FACTORS ASSOCIATED WITH FAVOURABLE SHORT-TERM NON-OPERATIVE TREATMENT OUTCOMES AMONG PATIENTS WITH DEGENERATIVE CERVICAL SPINE DISEASE AT MUHIMBILI ORTHOPAEDIC INSTITUTE

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ABSTRACT

Background: Non-operative treatment of cervical degenerative spine disease involves pharmacotherapy and physical therapy. Favorable Short-term treatment outcomes include pain reduction and sensory-motor recovery, with an eventual return to normal daily activities as a long-term outcome. Several factors have been attributed to early pain relief and sensorimotor recovery; these include early diagnosis and combined therapy.

Objective: This prospective study was carried out from June to December 2022 and was carried out to determine factors associated with favourable short-term treatment outcomes among patients with degenerative cervical spine disease treated non-operatively at Muhimbili Orthopaedics Institute (MOI).

Methods: This prospective study involved 78 individuals diagnosed with chronic degenerative cervical spine disease, undergoing six weeks of non-operative treatment. Patient data, including gender, age, occupation, and symptoms, were collected via a questionnaire. Disease severity and treatment outcome were assessed using the Copenhagen Neck Functional Disability Scale (CNFDS) and the modified Japanese Orthopaedic Association scale (mJOA).

Results: Out of 78 patients, most were female (71.79%) and over 60 years old. Axial neck pain and radiculopathy were common clinical presentations, with moderate severity at presentation predominating. Combined therapy was frequently used and showed better pain reduction than pharmacotherapy alone ($p = 0.002$) also initial disease severity significantly influenced pain reduction ($p = 0.02$).

Conclusion: The study findings indicate that non-surgical treatments at MOI can notably alleviate initial pain in degenerative cervical spine disease patients, with initial severity significantly influencing short-term outcomes. However, sensorimotor improvements from non-operative methods were insufficient, warranting additional research for validation.

Key words: Non-operative management, Degenerative cervical spine disease, Treatment outcomes, Cervical radiculopathy, Cervical myelopathy

INTRODUCTION

Degenerative cervical spine disease refers to the progressive deterioration of the cervical spine's intervertebral discs, joints, and other structures, often leading to symptoms such as axial neck pain, myelopathy (spinal cord compression), or radiculopathy (nerve root compression). This condition is common and typically results from aging, wear and tear, or other degenerative processes (1).

Treatment for cervical degenerative spine disease can be either non-operative or operative, depending on the patient's specific symptoms. In most cases, especially when the illness is not severe, non-operative management is preferred. This conservative approach often includes a 4 to

6 week course of physical therapy combined with medication (1).

Pharmacotherapy is a key component of non-operative treatment. Nonsteroidal Anti-Inflammatory Drugs (NSAIDs) are usually the first-line option because they are effective in reducing inflammation and relieving pain. If NSAIDs are ineffective or cause intolerable side effects, other medications may be considered. For instance, oral opioids can be prescribed to manage severe pain that is not adequately controlled by NSAIDs (2).

Additionally, muscle relaxants may be prescribed to alleviate muscle spasms and promote relaxation of the affected muscles. Corticosteroid injections are also prescribed to reduce inflammation and swelling in the affected area. Ultimately, the choice of pharmacotherapy depends on the severity of the symptoms, the patient's medical history, and their response to previous treatments. Close monitoring of the patient for potential side effects and adjusting treatment as needed is essential to ensuring the best possible outcome (2). Physical therapy is key in non-operative care for degenerative cervical spine disease, strengthening muscles and alleviating nerve compression. Passive treatments like heat, ice, massage, ultrasound, and electrotherapy reduce pain and swelling. Active therapy involves self-directed exercises for pain relief (1).

The favourable short-term outcomes for patients with degenerative cervical spine disease are characterized by pain relief and enhanced sensorimotor function. It was observed that the initial disease severity, chosen treatment modality, as well as age and gender, had an impact on the short-term treatment outcomes (1). In cases where patients do not achieve satisfactory results in the short term, alternative non-operative or surgical treatment options are available. To assess treatment outcomes, various evaluation tools, such as the modified Japanese Orthopaedics scale (mJOA) and the Copenhagen Neck Functional Disability Score, can be used (3-7).

Despite the high success rate of non-operative treatment, the impact of initial pain severity and sensory-motor disability level, presenting symptoms, and type of nonsurgical therapy on short-term treatment outcomes is unclear in clinical settings at Muhimbili Orthopaedics Institute (MOI) in Tanzania. The lack of scientific evidence of this relationship at MOI poses a challenge for doctors who are striving to select adequate non-operative treatment modalities for their patients.

MATERIALS AND METHODS

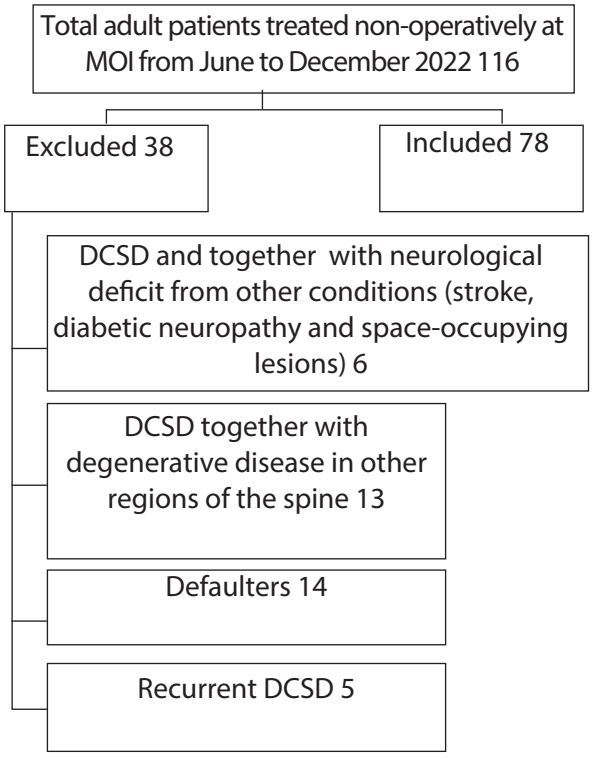
This was a single arm prospective cohort study conducted at MOI, which offers tertiary orthopaedic, trauma, and neurosurgical services, with patients from all around Dar es Salaam and also referrals from all Tanzanian regions and neighboring countries. We involved 78 patients with degenerative cervical disease of the spine treated non-operatively for 6 weeks at the MOI outpatient clinic from June to December 2022.

Simple random sampling was used, whereby patients with degenerative cervical spine disease treated non-operatively at MOI within the exclusion and inclusion criteria were enrolled on even dates until the 78 sample size was reached.

We included all patients with degenerative cervical spine disease on non-operative management at MOI outpatient clinics within 6 weeks of non-operative treatment. We excluded participants with neurological deficits from other conditions (e.g., stroke, diabetic neuropathy, and space-occupying lesions), degenerative cervical spinal disease in a combination of degenerative disease in other regions of the spine, recurrent cervical degenerative disease of the spine symptoms after non-surgical and surgical treatment in the past, and patients referred from other facilities after being on long-standing non-operative management as it can be seen in Figure 1.

Figure 1

Study population flow chart

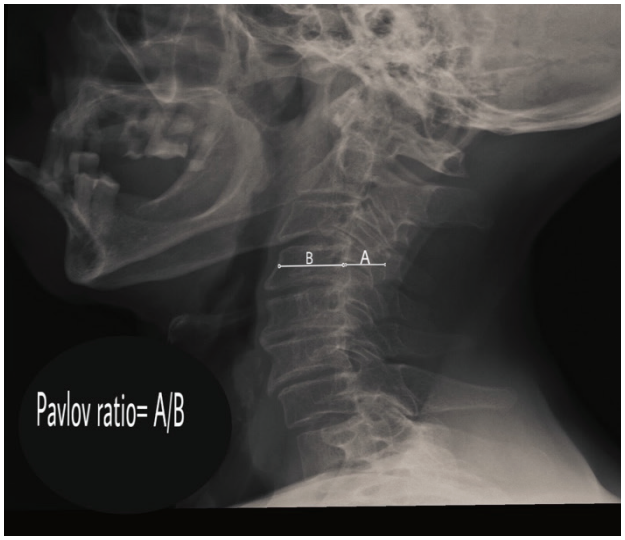


Participants were recruited from clinics, providing sociodemographic data. Qualitative clinical assessments, guided by attending neurosurgeons or orthopaedic spine surgeons, determined pain and neurological deterioration, utilizing standard assessments and specialized tests such as the Spurling test and reflexes.

Following clinical assessment, diagnosis confirmation involved plain radiographs for disc space narrowing, osteophytes, and Pavlov ratio (Figure *2*), followed by MRI for detailed evaluation of disc degeneration, nerve root stenosis, and spinal cord compression. Symptoms were categorized into axial neck pain, cervical radiculopathy, cervical myelopathy, or their combinations, based on the radiologist's reports.

Figure 2

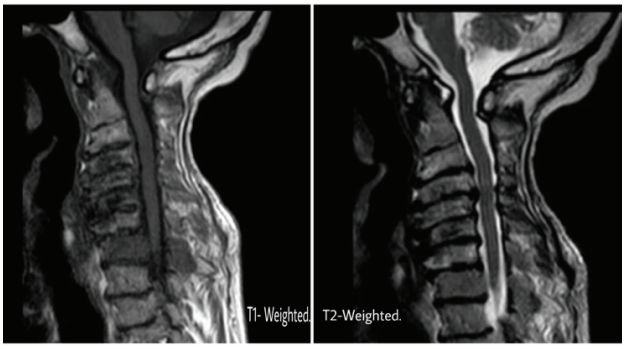
An example of plain radiograph of a patient with degenerative cervical spine disease showing pavlov ratio



As this study followed an observational design, it's important to note that the attending surgeon had full autonomy in making diagnoses, deciding on radiological investigations, and selecting non-operative management approaches for the patients under their care but only patients who had the same diagnosis by the attending surgeon and radiology report were included in the study.

Figure 3

An example of an MRI image showing degenerative cervical spine disease



Structured questionnaires and neck disability assessment tools, including the Copenhagen Neck Functional Disability Score (CNFDS) and modified Japanese Orthopaedic Association Scale (mJOA), were utilized for data collection. Non-surgical therapy, either pharmacotherapy alone or combined with physical therapy, was initiated. Assessments occurred at treatment onset, 2, 4, and 6 weeks thereafter.

Patients were disposed of from the study after data collection; those with poor treatment outcomes were returned to the attending surgeon for treatment modality revision, including dosage change or possibly surgical management.

The research investigator used an Excel spreadsheet to manage data collection, including clinical evaluation and diagnosis based on symptoms, signs, and radiological results as reported by the radiology department.

The data was analyzed using STATA version 14.2. Frequencies and proportions were computed for the appropriate variables. Pain reduction was grouped into two groups: those with moderate to severe pain and those with mild to no pain. Sensorimotor recovery was grouped into two groups: those with moderate to severe disabilities and those with mild to no disabilities. The distribution of variables among the two groups of pain reduction and the two groups of sensorimotor recovery was assessed, and chi-square was used to obtain the p-values.

A logistic regression model was used to assess the associations between independent variables and the dependent variables and obtain odds ratios, confidence intervals, and P-values. The level of significance was 0.05. A multivariable analysis was done to obtain adjusted odds ratios, confidence intervals, and P-values.

RESULTS

The results of this study provide valuable insights into the non-operative management of degenerative cervical spine disease at the Muhimbili Orthopaedics Institute (MOI) in Tanzania. The study examined various factors, including sociodemographic characteristics, clinical presentations, disease severity, treatment modalities, and short-term treatment outcomes.

Socio-demographics and clinical presentation

The research found a higher occurrence of degenerative cervical spine disease in older women, with axial neck pain and radiculopathy being predominant. Early detection and intervention are vital for effective management and informed clinical decisions. Table 1 further illustrates the sociodemographic characteristics and clinical presentation among patients with degenerative cervical spine disease in this study.

Table 1

Sociodemographic data and clinical presentation

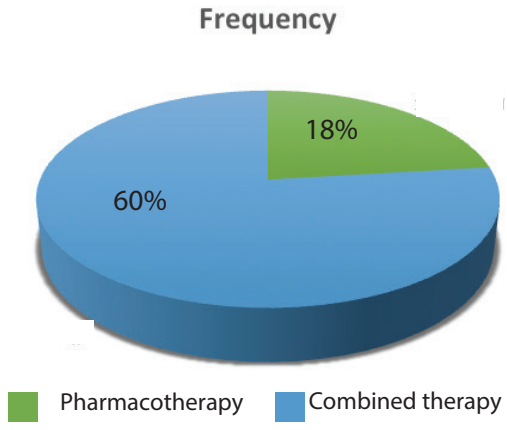
Variable	Frequency	(%)
Sociodemographic		
Sex		
Female	56	71.79
Male	22	28.21
Age groups (years)		
<40	11	14.10
40-60	16	20.51
>60	51	65.38
Occupation groups		
Desk	36	46.15
Mobile	42	53.58
Clinical presentation		
Syndrome		
Axial neck pain and radiculopathy	59	75.64
Radiculopathy and myelopathy	15	24.36
Severity at presentation		
Copenhagen Neck Functional Disability Score (CNFDS)		
Moderate	47	60.26
Severe	31	39.74
Modified Japanese Orthopaedic Association score (mJOA)		
No disease	59	75.64
Mild	13	7.67
Moderate	6	7.69

Non-operative treatment modality

Two main non-operative treatment modalities were used in this study. Figure 4 below illustrates the distribution of non-operative treatment modalities in this study.

Figure 4

Non-operative treatment modalities



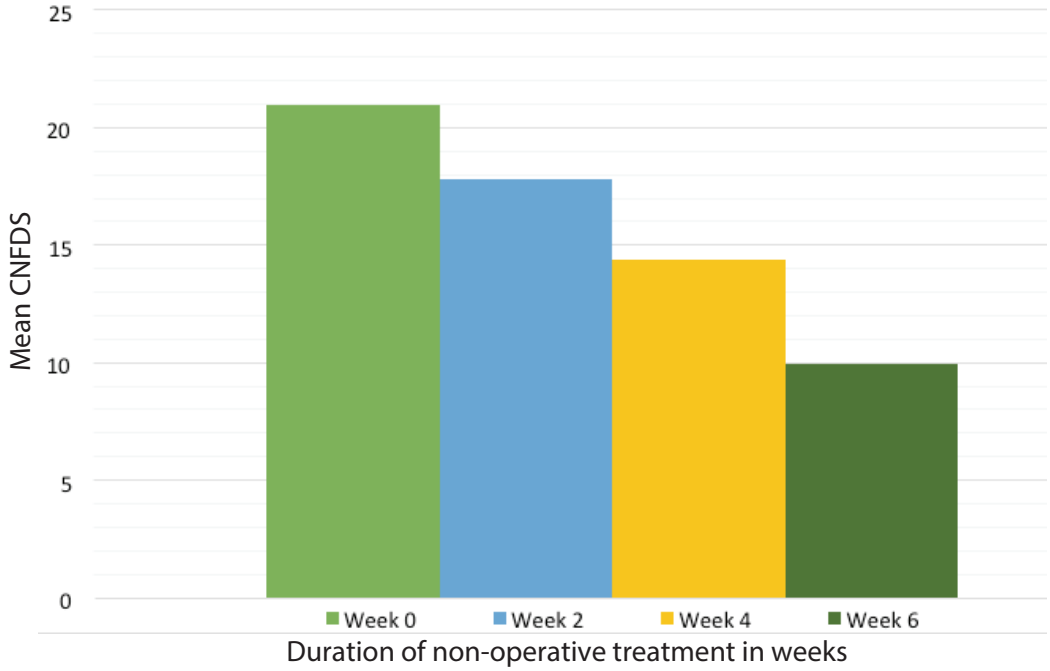
Pain reduction

Figure 5 shows a steady decrease in CNFDS scores throughout treatment, indicating improved neck function and reduced disability and pain. Overall,

this data suggests that non-operative treatment can lead to significant pain reduction and improvements in functional disability scores for patients with cervical degenerative disease.

Figure 5

Copenhagen Neck Functional Disability Scores (CNFDS) for 6 weeks of non-operative treatment



Factors associated with pain reduction

Significant associations were found between clinical syndromes, disease severity, and treatment modality with treatment outcomes. The majority had axial neck pain and radiculopathy; a severe disease associated with worse outcomes. Combined therapy showed better outcomes compared to pharmacotherapy alone.

These results suggest that the type of clinical presentation, severity of the disease, and treatment modality are important factors that influence the outcome of non-operative treatment in patients with cervical degenerative disease. Table 2 shows the chi-square test for pain reduction among patients with degenerative cervical spine disease.

Table 2

Chi-square test for factors associated with pain reduction

Variable	Yes No. (%)	No No. (%)	P-value
Sex			
Male	12 (54.54)	10 (45.45)	0.518
Female	35 (62.50)	21 (37.50)	
Age groups (years)			
<40	7 (63.63)	4 (36.36)	0.937
40-60	10 (62.6)	6 (37.5)	
>60	30 (58.82)	21 (41.18)	
Occupation groups			
Desk	22 (61.11)	14 (38.89)	0.886
Mobile	25 (59.52)	17 (40.48)	

Clinical presenting syndromes			
Axial neck pain and radiculopathy	41 (69.49)	18 (30.51)	0.003
Radiculopathy and myelopathy	6 (31.58)	13 (68.42)	
Presenting severity of the disease by CNFDS			
Moderate	39 (82.97)	8 (17.03)	0.00
Severe	8 (25.81)	23 (74.19)	
Non-operative treatment modality			
Pharmacotherapy	5 (27.78)	13 (72.22)	0.001
Combined therapy	42 (63.64)	18 (36.36)	

The severity of the disease at presentation also appears to be a significant predictor of the outcome, with patients with severe symptoms having a worse prognosis. As can be seen in Table 3 the use of combined therapy appears to have a higher odds ratio for success compared to pharmacotherapy alone. However, the adjusted odds ratio was not statistically significant.

Table 3

Logistic regression for factors associated with pain reduction

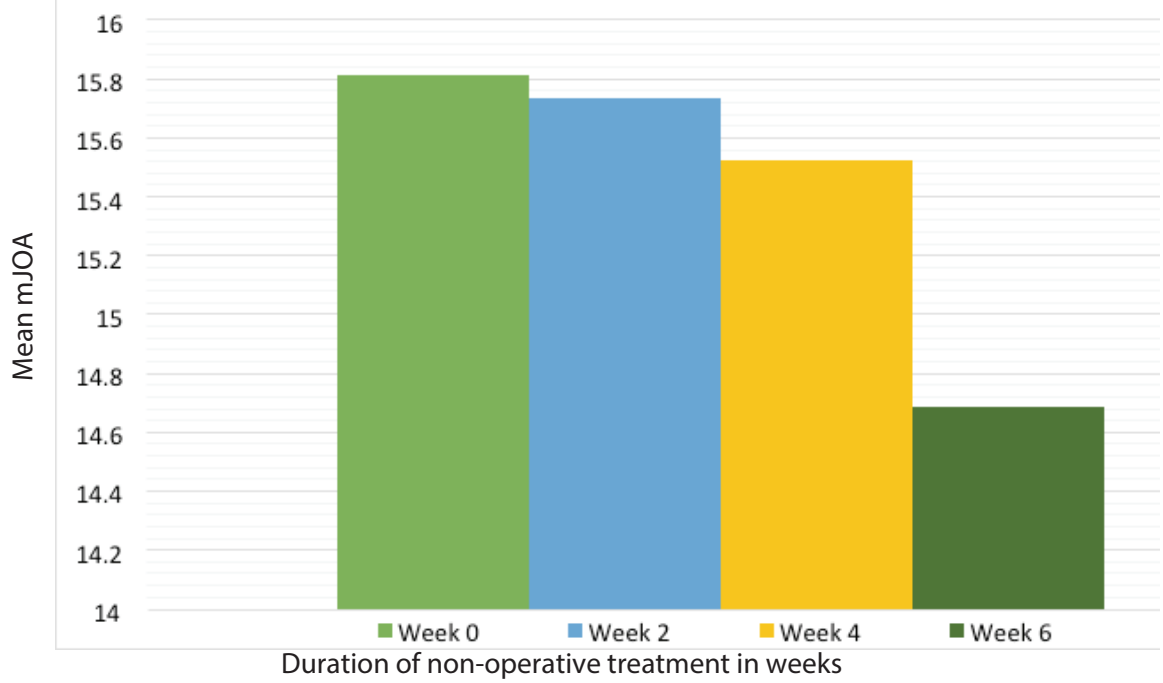
Variables	Crude Odds Ratio (95% CI)	P-value	Adjusted Odds Ratio (95% CI)	P-value
Clinical presenting syndromes				
Axial neck pain and radiculopathy	4.93519	0.005	1.23301	0.090
Radiculopathy and myelopathy	ref.			
Presenting severity of the disease by CNFDS				
Moderate	14.01562	0.000	10.02541	0.002
Severe	ref			
Non-operative treatment modality				
Pharmacotherapy	ref			
Combined therapy	6.06667	0.003	1.82676	0.070

Sensorimotor recovery

The data shows a steady decrease in mJOA scores throughout treatment, indicating a decline in neurological function. Overall, this data suggests that non-operative treatment may not have a significant impact on neurological function in patients with cervical degenerative diseases (Figure 6).

Figure 6

Mean modified Japanese Orthopaedics Association scores (mJOA) for 6 weeks of non-operative treatment



Factors associated with sensorimotor recovery

Based on the findings in Table 4, it appears that non-operative management may not have a significant influence on positive sensorimotor outcomes in patients with cervical degenerative disease.

Table 4

Chi-square test for factors associated with sensorimotor recovery

Variable	Yes No. (%)	No No. (%)	P-value
Sex			
Male	0 (0.00)	7 (100)	0.086
Female	4 (33.33)	8 (66.67)	
Age groups (years)			
<40	0 (0.00)	2 (100)	0.678
40-60	2 (28.58)	5 (71.42)	
>60	2 (20.00)	8 (80.00)	
Occupation groups			
Desk	3 (25.00)	9 (75.00)	0.581
Mobile	1 (14.29)	6 (85.71)	
Presenting severity of the disease by mJOA			
Mild	3 (23.08)	10 (76.92)	0.750
Moderate	1 (16.67)	5 (83.33)	
Treatment modality			
Pharmacotherapy	1 (50.00)	1 (50.00)	0.288
Combined therapy	3 (17.65)	14 (82.35)	

DISCUSSION

The results of this study highlight several key factors associated with degenerative cervical spine disease. Notably, the condition is more prevalent in females than males, with the highest incidence observed in individuals aged over 60 years old. These findings are consistent with previous research, which has similarly reported a higher prevalence of cervical degenerative disc disease and spondylosis in women and an increasing incidence with age. This suggests that age and gender are significant risk factors for the development of degenerative cervical spine diseases (8,9).

Additionally, the study identified an association between occupation and the prevalence of cervical degenerative disease, with both desk and mobile jobs being linked to a higher risk. This aligns with earlier studies, such as a 2017 study, which found that individuals with sedentary jobs are particularly prone to developing cervical spondylosis. Understanding these occupational risk factors, along with age and gender, can help clinicians better identify individuals at higher risk and implement targeted preventive strategies (8,10).

Degenerative cervical spine disease can manifest in various symptoms, including axial neck pain, radiculopathy, and myelopathy, all of which can profoundly affect a patient's quality of life. In this study, axial neck pain and radiculopathy were the most common clinical presentations, reflecting the well-documented trend in existing literature that identifies neck pain as the predominant symptom in cervical degenerative disease. For example, A 2021 study by Lannon *et al.* (11) similarly highlighted neck pain as the primary symptom among patients with cervical spondylosis.

In this study, the majority of participants received combined therapy, likely consisting of both pharmacotherapy and physiotherapy. This approach is supported by existing research, which consistently demonstrates that combined therapy is more effective in managing the symptoms of cervical degenerative disease compared to pharmacotherapy alone (11).

Regarding disease severity, the study observed a range of CNFDS scores, with most patients experiencing moderate disability and a significant number facing severe disability. This finding aligns with earlier research, which has consistently reported moderate to severe disability in patients with cervical degenerative conditions, particularly among older individuals (12-15).

The mJOA score findings also correspond to previous studies, indicating that while many patients showed no signs of the disease, others exhibited varying degrees of mild to moderate symptoms. This variability in disease severity is well-documented, with some patients experiencing minimal symptoms and others facing more significant challenges due to cervical myelopathy (16). Overall, the study reinforces the critical role of age, gender, occupation, and severity in the presentation and management of cervical degenerative disease, echoing trends observed in previous research (17,18).

The study highlights the critical factors that influence the outcomes of non-operative treatment in patients with Cervical Degenerative Disease (CDD), emphasizing the importance of clinical presentation, disease severity, and treatment modality. Patients presenting with axial neck pain, radiculopathy, and moderate disease severity (as measured by CNFDS) were found to have higher odds of experiencing pain reduction. This insight emphasizes the need for personalized treatment approaches, where the specific symptoms and severity of the disease are carefully considered to optimize patient outcomes.

These findings resonate with prior research on CDD management. A systematic review and meta-analysis of randomized controlled trials, found that therapies such as physical therapy, exercise therapy, and manual therapy effectively reduce pain and enhance function in CDD patients. Similarly, another study demonstrated that a multimodal treatment approach, incorporating exercise, manual therapy, and patient education, led to better outcomes for patients suffering from neck pain and disability compared to standard care (19).

Notably, another study in Canada also found that patients receiving combined therapy likely a combination of pharmacotherapy and physiotherapy had higher odds of pain reduction than those relying solely on pharmacotherapy. This aligns with existing literature suggesting that a multimodal treatment approach, which integrates various therapeutic methods such as exercise, manual therapy, and medication, tends to be more effective than monotherapy in managing chronic pain associated with CDD (11).

However, when other variables were accounted for, the association between treatment modality and pain reduction was not statistically significant. This finding indicates that while treatment modality plays a role, it may not be the most decisive factor in predicting pain reduction. The study's results offer valuable insights into the management of CDD, yet they also highlight the complexity of treatment outcomes. Future research should aim to confirm these findings in larger, more diverse patient populations and explore additional factors that might influence the effectiveness of non-operative treatments for CDD.

The study's findings reveal a consistent decline in modified Japanese Orthopaedics Association (mJOA) scores among patients with cervical degenerative disease undergoing non-operative treatment, indicating an unfavorable short-term outcome. This decline suggests a progressive deterioration in neurological function, implying that non-operative approaches may be limited in their ability to promote sensorimotor recovery in these patients.

These results are consistent with previous research on the natural progression of cervical myelopathy, which is often marked by worsening neurological function until surgical intervention is performed to relieve compression. While non-operative treatments can offer symptomatic relief, their impact on restoring sensorimotor function appears limited. In contrast, surgical options such as decompression or fusion are typically favored for improving neurological outcomes, particularly in cases of significant neural compression or advanced disease (20,21).

Study limitations

Several limitations should be taken into account when interpreting these results, including firstly follow-up period, while a prospective design allows for collecting data over time, this study may still have limitations in terms of the follow-up period. Depending on the duration of the study, the long-term effects of non-operative treatment modalities may not be fully captured. Longer follow-up periods would provide a more comprehensive understanding of treatment outcomes and potential complications.

Lastly, patient compliance and the effectiveness of non-operative treatment modalities rely on patient compliance and adherence to the prescribed interventions. However, the study may not have accounted for variations in patient compliance, which could impact the observed treatment outcomes. It is important to consider factors such as patient motivation, lifestyle factors, and socioeconomic status that may influence patient compliance.

CONCLUSION

The study findings indicate that non-surgical treatments at MOI can notably alleviate initial pain in degenerative cervical spine disease patients, with initial severity significantly influencing short-term outcomes. However, sensorimotor improvements from non-operative methods were insufficient, warranting additional research for validation.

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Conflicts of interest: None to declare.

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