Original Article

Correlation between Cervical Spondylosis and Myofascial Pain Syndrome: A Retrospective Study

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ABSTRACT

Objectives: To determine the prevalence and characteristics of myofascial pain syndrome (MPS) in people diagnosed with cervical spondylosis and the correlation between these two conditions.
Study design: Retrospective study.
Setting: Outpatient Rehabilitation Clinic, Saraburi Hospital.
Subjects: Patients diagnosed with cervical spondylosis between March 1, 2019 and February 28, 2022.
Methods: Patient characteristics and general information were obtained from medical records. The level and severity of cervical spondylosis were determined from radiographic findings. Muscles of the neck, shoulder, arm, and hand areas diagnosed with MPS were used to determine the prevalence of MPS and to analyze correlations with cervical spondylosis and other related factors.
Results: Of the 281 patients with cervical spondylosis recruited, 71.5% were diagnosed with MPS and the average number of MPS-affected muscles was 2.29 per person. The severity of cervical spondylosis was statistically significantly associated with a diagnosis of MPS (p = 0.003). Those with a minimal degree of cervical spondylosis on radiographic study were approximately 13 times more likely to have a diagnosis of MPS than those with a gross degree; however, severity had a weak negative correlation with the number of MPS-affected muscles (r = -.224, $p < 0.001$). Multivariable logistic regression analysis demonstrated that less severe cervical spondylosis, female gender and lower body mass index were independent factors correlated with a diagnosis of MPS ($p < 0.05$).
Conclusions: Patients diagnosed with cervical spondylosis have a high prevalence of concomitant MPS. Physicians need to be aware of the possibility of MPS when treating cervical spondylosis, especially if the patient is female, has a low BMI, and has less severe cervical spondylosis.

Keywords: cervical spondylosis, myofascial pain syndrome, pain, prevalence, risk factors

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Introduction

Cervical spondylosis is the medical term for the degeneration of the cervical spine and its associated components. The pathophysiology involves the vertebral bodies, intervertebral discs, facet joints, joints of Luschka, ligamentum flava, and vertebral laminae.[1] Since cervical spondylosis is related to degenerative processes, it is more prevalent in those over 50 years old.[2] Clinical manifestations of cervical spondylosis include neck pain as well as stiffness of the neck. When an adjacent nerve root is compressed, radicular pain presents.[3] In addition to aging, other causes of cervical spondylosis include mechanical overload on the cervical spine and spinal trauma from certain sports activities such as rugby playing, football competition, and horseback riding.[4,5] The severity of cervical spondylosis could be assessed and graded using a plain radiographic study of the cervical vertebrae in a lateral view.[6,7]

Cervical spondylosis is treated depending on the severity of the signs and symptoms. However, other diagnoses mimicking cervical spondylosis should be further investigated and adequately treated.[8] Physicians have to check the red flag signs, such as fever, weight loss, and lymph node enlargement. If there is no red flag sign, the goal of treatment is to relieve pain, increase the patient's ability to do daily activities, and prevent nerve root damage. The pharmacological therapies include nonsteroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, antidepressants, and opioids. The non-pharmacological therapies are physical modalities, soft cervical collars, and therapeutic exercises.[1] Epidural steroid injections and facet joint injections could be a choice for patients with intractable neck or radicular pain that resists other non-invasive treatments.[9,10]

Myofascial pain syndrome (MPS) is a common diagnosis in patients with regional pain related to a trigger point in an affected muscle.[11] Approximately 25%-90% of patients who present with musculoskeletal pain in general medical practices are diagnosed with MPS.[12-16] Pain from the trigger point could be referred to distant regions,[17] so-called referred pain, a pathognomonic sign of MPS. Trigger points can be distinguished from tender points that cause pain only at the pressure-applying area.[18] Also, patients with MPS may complain of paresthesia and numbness, which may not be confirmed with the sensory examination. To be noted, MPS can mimic

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various diseases[18] and can be secondary to pathologic neuromusculoskeletal lesions such as enthesopathy, arthritis, spinal disc lesion, and radiculopathy.[19]

Although the prevalence is high, general practitioners have low awareness of MPS. An underdiagnosis caused a missed opportunity for the patient to receive appropriate treatment.[20-22] Muscle stretching, trigger point injections, dry needling, deep pressure massage, and physical modalities, including diathermy, shock wave, or laser therapy, are treatment options for MPS.[23,24] In chronic pain, depression, or stress, antidepressants and anxiolytics may also be required.[25] There is inadequate evidence for using NSAIDs as a treatment for MPS because MPS is a non-inflammatory pain syndrome.[26] In addition, eliminating perpetuating factors, such as poor posture at work, is essential for preventing the recurrence of MPS.[19]

The researcher, a physiatrist, has observed when treating patients with cervical spondylosis in the rehabilitation outpatient department of Saraburi Hospital that MPS trigger points in the neck, arms, and hands are frequently detected together. Given that cervical spondylosis and MPS are treated differently. Therefore, failure to diagnose MPS in patients with cervical spondylosis may result in inadequate treatment and unsatisfactory treatment outcomes. The observed data from routine practice contributed to the aim of this research, which was to determine the prevalence and characteristics of MPS in patients diagnosed with cervical spondylosis. The knowledge may help to increase awareness of co-diagnosis of MPS or secondary MPS and lead to appropriate treatment and rehabilitation programs for patients with cervical spondylosis.

Methods

Study design

This was a retrospective study. The protocol of this study was approved by the Saraburi Hospital Research Ethics Committee (Research Project No. SRBR65-015, Certificate No. EC015/2565).

Participants

The target population was patients diagnosed with cervical spondylosis who visited the outpatient rehabilitation department of Saraburi Hospital between March 1, 2019, and February 28, 2022.

The researcher screened electronic medical records, which were retrieved if cervical spondylosis ICD-10 codes (M4712, M4722, M4782, and M4792) were applied. Data would be excluded if one of the following conditions was found: 1) no cervical radiography done within five years before the diagnosis; 2) no medical records or missing data resulting in an uncertain diagnosis of cervical spondylosis; 3) no hospital visitations during the study period, such as receiving medicine by mail due to the COVID-19 pandemic situation.

Variables for statistical analysis

The following data were retrieved from the patient's medical records: 1) demographic and medical characteristics, including gender, age, and body mass index (BMI); 2) the most affected level and severity of cervical spondylosis; 3) muscles affected by MPS at the neck, shoulder, arms, and hand. The severity of cervical spondylosis was determined based on a lateral view of cervical radiography and the Kellgren-Lawrence grading scale: minimal (grade 1), mild (grade 2), moderate (grade 3), and gross (grade 4).[6,7]

Statistical methods

Descriptive statistics including percentage, frequency, mean and standard deviation (SD) were used to describe the variables. Kolmogorov-Smirnov and Shapiro-Wilk tests were used to analyze whether the variable was normally distributed. The association or correlation between variables was analyzed as follows: 1) between the severity of cervical spondylosis, gender, and the presence of MPS using a chi-square test for significance testing and using logistic regression to obtain crude odds ratio (OR) with a 95% confidence interval (CI) for detecting the direction and the magnitude of the association; 2) between the severity of cervical spondylosis as well as age and BMI and number of the muscles diagnosed with MPS, using Spearman's rank correlation; 3) between gender, and the number of the muscles diagnosed with MPS, as well as between age, BMI and the diagnosis of MPS using Point-biserial correlation. If $r^2 < 0.4$, 0.4-0.6, > 0.6, then the strength of the correlation is weak, moderate, and strong respectively.[27] Lastly, the multivariable logistic regression analysis was used to adjust the confounding factors and prove the independent association of interested factors and the diagnosis of MPS. A p-value of less than 0.05 was considered to be clinically significant.

Results

According to data extraction from the hospital medical records between March 1, 2019, and February, 28 2022, 389 cases were diagnosed with cervical spondylosis. Among these retrieved data, 108 cases were excluded due to having one of the exclusion criteria (Figure 1). Of the remained 281 patients, 27.8% were men, the mean (SD) age was 57.12 (10.22) years, the mean (SD) BMI was 24.37 (3.58) kg/m^2, and 71.5% were diagnosed with MPS. The average number of MPS-affected muscles in those co-diagnosed with MPS and cervical spondylosis was 2.29 (Table 1), and the trapezius was the most frequently affected muscle, followed by paracervical muscles and infraspinatus, respectively (Table 2).

Of the 281 cervical spondylosis cases, 125 (44.5%) had moderate severity. The most common level was C5/C6 (136 cases, 48.4%).

Figure 2 shows the highest percentage of MPS (95.5%) in those with a minimal degree and the lowest percentage (61.0%) in those with a gross degree of cervical spondylosis. Table 3 shows the association between the severity of cervical spondylosis and the diagnosis of MPS (p = 0.003). For

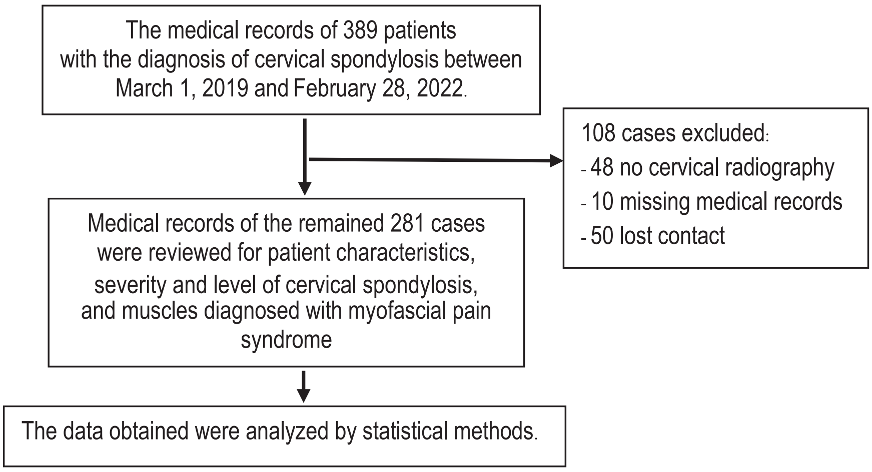

Figure 1. Flow chart of the study

Table 1. Demographic and clinical data of the patients diagnosed with cervical spondylosis (N = 281)

Parameters	
Gender, male[1]	78 (27.8)
Age, years [2]	57.12 (10.22)
Body mass index, kg/m^2 [2]	24.37 (3.58)
MPS, present[1]	201 (71.5)
Number of MPS-affected muscles per patient[2]	2.29 (1.05)

[1]Number (%), [2]mean (standard deviation)
MPS, myofascial pain syndrome

instance, the patients with minimal cervical spondylosis were 13 more likely to have MPS than those with a gross degree of cervical spondylosis. The patients with mild cervical spondylosis were 3 times more likely to have MPS than those with a gross degree of cervical spondylosis.

Regarding the effect of gender on the presence of MPS, MPS was found more in females than in males. Furthermore, statistical analysis revealed a significant relationship between gender and the diagnosis of MPS ($p < 0.001$).

Table 2. Muscles diagnosed with myofascial pain syndrome (MPS) (N = 201)

Muscles	Right	Left
Trapezius	110 (54.7)	107 (53.2)
Paracervical muscles	52 (25.9)	41 (20.4)
Levator scapulae	7 (3.5)	13 (6.5)
Rhomboideus	3 (1.5)	13 (6.0)
Infraspinatus	29 (14.4)	38 (18.4)
Teres muscles	-	1 (0.5)
Deltoideus	19 (9.5)	21 (10.4)
Biceps brachii	-	3 (1.5)
Triceps brachii	2 (1.0)	3 (1.5)
Wrist extensors	5 (2.5)	4 (2.0)
Intrinsic hand muscles	-	1 (0.5)

Number (%)

The correlations between variables analyzed by Spearman's rank correlation and point-biserial correlation are shown in Table 4. The severity of cervical spondylosis, age, and BMI had a weak but statistically significant negative correlation with the number of MPS-affected muscles. In contrast, females

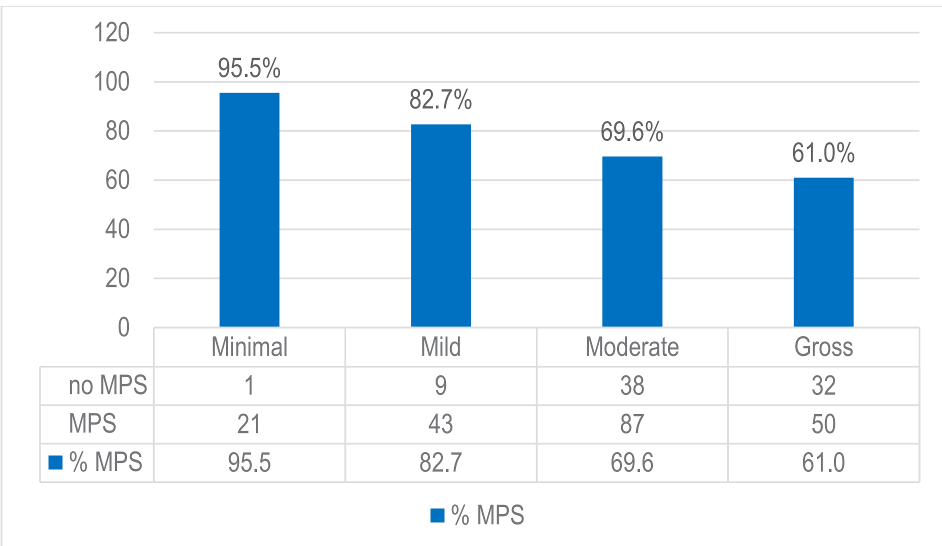

Figure 2. The distribution of myofascial pain syndrome (MPS) in each severity of cervical spondylosis

Table 3. Association between severity of cervical spondylosis and the diagnosis of myofascial pain syndrome (MPS)

Muscles	Diagnosis of MPS		Odd ratio[1]	95% CI		*p*-value
	Absent	Present		Lower	Upper	
Minimal	1	21	13.440	1.722	104.879	0.013
Mild	9	43	3.058	1.314	7.114	0.009
Moderate	38	87	1.465	0.816	2.630	0.200
Gross	32	50	-	-	-	0.009

[1]Crude odd ratio

Table 4. Correlation between variables and numbers of muscles with myofascial pain syndrome (MPS), diagnosis of MPS, and severity of cervical spondylosis

Interesting factors	Number of muscles with MPS		Diagnosis of MPS	
	Coefficients	*p*-value	Coefficients	*p*-value
The severity of cervical spondylosis	-0.224[1]	< 0.001	-	-
Age	-0.321[1]	< 0.001	-0.189[2]	0.002
BMI	-0.187[1]	0.002	-0.193[2]	0.002
Gender, female	0.285[2]	< 0.001	-	-

[1] = Spearman's Rank Correlation Coefficients; [2] = Point Biserial Correlation Coefficients

BMI, body mass index; MPS, myofascial pain syndrome

Table 5. Summary of multiple logistic regression analysis for the diagnosis of myofascial pain syndrome (MPS)

	B[1]	SEB[2]	Odds ratio	95% CI		*p*-value
				Lower	Upper	
Gender, female	1.647	0.336	5.190	2.686	10.029	< 0.001
BMI	-0.138	0.048	0.871	0.793	0.956	0.004
The severity of cervical spondylosis	-0.643	0.219	0.526	0.342	0.808	0.003
Age	-0.012	0.017	0.988	0.956	1.021	0.472

[1]B, unstandardized regression weight; [2]SEB standard deviation to a mean

BMI, body mass index

had a weak but statistically significant positive correlation. A weak but statistically significant negative correlation was found between age and BMI and the diagnosis of MPS.

Using the enter method of multivariable logistic regression analysis, female gender, low BMI, and less severity of cervical spondylosis were independent correlating factors for the diagnosis of MPS. At the same time, age was not an independent correlating factor for diagnosing MPS (Table 5). For instance, when another factor is held constant, female patients diagnosed with cervical spondylosis are approximately 5 times more likely than male patients to have the diagnosis of MPS (OR 5.190, 95% CI = 2.686-10.029). Compared to patients with a one-unit lower BMI, those with a one-unit higher BMI had a 12.9% lower likelihood of having the diagnosis of MPS (OR 0.871, 95% CI = 0.793-0.956). In addition, patients with gross degree cervical spondylosis had a 47.4 percent lower probability of having the diagnosis of MPS than those with moderate degree cervical spondylosis. Patients with moderate degree cervical spondylosis had a 47.4 percent lower probability of having the diagnosis of MPS than those with mild degree cervical spondylosis (OR 0.526, 95% CI = 0.342-0.808).

Discussion

There were 281 patients with cervical spondylosis who met the inclusion criteria for this study. The prevalence of MPS was 71.5%, and the mean number of MPS-affected muscles was 2.29 per person. In this study, the high prevalence of MPS in patients with cervical spondylosis may be due to the investigator's specialist, who seems more concerned about MPS than other medical specialists. On the other hand, treating physicians who are general practitioners may misdiagnose MPS, or MPS may be underdiagnosed.

Interestingly, this study found a negative correlation between the degree of cervical degeneration and the diagnosis of MPS and a negative correlation between the degree of cervical degeneration and the number MPS affected muscles. The possible explanation may be that MPS in those with a less severe degree of cervical spondylosis may be primary MPS. Alternatively, cervical spondylosis can be an incident finding as radiographs frequently reveal some degenerative changes in asymptomatic individuals.[28-30]

Moreover, the result of this study demonstrated that females diagnosed with cervical spondylosis were approximately five times more likely to be diagnosed with MPS and have a higher number of MPS than males. This finding is in line with the results reported by Fricton JR et al.[12] and Sabeh AM et al.[31] Both found that females experience MPS more often than men, which may be the result of an altered level of female hormones during the menstrual phase and may increase pain sensitivity, particularly during the second week of the menstrual cycle.[32]

In addition, this study found a negative correlation between age and the diagnosis of MPS and between age and the number of MPS-affected muscles in the univariable analysis. This finding may be because younger patients are in their working years and have more significant muscle activity with poor ergonomic postures, a risk factor for MPS[19] leading to the upper cross syndrome.[33] Also, younger females are more likely than older females to experience the altered hormone levels discussed previously.[32] However, the correlation was not significant by using the multivariable analysis.

Surprisingly, this study found an unexpectedly negative correlation between BMI and the diagnosis of MPS, which is inconsistent with a previous study[34] Agung I et al. reported no correlation between BMI and MPS, meaning that MPS can be found in both thin and obese people. Possible explanations for these results include that BMI is calculated based on height and weight, indicating poor body composition.[35,36] Some studies have found that a low BMI is associated with low muscle mass.[37,38] This may make them more prone to muscle overload and fatigue, which are important risk factors for MPS.[19,39-41] However, this study lacks information regarding body composition. Future research should collect the data required to determine the cause of this correlation.

Other findings of cervical spondylosis from this study are in line with other studies.[28,42] The most common vertebral levels affected by cervical spondylosis were C5/6[42].

Besides the findings mentioned above, this study had some limitations. First, it is a retrospective study. There were no pre-specified diagnostic criteria for MPS. Therefore, physiatrists in the department might not strictly follow the diagnostic criteria of MPS[11] and not be concerned about whether MPS is primary or secondary. A future study should be prospectively conducted to avoid this limitation. Next, the data were recruited from the patients who visited the rehabilitation outpatient department, resulting in a selection bias that may overestimate the prevalence of MPS. So, randomization of the study population from various departments such as orthopedic surgery, neurosurgery, or neuro-medicine should be conducted to confirm whether the diagnosis of MPS is not specialist-dependent. In addition, data for this study were collected during the COVID-19 pandemic, and many patients were excluded from the study. During this time, confounding factors such as poor ergonomics while working from home, psychological stress, and long COVID syndrome may exist but were not explored. Lastly, outcomes of combined treatment of cervical spondylosis and MPS should be further studied to demonstrate the benefit of diagnosis of MPS in those with cervical spondylosis.

This study suggests that individuals with cervical spondylosis have a relatively high likelihood of having MPS for clinical application.

Conclusions

Patients with cervical spondylosis have a high incidence of MPS in the neck, shoulder, arm, and hand regions. It is important to raise the treating physician's awareness of the concomitant MPS, especially if the patient is female, has a low body mass index (BMI), and has less severity of cervical spondylosis.

Disclosure

The authors declare that there is no conflict of interest.

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