Prevalence Of Cervical Movement System Impairment Subgroups In Patients With Mechanical Neck Pain

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Abstract

Introduction

Neck pain is a major global health concern, ranking 11th among causes of disability worldwide according to the Global Burden of Disease (2016), with an annual prevalence exceeding 30%. Approximately 10% of adults experience neck pain daily, and 50%–70% will encounter it at least once in their lifetime, particularly among middleaged individuals. The multifactorial origins of mechanical neck pain (MNP), involving structural and functional dysfunctions of the cervical and thoracic spine, classify it as nonspecific. Effective management of MNP requires targeted interventions and patient education regarding posture and ergonomics, as highlighted by recent studies. This study aimed to determine the prevalence of cervical movement system impairment (MSI) syndrome subgroups in individuals with MNP.

Materials and Methods

The study was carried out in two phases. Phase 1 established the interrater reliability of the MSI-based assessment tool. In Phase 2, 160 participants aged 18–55 years with nonspecific neck pain persisting for more than 3 months were recruited using convenience sampling. Individuals with cervical disc pathology, prior cervical surgery, scoliosis, or neurological disorders were excluded. Baseline assessments categorized participants into MSI subgroups. The prevalence of each subgroup was calculated using percentage analysis.

Results

Cervical MSI syndromes were present in 86.25% of participants with MNP. The most prevalent subgroup was cervical extension rotation syndrome (CERS; 33.75%), followed by cervical flexion syndrome (20%), cervical extension syndrome (18.13%), and cervical flexion rotation syndrome (CFRS; 14.38%). A minority (13.75%) did not fit any specific MSI subgroup.

Conclusion

CERS was the most common MSI in MNP, followed by cervical flexion, cervical extension, and CFRSs.

Keywords: *Mechanical neck pain, movement system impairment, neck pain, prevalence of neck pain, cervical disorders*

INTRODUCTION

Mechanical neck pain (MNP), or nonspecific neck pain, is the second most common musculoskeletal disorder after low back pain, frequently causing physical impairment and disability, often linked to poor head and neck posture.[1,2] According to the Global Burden of Disease (2016), neck pain ranks 11th among global disability causes, with an annual prevalence exceeding 30%.[3] Approximately 10% of adults experience neck pain daily, and 50–70% will encounter it at least once in their lifetime, particularly in middle-aged populations.[4] MNP refers to neck pain caused by mechanical disturbances such as strain, sprain, or degenerative changes in the cervical spine, without serious underlying pathology.[3,4] Its multifactorial etiology, involving structural and functional dysfunctions of the cervical and thoracic spine, often leads to classification as nonspecific.[3] Recent studies have emphasized conservative interventions and postural education to alleviate pain.[5]

Pain in MNP is typically localized to the posterior neck and aggravated by movement or prolonged abnormal postures. The cervical spine's susceptibility to wear and tear is due to frequent head movements and increasingly sedentary lifestyles, particularly associated with prolonged computer use.[6] Proper segmental motion is essential in preventing and managing musculoskeletal pain.[3] However, the diverse factors contributing to MNP complicate the development of standardized treatment protocols. Several classification systems, such as the Quebec Task Force Classification for Whiplash-Associated Disorders and models based on tissue pathology, have been proposed for diagnosing and managing neck pain.[5,7]

The movement system impairment (MSI) classification, developed by Shirley Sahrmann, provides a more individualized diagnostic approach for MNP.[8] MSI syndromes, based on the kinesiopathologic model (KPM), are characterized by impaired movement control during functional activities. According to the KPM, repetitive movements and prolonged postures may cause pathological tissue changes and kinetic dysfunction.[9] While MSI-based interventions have been studied for other musculoskeletal disorders like low back, knee, and shoulder pain, research on MSI syndromes in MNP is limited. Establishing the prevalence of these subgroups in MNP is critical for advancing research and clinical practice.[10] Sahrmann's cervical spine MSI classification includes four subgroups: cervical extension, cervical extension rotation, cervical flexion, and cervical flexion rotation. This classification system offers a patient-specific framework for tailoring treatment strategies and prognosis, emphasizing movement dysfunction over generalized diagnostic labels like "mechanical" or "nonspecific" neck pain.[11] Given the lack of studies exploring cervical MSI subgroups in MNP, particularly in terms of prevalence and gender distribution, this study aimed to assess the prevalence of cervical MSI syndrome subgroups in individuals with MNP. The study also sought to identify the most common MSI syndrome in relation to gender.

MATERIALS AND METHODS

This cross-sectional observational study was conducted over 12 months to assess the prevalence of cervical MSI syndrome subgroups in individuals with MNP. Ethical approval was obtained from the Institutional Review Board and Ethics Committee. Informed consent was collected from all participants, who were briefed about the study's purpose and their right to withdraw at any point.

A total of 160 participants with MNP were recruited. Inclusion criteria were adults aged 18–55 years with a history of neck pain lasting more than three months. Exclusion criteria included cervical disc pathology, prior cervical spine surgery, scoliosis, cervical myelopathy, trauma, systemic diseases such as ankylosing spondylitis, inflammatory arthritis, rheumatoid arthritis, neoplasm, and other neurological disorders. The sample size was calculated to ensure adequate power for detecting differences in MSI subgroup prevalence. Given the exploratory nature of the study and limited prior research, a sample of 160 participants was considered sufficient to provide baseline data for future studies.

The study was conducted in two phases: Phase 1: A pilot study assessed inter-rater reliability for classifying MNP into MSI subgroups. Two experienced physiotherapists, including the primary investigator, independently assessed 10 participants. The primary investigator, with four years of clinical experience, underwent a one-month training under an expert physiotherapist before conducting the pilot study. Phase 2: In the main study, 160 participants were recruited via convenience sampling. Following screening for eligibility, a baseline assessment was conducted using standardized observation of static and dynamic postures and pain response. Participants were categorized into MSI subgroups according to a standardized assessment protocol.[11] The prevalence of each subgroup based on
[Table 1] classification chart was calculated as a percentage of the total sample

MSI syndrome	**Characteristics**	**Symptoms**
Cervical Extension Rotation Syndrome	Forward-head posture may be sidebend or rotated Thoracic kyphosis with increased cervical extension	Cervical rotation ROM is limited and painful Observe cervical side bending and extension during rotation
Cervical Extension syndrome	Forward-head posture: Increased lordosis of the upper and lower cervical spine	Cervical extension range of motion (ROM) is painful
Cervical Flexion Rotation Syndrome	Decreased cervical inward curve with a position of side bend or rotation. Increasing the inward curve of the cervical spine and/or position of side bend or rotation decrease symptoms.	Cervical flexion ROM is painful. Cervical flexion during performance of rotation: Correction of cervical flexion movement results in diminished symptoms and/or improved cervical rotation ROM.

Cervical Flexion Syndrome	Decreased cervical inward curve Correction encourages greater flexion movement in the upper thoracic region and limits lower cervical flexion.	Cervical flexion ROM is painful

Table1. MSI syndromes of cervical spine classification chart

RESULTS

Descriptive statistics were performed for all baseline characteristics like age and gender. Data were checked for normalcy. The P value was set to less than or equal to 0.05 with a 95% confidence interval (CI). The study data were statistically analyzed by Minitab. In the Phase 1 study, the inter-rater reliability was established by using the kappa coefficient [Tables 2 and 3].

Count						
		Rater 2				
		Cervical Extension Rotation Syndrome	Cervical Extension Syndrome	Cervical Flexion Rotation Syndrome	Cervical Flexion Syndrome	Total
Rater 1	Cervical Extension Rotation Syndrome	3	1	0	0	4
	Cervical Extension Syndrome	0	2	0	0	2
	Cervical Flexion Rotation Syndrome	0	0	2	1	3
	Cervical Flexion Syndrome	0	0	0	1	1
Total		3	3	2	2	10

Table 2: Pair-wise raters judgments compared to all syndrome's judgments

		Value	Asymptotic Standard Error	Approximate Tb	Approximate Significance
Measure of Agreement	Kappa	.730	.165	4.052	.000
N of Valid Cases		10			

Table 3: Kappa value and P value of Kappa

In Phase 2 of the study, 160 subjects were assessed, comprising 82 females (51.25%) and 78 males (48.75%). The mean age of participants was 37.92 years (standard deviation = 9.51). Among patients with MNP, cervical extension rotation syndrome (CERS) was the most prevalent subgroup, affecting 33.75% (54/160) of participants, with a 95% CI of 26.48–41.64%. Cervical flexion syndrome (CFS) accounted for 20% (32/160) with a CI of 14.1–27.04%, followed by cervical extension syndrome (CES) at 18.13% (29/160; CI: 12.49–24.98%) and cervical flexion rotation syndrome (CFRS) at 14.38% (23/160; CI: 9.34–20.78%). Additionally, 13.75% (22/160; CI: 8.82–20.07%) of patients did not fit into any of the four MSI subgroups [Table 4, Figure 1].

Subgroup	Frequency	Percent	95% Confidence Interval
Cervical Extension Rotation Syndrome	54	33.75	26.48% to 41.64%
Cervical Extension Syndrome	29	18.13	12.49% to 24.98%.
Cervical Flexion Rotation Syndrome	23	14.38	9.34% to 20.78%.
Cervical Flexion Syndrome	32	20.00	14.1% to 27.04%.
None	22	13.75	8.82% to 20.07%.
Overall	138	86.25	79.93% to 91.18%

Table 4: Summary of all syndrome of MSI.

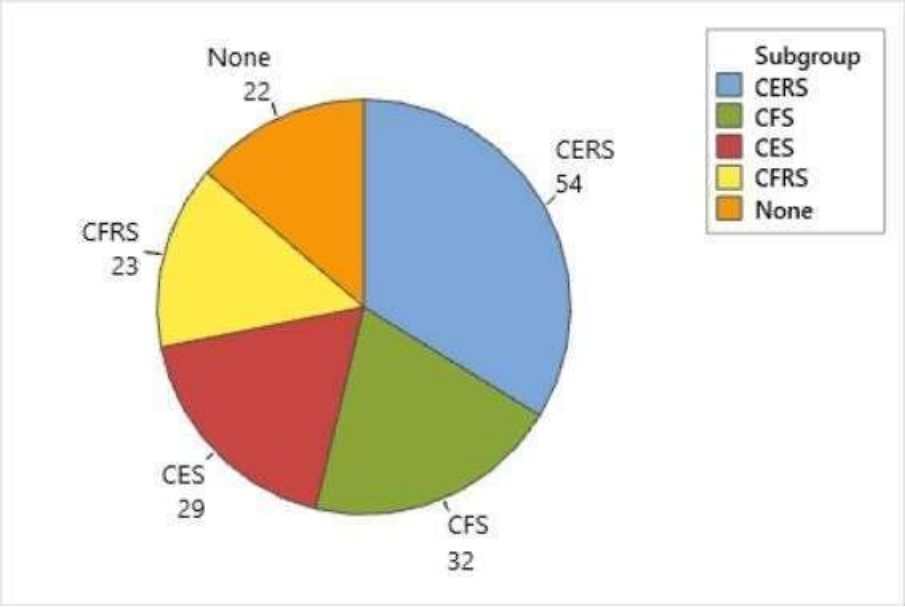

Figure 1: Pie chart of frequency distribution of subgroup

The overall prevalence of cervical MSI syndromes was 86.25%, implying that 138 out of 160 patients with mechanical pain could be classified into four categories. The CI for this prevalence is 79.93–91.18%. A

chi square test of tabulation was conducted to examine the association between gender and five subgroups [Table 5 and Figure 2].

Subgroups	Females	Males	All
Cervical Extension Rotation Syndrome	31	23	54
Cervical Extension Syndrome	12	17	29
Cervical Flexion Rotation Syndrome	12	11	23
Cervical Flexion Syndrome	16	16	32
None	11	11	22
All	82	78	160

Table 5: Gender wise distribution of syndromes subgroups

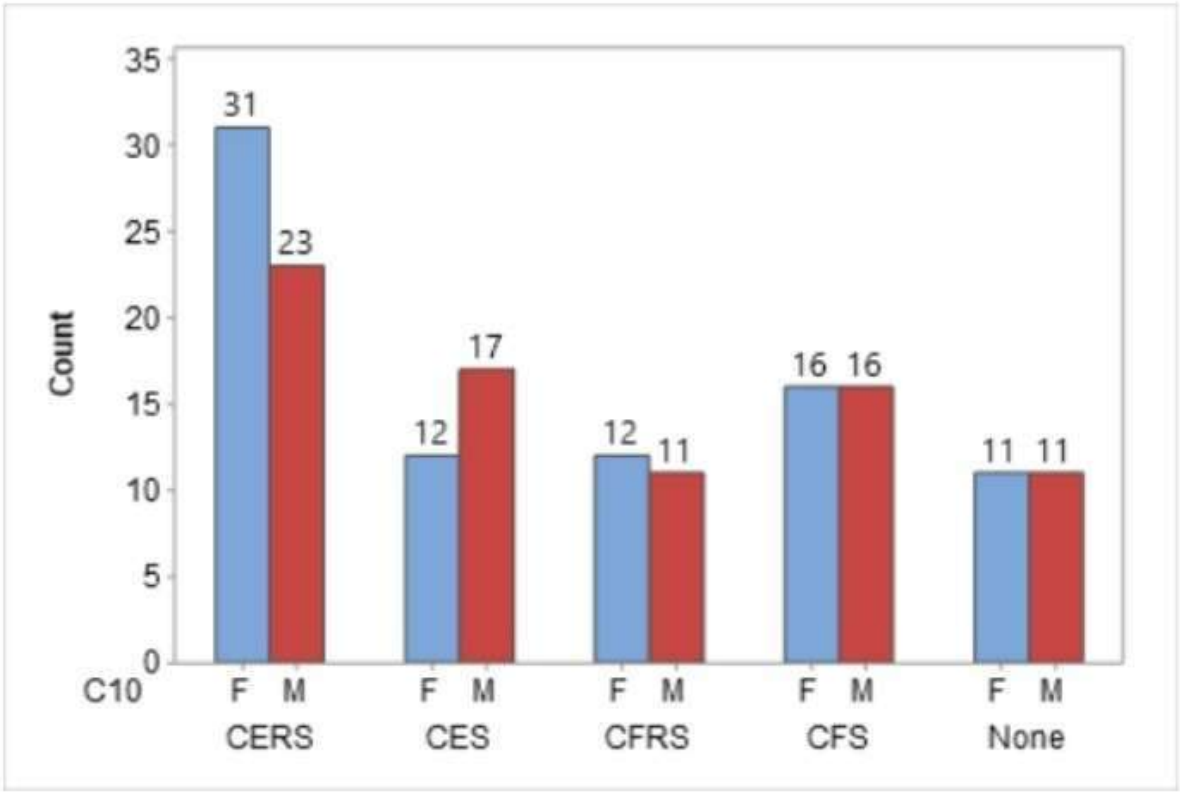

Figure 2: Bar chart of gender wise distribution of the syndromes subgroup

Discussion

The MSI-based classification enables clinicians to categorize patients with MNP into specific subgroups, facilitating individualized rehabilitation strategies and the development of targeted treatment protocols. Subgroup classification of MNP patients is recognized as a research priority to improve clinical outcomes.[12] This study assessed the inter-rater reliability of cervical MSI syndrome subgroup classification and determined the prevalence of these subgroups in individuals with MNP. Among 160 participants (82 females and 78 males), the overall prevalence of MSI syndromes was 86.25%. A notable finding was the higher prevalence of CERS in females, suggesting a gender-related association in this subgroup.

Neck pain remains a persistent musculoskeletal disorder with a multifactorial etiology. The inter-rater reliability of MSI-based classification for the cervical spine, evaluated using the kappa statistic, showed a kappa coefficient of 0.73, indicating good agreement between raters. These results align with prior studies, such as Henry et al., who reported good inter-rater reliability for MSI classification in low back pain.[13] Regarding prevalence, CERS was the most common subtype (33.75%), followed by CFS at 20%, CES at 18.13%, and CFRS at 14.38%. The predominance of CERS aligns with Sahrmann's earlier findings and is attributed to weak intrinsic cervical flexors, overactive extrinsic cervical rotators, and shortened posterior cervical tissues.[14]

The cervical flexor muscles play a crucial role in maintaining head and neck posture. Weakness and tightness in these muscles create an imbalance with the extensors, contributing to discomfort during neck extension. Repetitive movements in daily life can exacerbate this imbalance, increasing stress on cervical structures and producing pain during neck extension and rotation.[15] Previous research has also shown that neck pain reduces the strength and endurance of cervical flexor and extensor muscles. Altered motor control strategies may result in co-activation of both muscle groups, leading to muscle imbalances and discomfort.[16-18] Additionally, the body's tendency to follow the path of least resistance may cause abnormal joint movements, where stiffness or laxity in surrounding structures increases mechanical stress on cervical joints.

This study provides updated prevalence data on cervical MSI subgroups in MNP, addressing a gap in the literature and emphasizing the need for further research. Reliable syndromic classification systems are critical for guiding physiotherapists in tailoring rehabilitation for MNP patients. These findings offer baseline data for selecting well-defined subgroups for future randomized controlled trials and evaluating the impact of treatment strategies targeting specific musculoskeletal impairments. Future research should also investigate MSI subgroup prevalence in other joints, as current literature remains limited.

CONCLUSION

This study found that majority of the patients exhibited cervical movement system impairment (MSI) syndromes, highlighting the effectiveness of MSI classification for personalized treatment. Cervical extension rotation syndrome (CERS) was the most prevalent subgroup, followed by cervical flexion syndrome (CFS), cervical extension syndrome (CES), and cervical flexion rotation syndrome (CFRS). CERS was more common in females, suggesting potential gender-related factors in posture or muscle imbalances. These findings emphasize the value of MSI-based subgrouping for tailoring rehabilitation strategies to specific movement dysfunctions. The predominance of CERS aligns with biomechanical issues like forward-head posture and weak cervical flexors. This study provides critical baseline data for designing targeted interventions, particularly for middle-aged adults with chronic neck pain. Integrating MSI classification into clinical practice could enhance patient outcomes and reduce the global burden of neck pain.

CONFLICT OF INTEREST

The author's declare no conflict of interest.

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