Chettinad Health City Medical Journal
Volume 11, Issue 3 - 2022, Pg. No. 3-9
Peer Reviewed & Open Access Journal

Research Article

Bio Psychosocial Factors and Central Sensitization in Patients with Chronic Musculoskeletal Pain

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DOI: https://doi.org/10.24321/2278.2044.202222

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How to cite this article:
Alagappan TR, Senthilkumar SN, Tank H, Kapdi K, Vaid S, Gamit S. Bio Psychosocial Factors and Central Sensitization in Patients with Chronic Musculoskeletal Pain. Chettinad Health City Med J. 2022;11(3):3-9.

Date of Submission: 2022-08-04
Date of Acceptance: 2022-09-16

A B S T R A C T

Introduction: Central sensitization (CS) is a neurological sensitivity phenomenon that causes patients to perceive more pain and broader discomfort. However, the bio psychosocial factors associated with the phenomenon of perception continue to explore and further the current knowledge on CS in patients with chronic musculoskeletal pain. The main purpose of this study was to determine the extent of associative relationship between central nervous system sensitization and bio psychosocial measures in patients with chronic musculoskeletal pain.

Settings and Design: An observational cross-sectional study was carried out in a tertiary care hospital's outpatient unit.

Methods and Materials: Two hundred patients with chronic musculoskeletal pain were included in the present cross-sectional study. They completed questionnaires such as Central sensitisation inventory (CSI), Tampa Scale of Kinesiophobia (TSK), Pain Catastrophizing index (PCI), Insomnia Severity Index (ISI), Widespread Pain Index (WPI), Symptom Severity Score (SS), Kessler Psychological Distress Scale (K10 SCORE) and Fatigue Severity Scale (FSS).

Results: The bio psychosocial factors showed mild to moderate correlation with CSI score ,FSS (r=0.432); TSK (r=0.432); K10 score (r=0.450);PCI score (r=0.465); Total (WPI+SS) score (r=0.467) and ISI score(r=0.249).These bio psychosocial factors in a statistically significant hierarchical regression model showed 37.9 % variance on CSI score (F- 31.39;P< 0.001) where kinesiophobia and Insomnia did not satisfy the model fit.

Conclusion: Even the CS showed a significant association with bio psychosocial factors, it kept kinesiophobia and Insomnia out in its variance contribution.

Keywords: Musculoskeletal Pain, Central Sensitization, Pain Catastrophizing, Kinesiophobia, Widespread Pain, Fibromyalgia

Introduction

Central sensitization is characterized by generalised hypersensitivity and increased temporal summation of nociception, as a contributing factor leads that to chronicity of musculoskeletal pathology and which is believed to be associated with psychosocial and cognitive behavioural factors.[1-8] With increased sensitization of the central nervous system and decreased functioning of the nervous system to perform or regulate descending pain inhibition which may lead to phenomenon like allodynia and hyperalgesia in chronic Musculoskeletal conditions, subsequently limiting physical, mental and functional ability and capacity of individuals.[9,10] Among the bio psychosocial variables associated to CS, Pain catastrophizing, the tendency to overreact to pain has become a significant psychological predictor of clinical pain outcomes. It is distinguished by a propensity to exaggerate the threat value of the pain stimulus and by the relationship between cognition, attitudes, coping mechanisms, and functioning and the sensation of pain.[11-13] A person who has kinesiophobia, also known as "fear of movement," is said to have this condition when they have an excessive, unreasonable, and crippling dread of physical exercise as a result of feeling vulnerable to suffering a painful injury or re-injury.[14-16] Long-term usage of this cognitive avoidance behaviour results in impairment, disuse, and depression in addition to trapping the patient in a loop of increasing fear of pain, further pain, and disability.[15-17] Insomnia, difficulty in initiating and maintaining sleep and central sensitization are strongly related that, more the increase in pain and symptoms like fatigue in chronic musculoskeletal conditions, higher the risk of insomnia.[18-20] Fibromyalgia is a condition that is associated with chronic musculoskeletal pain, fatigue and tenderness. Widespread pain is frequently caused by it. The people suffering from any chronic musculoskeletal pain have associated features of fibromyalgia, insomnia as well as fatigue. Studies suggest that poor quality of sleep, fatigue contributes to increase in the chronic musculoskeletal pain which further decreases pain inhibition and contributes to central sensitization of the central nervous system.[21] It is very important to find out the centrally sensitized pain patients in clinical practice to avoid unwanted consequences during execution of physiotherapeutic interventions as the application of therapeutic interventions may aggravate or worsen the condition and finding out the bio psychosocial factors contributing to the phenomenon prove to be clinically important in the management of the sub group of patients with central sensitization. Hence the main purpose of this study was to find out the presence of central nervous system sensitization and the extent to which the central nervous system sensitization correlate with bio psychosocial measures in patients with chronic musculoskeletal pain.

Subjects and Methods

Subjects

A cross-sectional observational study was conducted using 200subjects with an age limit of 16-65 years from different hospitals and physiotherapy clinics in the locality where the study was conducted. All the subjects had different chronic musculoskeletal pain conditions (neck, back, hip, knee and widespread pain) for more than 3 months, receiving the physiotherapy treatment in their respective painful area were recruited through a non probability sampling.

Tools

Central Sensitization Inventory (CSI)

There are 25 assertions in the central sensitization inventory that are connected to present medical symptoms. The 5-point temporal Linkert scale is used to evaluate each of these components. The cumulative score has a range of 0 to 100. Central sensitization is present when the score is less than 40 out of 100.[22-24]

Numerical Pain Rating Scale (NPRS)

The patient is asked to rate his or her present, best, and worst level of pain during the last 24 hours. The patient's 24-hour pain history was represented by the average of the three scores.[25,26]

Tampa Scale of Kinesiophobia (TSK)

The TSK is a self-completed questionnaire. Its scores vary between 17 and 68, and the higher scores indicate an increasing degree of kinesiophobia. A cut-off score of 37 or over is considered as a high score, while scores below that are considered low scores.[27-30]

The Kessler Psychological Distress Scale

The Kessler Psychological Distress Scale (K10) is a simple screening measure of psychological distress consists of 10 questions about emotional states each with a five-level response scale,yielding a minimum score of 10 and a maximum score of 50.[31]

The Fatigue Severity Scale (FSS)

The Fatigue Severity Scale (FSS) is a short questionnaire that requires the subject to rate his or her own level of fatigue depending on how appropriate they felt the statement applied to them over the preceding week. A low value indicates that the statement is not very appropriate and a high value indicates agreement.[32]

Fibromyalgia Diagnostic Criteria

The American College of Rheumatology states that a patient meets all three of the following requirements to be diagnosed with fibromyalgia: Symptom severity (SS) scale score of 5 (or) WPI of 3 to 6 and SS scale score of 9

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202222

(or) widespread pain index (WPI) score of 7 and symptom severity (SS) scale score of 5 (or) fibromyalgia pain. And no other conditions that may account for the pain are present, and symptoms have persisted for at least three months at the same degree of intensity.[33]

Pain Catastrophizing Scale

It is curious about the kinds of thoughts and emotions experienced throughout painful situations. There are thirteen statements that describe various ideas and emotions that may be connected to pain.[34,35]

Insomnia Severity Index

The Insomnia Severity Index (ISI) is a self-reported screening tool designed to evaluate insomnia, comprises of seven items attributed to the sleep problem.[36,37]

Procedure

The background and purpose of the study was explained before the standard interview or schedule and filling of the instruments in the known language (Gujarati/Hindi) and besides the institutional approval of the study, all the patients signed a written informed consent form as a prerequisite to participate in this study.

Statistical Analyses

The demographic and clinical outcomes' numerical variables were given as means and standard deviations. Patients were classified as having no CS, subclinical, mild, moderate, or severe CS based on their CSI scores. The measurements of central sensitization and other biopsychosocial factors were compared using a correlation analysis. To determine the variance of independent factors on the central sensitization score, linear regression analysis was used. Version 20.0 of IBM SPSS Statistics for Windows was used for all the analyses (IBM Corp., Armonk, New York). The level of significance for all statistical analyses were kept "$p<0.05$".

Results

The present study included 200 musculoskeletal pain patients with mean age 44.97±10.87 years. In this sample, there were 78 (39%) male and 122 (61%) female subjects (Figure 1). The Table 1 and 2, describes the subject characteristics of the sample as frequencies & percentages and mean and standard deviations of all the outcome measures respectively. The severity level of CS described by Randy N et al. describes five levels of CSI severity ranging from Subclinical (0-29), Mild (30-39), Moderate (40-49), Severe (50-59) and Extreme (60-100) based on CSI scores (38) (Figure 1).

Among the seven tools selected for the current study, The Insomnia Severity Index has weak correlation with CSI score while all the other scales such as TSK, PCI, Fibromyalgia score (WPI+SSS), K10 score and FSS scores have mild correlation with CSI score (Table 3). The ascending order of mild correlation of scales is: FSS score and TSK scale (0.432) < K10 score (0.450) < PCI score (0.465) < Total score (0.467) (WPI+SSS).

Table 1.Demographic Data of Participants (n=200)

Subject characteristics	Frequency (percentage)
Gender	
Male	78(39)
Female	122(61)
Occupation	
White collar	27(13.5)
Blue collar	173(86.5)
Education level	
Primary	34(17)
Secondary	71(35.5)
Higher secondary	95(47.5)
Smoking	
Yes	2(1)
No	198(99)
Alcohol	
Yes	2(1)
No	198(99)
Marital status	
Single	11(5.5)
Married	189(94.5)
Living status	
Nuclear family	160(80)
Joint family	40(20)
Duration of the condition	
3– 6 months	50(25)
7 – 24 months	46(23)
More than 24 months	104(52)
Co morbid conditions	
Yes	84(42)
No	116(58)
Classification of CS	
subclinical CS	118(59.0)
mild CS	43(21.5)
moderate CS	19(9.5)
severe CS	17(8.5)
extreme CS	3(1.5)

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202222

Table 2.Mean and Standard deviation of Outcome Measures

Outcome Measure	Mean	Standard Deviation
CSI	28.35	13.50
TSK Scale (kinesiophobia)	35.52	7.15
PCI	15.19	8.82
Insomnia Severity Index	8.97	5.51
WPI Score	3.38	3.73
SS Score	3.50	2.18
Fibromyalgia Score (WPI+SS)	6.66	3.31
K10 (Psychological Distress)	17.71	5.96
FSS	29.30	9.23
NPRS	5.34	1.37

Central sensitisation inventory (CSI), Tampa Scale of Kinesiophobia (TSK), Pain Catastrophizing index (PCI), Insomnia Severity Index (ISI), Widespread Pain Index (WPI), Symptom Severity Score (SS), Kessler Psychological Distress Scale (K10 SCORE) ,Fatigue Severity Scale (FSS) and Numerical pain rating scale (NPRS)

Table 3.Correlation of Outcome Measures with CSI Score

Scale	CSI (p-value)
TSK scale	0.432(<.001)
PCI	0.465(<.001)
Insomnia severity index	0.249(<.001)
WPI score	0.226(<.001)
SS score	0.415(<.001)
Fibromyalgia score (WPI+SS)	0.467(<.001)
K10 score	0.450(<.001)
FSS score	0.432(<.001)

Central sensitisation inventory (CSI), Tampa Scale of Kinesiophobia (TSK), Pain Catastrophizing index (PCI), Insomnia Severity Index (ISI), Widespread Pain Index (WPI), Symptom Severity Score (SS), Kessler Psychological Distress Scale (K10 SCORE) and Fatigue Severity Scale (FSS)

In hierarchical regression analysis, model 1 showed that the TSK scale, PCI score, Fibromyalgia score (WPI+SSS), Insomnia Severity Index, K10 score and FSS score as independent variables in the analysis which had 38.3% variance on CSI score (P <0.001). After removing the non-significant Insomnia Severity Index variable from the analysis model 2 showed 38.6% variance on CSI score (P <0.001). Further removing the TSK scale model 3 showed 37.9% variance on CSI score (P <0.001) (Table 4).

Table 4.Hierarchical Regression Analysis Models

Model	Independent variables	Variance	F value	Significance
1.	TSK scale	38.3	21.56	<0.001
	PCI score			
	Fibromyalgia score (WPI+SS)			
	Insomnia severity index			
	K10 score			
	FSS score			
2.	TSK scale	38.6	25.98	<0.001
	PCI score			
	Fibromyalgia score (WPI+SS)			
	K10 score			
	FSS score			
3.	PCI score	37.9	31.39	<.001
	Fibromyalgia score (WPI+SS)			
	K10 score			
	FSS score			

Central sensitisation inventory (CSI), Tampa Scale of Kinesiophobia (TSK), Pain Catastrophizing index (PCI), Insomnia Severity Index (ISI), Widespread Pain Index (WPI), Symptom Severity Score (SS), Kessler Psychological Distress Scale (K10 SCORE) and Fatigue Severity Scale (FSS)

Discussion

The present study aimed to find out the presence of central nervous system sensitization and the extent to which the central nervous system sensitization correlate with bio psychosocial measures in patients with chronic musculoskeletal pain. In the current sample, 39 patients had CSI score of above 40 indicating 19.5% patients suffering from central sensitization phenomenon. Reflecting this statistic on our previous work, where there was a similar percentage of population with CS in a given sample, thereby supporting a premise that 1 in 5 person with any musculoskeletal could be susceptible to CS. Additionally, among this sub sample of 39, the severity of symptoms of CS was found more in females compared to males, thereby higher gender association for CS in females is shown in the

ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202222

current selected sample. This gender association supports our previous work on CS in unilateral shoulder pain in which there was a weak correlation between feminine gender and CS. As shown in the results, the association between psychosocial factors and symptoms of CS using CSI for patients with chronic musculoskeletal pain conditions is consistent with our previous research study results, where definitive relationship between chronic pain as well as all psychological factors was emphasized. Whereas our previous study was specific on unilateral shoulder conditions in this study, we elaborated to include generally musculoskeletal conditions. Keeping this in mind, this study expanded the relationship in terms of association between bio psychosocial factors and chronic pain.[39]

When the bio psychosocial factors subjected statistically to a hierarchical regression analysis in the present study it was found that tools on four major factors namely, widespread pain, fatigue, pain catastrophes and psychological distress contributed significantly to the variance of CS accounting 37.9% in patients with chronic musculoskeletal pain suggesting these factors had higher predictability for CS outcome.

In our current study, the Kinesophobia as a factor was excluded as a non-significant contributor for chronic pain. This is in line with the results of a recent non- randomized study, where, in a prospective cohort analysis, the researchers analysed the effect of Kinesophobia on subjects with chronic LBP, In that a decision curve analysis using the net benefit which has a higher predictive value bio psychosocial factors which could be considered to having studied the true effect of Kinesiophobhia.[40] Hence, from results of our current study, it could be said that Kinesiophobhia has no to minimal effect in contributing for chronic pain.

Similarly, the results of our current study echoed previous research by Wilson et .al on relationship between Insomnia and Chronic pain. This study analysed the effect of depression and insomnia on chronic pain. While insomnia associated with depression contributed to chronic pain, insomnia independently did not contribute to chronic pain but contributed to severity of pain considering the results of our study.[41]

The WPI score thus demonstrated a strong relationship with the CSI outcomes in our current study among all psychosocial factors, which is consistent with the expectation based on the algorithm developed by Nijs J et al.[42] in which diffuse or neuro anatomically illogical pain is proposed as the key factor in CS. This result concurred with the findings of a Delphi research on clinical indicators, which revealed "widespread, non-anatomical distribution of pain, acquired up to 96% consensus level agreement among expert clinicians as clinical indicator of CS pain, which is reflected in our study.[3,17,38,43]

Further, Fatigue and pain catastrophes symptoms relationship with CS in this study also showed the Clinical significance to sensory hypersensitivities similar to other studies on chronic pain patients.[44,45] The purpose of this article was to highlight biological, psychological and social factors relevance to sensitization. The presence of association may warrant a consideration in the management of chronic musculoskeletal pain patients. We can say that, these factors may contribute or exacerbate a patient's clinical sensory hypersensitivity symptoms.[46]

Though this current study brought out some interesting inferences like identifying the effect of biopsychosocial factors on Chronic pain, effect of gender on chronic pain and when subjected to rigorous analysis, excluded two factors as a contributing mechanism to the chronic pain. Yet there are some limitations to the current study. There was no sample size calculation done and sampling was a purposive sampling, which could have negated the true study effects. We did not attempt any subgroup analysis based on the musculoskeletal condition to study the true effect or cluster the samples into groups based on duration of condition. So further studies with better sampling through randomization, appropriate sample size through sample size calculation would eliminate potential biases and would throw light to clear the cloud on this result.

Conclusion

The symptoms of CS were significantly associated with bio psychosocial factors. Mild to moderate associations were found with pain castrophizing, kinesiophobia, Psychological Distress, widespread pain, Insomnia and fatigue severity symptoms as well as gender factor reasonably stood on the path of insight describing sensitization of nervous system. However, kept kinesiophobia and Insomnia out in its variance contribution.

Financial Support: None

Conflicts of Interest: None

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ISSN: 2278-2044
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ISSN: 2278-2044
DOI: https://doi.org/10.24321/2278.2044.202222