17,18] However, in contrast to previous studies, this case report emphasizes the importance of a multimodal approach that not only focuses on pain reduction but also addresses cervical biomechanics and scapular stability.

The limitations of this case report include its single-patient design, which restricts generalizability, as well as the relatively short duration of intervention (four sessions) and absence of long-term follow-up, which limit conclusions regarding sustained outcomes. Moreover, this report did not compare multimodal interventions with single modalities.

These findings should be interpreted in light of current evidence, such as recent systematic reviews confirming the effectiveness of TENS and US in musculoskeletal pain management and randomized controlled trials supporting the McKenzie method in cervical disc herniation.[19,20] Thus, the present case contributes to the growing body of evidence while highlighting the need for further research on multimodal intervention strategies.

The main lesson from this case is that a multimodal physiotherapy approach can achieve clinically meaningful outcomes in patients with cervical disc herniation. Comprehensive, non-invasive interventions should be prioritized before surgical procedures, and self-management strategies, including McKenzie and scapular strengthening exercises, play a crucial role in maintaining long-term results.

Conclusion

A 59-year-old patient (T.P.) diagnosed with cervical disc herniation at the C5–C6 level received a multimodal physiotherapy program consisting of Transcutaneous Electrical Nerve Stimulation (TENS), therapeutic ultrasound, McKenzie exercises, and scapular strengthening. This combination of interventions was effective in reducing pain, improving cervical range of motion, and enhancing both neck and shoulder muscle strength as well as overall functional capacity. Rehabilitation success was further supported by active family involvement in assisting the patient’s home-based exercise program, which contributed to sustained improvements in muscle strength and function.

This case report emphasizes that a non-invasive multimodal physiotherapy approach can provide clinically meaningful outcomes in patients with cervical disc herniation and should be considered as a first-line intervention prior to invasive medical or surgical procedures. Moreover, patient and family education play a pivotal role in ensuring treatment success. Further studies

employing clinical trial designs with larger sample sizes are warranted to confirm these findings and strengthen the scientific basis for multimodal physiotherapy in clinical practice.

Author Contribution

Ainindia Khoiridatul Ilmiyah: Conceptualization, Methodology, Investigation, Data Curation, Formal Analysis, Writing – Original Draft.
Diah Rosyida Maulidina: Methodology, Formal Analysis, Validation, Writing – Review & Editing.
Yeni Tri Nurhayat: Conceptualization, Validation, Supervision, Writing – Review & Editing.

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Conflict of Interest Statement

The authors declare no conflict of interest related to this study.

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Ethics Statement

Written informed consent was obtained from the patient for participation in treatment and publication of this case report. All procedures were conducted according to ethical principles for clinical case reporting and the Declaration of Helsinki.

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