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Prevalence of Central Sensitization in Chronic Musculoskeletal Pain Disorders

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Abstract

Chronic musculoskeletal pain (CMP) is a leading cause of work absenteeism and increased costs for employers and the health care systems. It may emanate from activation of peripheral nociceptors due to tissue damage, but when the perception of pain persists beyond the expected time for tissue healing, it has become chronic. Central Sensitization (CS) is an important mechanism involved in chronic pain conditions causing amplified responses to noxious and innocuous inputs. Despite the association of CS in Chronic musculoskeletal pain disorders (CMPDs), the evidence regarding prevalence of CS in CMPDs is lacking.

Methodology: A descriptive study to document prevalence of CS in CMPDs was conducted among 190 participants with age group 18-65 years. The Central Sensitization Inventory (CSI) was used to determine severity of CS in chronic pain.

Results and Conclusions: The mean CSI score for the whole sample was 26.28±13.32 and the prevalence of CS was highest among participants with shoulder pain (28.6%) followed by leg pain (25%) and back pain (23.1%). In clinical practice, modification of life style factors and improving quality of life in patients with chronic musculoskeletal pain could be instrumental in mediating management strategies of CS in addition to pharmacological treatment.

Keywords: Central Sensitization, Inventory, Chronic Pain, Musculoskeletal Pain

Introduction

Musculoskeletal Disorders (MSD) are the leading cause of disability worldwide. Constant pain, reduced mobility and function, impaired quality of life and affliction of mental health are the common experiences associated with musculoskeletal conditions[1]. Most of the people experience one or more episodes of MSD once in their life, regardless of age, gender, or economic status. It affects approximately 47% of general population, out of which about 39-45% have long lasting problems necessitating intervention[2].

Pain that persists for a period longer than 3 months is classified as chronic pain, and this definition is consistent with several widely used epidemiological references[3]. Chronic musculoskeletal pain as per the proposed ICD-11 classification is defined as 'constant or recurrent pain that arises as part of a disease process directly affecting bones, joints, muscles or associated soft tissues[1]. According to World Health Organization (WHO), 20-33% of world's population has some form of CMP, translating to 1.75 people globally[4].

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Chronic pain is caused by not only physiological pathology but rather a complex interaction between biological, psychological and social factors[5]. There is strong evidence that chronic pain may be associated with physical disability, emotional disorders, and social difficulties. In addition, it has been recognized that emotional, cognitive, and social factors mediate the subjective experience of pain[6].

Chronic musculoskeletal pain disorders are the main contributors for components like years lived with disability and disability adjusted life years which significantly attributes to burden of disease worldwide[7].

As opposed to some symptoms which cannot be explained by scientific means highlights the importance of central sensitization in non organic or functional disorders. CS provides evidence based explanation for such cases and is defined as increased responsiveness of nociceptive neurons in the central nervous system which results in hypersensitivity to stimuli and an increased pain response[8]. It is oftenly associated with mechanical hyperalgesia and allodynia in patients with chronic pain conditions[9].

The scientific understanding of chronic pain where a clear origin for nociceptive input is lacking has been increased markedly in recent years. It is apparent that in most of the cases chronic pain results from traumatic or non traumatic injury which encompasses alterations in CNS processing. Such CNS dysfunctions alters the sensitivity of somatosensory system and results in increased brain activity. Once CS is established in such cases, it becomes plastic and any new injury will further results in an exaggerated CNS response[10, 11].

The signs of CS in chronic musculoskeletal pain can lead to lower quality of life and results in significant socioeconomic problems if they are not adequately managed. The prevalence of CS in low back pain and neck pain patients has been associated with high rates of disability[7]. This relationship has been understudied since most of the studies have been conducted in western countries except few studies in India[12]. Therefore the aim of the study was to document the prevalence CS in chronic musculoskeletal pain disorders.

Study Design and Methodology:

A cross sectional survey on subjects having any complaint of chronic musculoskeletal pain of more than 3 months duration aged between 18-65 years and having a score of at least 4 out of 10 on Numeric pain rating scale (NPRS) were recruited for the study. Subjects who had undergone any surgical intervention in the past 3 months, diseases of central nervous system, including cancer, brain or spinal cord injury, neurological disease or injury, primary diagnosis of neuropathic pain, any kind of infection and refusal to give informed consent for the study were excluded.

Sample Size determination:

The sample size was calculated by using the formula[7]:

$n = (Z^2 \times P (1 - P))/E^2$

n=163 (approximately)

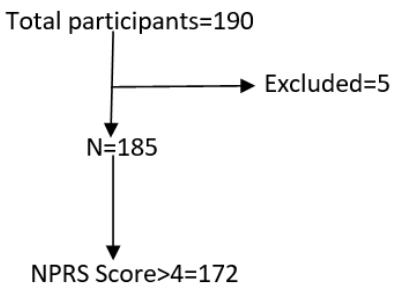
Where Z = value from standard normal distribution corresponding to desired confidence level

(Z=1.96 for 95% CI) P (.12) is expected true proportion E (.05) is desired precision.

Total sample size = 163

Procedure:

On the basis of selection criteria and on obtaining informed consent, a total of 190 subjects were interviewed out of which 172 were found to be eligible for the study. The demographic data including age, sex, weight, height and duration of symptoms was obtained and the prevalence of CS symptoms was assessed using the Spanish version of the CSI (CSI-Sp). The cut off score of greater than 40 was used for clinical relevance.



Statistical Methods

The statistical analysis was executed out using IBM SPSS version 20. All quantitative variables were evaluated using measures of central location (mean and median) and measures of dispersion (standard deviation). An analysis of variance (ANOVA with F and P values) was estimated out for the CSI variable i.e. cut off point and total score to determine the differences among BMI, age and gender. The chi-square test was carried out to test differences between categorical variables. The Kolmogorov–Smirnov test was used to check the normality of data.

Central Sensitization Inventory:

The Central Sensitization Inventory (CSI) is a screening instrument that helps identification of CS among subjects of CMP. It is a two-part questionnaire that contains a 25-item survey (Part A) that assesses the frequency of health-related symptoms associated with Central Sensitivity Syndromes (CSS) and a brief survey (Part B) for documentation of subjects that have been diagnosed with specific disorders. The participants were asked to rate each question on a 5-point scale with 0 meaning "never" and 4 meaning "always". The response will be summed up from a total possible score of 100. Higher CSI scores represent greater self proclaimed symptomatology. A cut off score of 40 or greater manifests acceptable psychometrics to recognize patients with central sensitivity syndromes[13, 14].

Results

A total of 190 participants were taken, out of which 185 completed the CSI questionnaire and 172 participants (43.41±13.32 years) were having NPRS score >=4. The majority of participants under study were females (61%) and from the age group of <=30 years. The most frequent diagnosis were back pain (45.3%) and neck pain (31.4%) followed by knee pain (19.2%), shoulder pain (12.2%), leg pain (9.3%), elbow pain (7.0%) and ankle or foot pain (6.4%). The details from demographic and anthropometric data are given in Table 1 and the frequencies of different areas of pain are given in Table 2.

Table 1: Demographic variables, CSI-Sp classification, and the most common diseases and diagnosis from the CSI-Sp part B

		N= 172
Avg age ± SD, years	43.41±15.15	
Avg weight ± SD, kgs	66.14±10.55	
Avg height ± SD, mts	1.63±.09	
Avg BMI ± SD, kg/m^2	25.24±4.14	
Gender, % (No.)	**Frequency**	**Percentage**
Men	67	39.0%
Women	105	61.0%
Condition		
Neck pain	54	31.4%
Shoulder pain	21	12.2%
Elbow pain	12	7.0%
Back pain	78	45.3%
Hip pain	1	.6%
Knee pain	33	19.2%
Leg pain	16	9.3%
Ankle/foot pain	11	6.4%
CSI part B classification		
Restless leg	14	8.1%
Chronic fatigue	11	6.4%
Fibromyalgia	19	11.0%
TMJ	3	1.7%
Migraine	20	11.6%
IBS	12	7.0%
MCS	1	.6%
Neck injury	2	1.2%
Anxiety	21	12.2%
Depression	17	9.9%

The cut off score of CSI<40 points was found among 144 participants and the remaining 28 participants had CSI score >=40. The mean CSI score for the whole sample was 26.28±13.32 whereas the CSI score >=40 was highest among participants with shoulder pain (28.6%) followed by leg pain (25%), back pain (23.1%) and neck pain (22.2%). The detailed values of CSI score has been mentioned in Table 3 and Table 4.

Table 2: Frequency of CSI<40, CSI >40 points and CSI total score in each CMPD

CMPD	CSI score				CSI Total Score, Mean±SD
	<40; (No., %)		>40; (No., %)		
Neck pain	42	77.8%	12	22.2%	26.65±13.74
Shoulder pain	15	71.4%	6	28.6%	31.14±15.45
Elbow pain	10	83.3%	2	16.7%	26.25±15.66
Back pain	60	76.9%	18	23.1%	30.13±13.95
Hip pain	1	100.0%	0	0.0%	17.00
Knee pain	27	81.8%	6	18.2%	25.94±13.97
Leg pain	12	75.0%	4	25.0%	27.63±16.03
Ankle/foot pain	11	100.0%	0	0.0%	21.82±8.59

Table 3: Frequency of CSI<40, CSI >40 points and CSI total score in BMI subgroup

BMI Subgroup	No. (%)	CSI <40, No. (%)	CSI>40, No. (%)	CSI Total Score, Mean±SD
Underweight	4 (2.3%)	4 (100.0%)	0 (0.0%)	20.50±9.43
Normal	89 (51.7%)	76 (85.4%)	13 (14.6%)	24.51±12.61
Overweight	57 (33.1%)	46 (80.7%)	11 (19.3%)	27.37±14.52
Obese	22 (12.8%)	18 (81.8%)	4 (18.2%)	31.68±12.27

Table 4: Frequency of CSI<40, CSI >40 points and CSI total score in age subgroup

Age Subgroup (years)	No. (%)	CSI <40, No. (%)	CSI>40, No. (%)	CSI Total Score, Mean±SD
<=30	45 (26.2%)	40 (88.9%)	5 (11.1%)	21.67±11.80
31-40	35 (20.3%)	29 (82.9%)	6 (17.1%)	26.86±13.84
41-50	37 (21.5%)	31 (83.8%)	6 (16.2%)	27.24±12.62
51-60	30 (17.4%)	27 (90.0%)	3 (10.0%)	25.03±12.37
>60	25 (14.5%)	17 (68.0%)	8 (32.0%)	33.84±14.52

Table 5: CSI differences by BMI, age and gender

	ANOVA, F (P)	
	CSI Cutoff Point	CSI Total Score
BMI	2.153 (.096)	1.400 (0.706)
Age	3.714 (.006)	6.302 (0.178)
Gender	1.409 (.161)	0.002 (0.969)

Discussion

In the present study, the CSI score and their distribution were based on 40 point CSI score as a cut off value to identify CS among chronic pain samples. Pain in shoulder (28%), leg (25%), back (23.1%) and neck (22.2%) was most commonly found to be associated with high CSI scores. The previous studies have also claimed a high prevalence of CS in subjects of chronic low back pain[7, 9, 16], neck pain[7, 12 15], extremities pain[15] and knee pain[22]. These differences can be attributed to variation of various factors like different lifestyle, structural, psychosocial and neurophysiological factors[16].

The CSI score>40 was found to be more frequent in overweight and obese individuals and those aged >60 years. However no difference was found among males and females. On further analysis age, gender and BMI was not found to be significantly associated with CS. The previous studies also reported that there is weak association of age[15] and BMI[25] with

CS. However some studies evaluated that CS is significantly associated with women[7, 17].

In addition to the above findings, it was found that participants were also having significant prevalence of anxiety (12.2%), migraine (11.6%), fibromyalgia (11%) and depression (9.9%). Restless leg syndrome (p=0.0001), chronic fatigue (p=0.007), migraine (0.0001), anxiety (p=0.024) and depression (p=0.003) were found to be significantly associated with presence of CS in CMPD patients. The previous studies suggested the gender differences in chronic pain risks and pain related psychosocial characteristics may be related to higher prevalence of CS in conditions like fibromyalgia, migraine, chronic widespread pain and post operative pain[7, 20, 21].

The proposed pathology of CS involves an amplification of neural signalling and circuits in nociceptive pathways caused by membrane excitability and reduced sympathetic inhibition[18]. These changes not only influence the perception of CP, but also enhance other nonpainful stimuli[19]. Thus patients with chronic pain are more sensitive to stimuli like visual and auditory sensations. This shows that these patients had a fundamental problem with pain or sensory processing rather than an abnormality confined to the specific body region where the pain was perceived to be situated[5].

Exercise habits and high resilience have shown to lower the incidence of CS whereas high levels of perceived stress, fewer sleeping hours a day, low resilience and smoking have been found to be associated with increased risk of the development of chronic pain[17]. These findings are in line with research suggesting the important role of psychiatric factors in onset, persistence of chronic pain and prevalence of co morbid psychiatric disorder in CMPDs[24].

The CSI used in the study is a valid tool to assess the significance of CS in CMPDs but the information generated by CSI is a patient reported outcome and is highly subjective in nature. Thus use of CSI needs to be supplemented by objective measures such as quantitative sensory testing that is a proved predictor of CS in CMPDs[24]. The results of the study cannot be generalized and a further research based on wider sample would allow a comparative analysis of the condition.

Conclusion

The present study revealed the presence of central sensitization in chronic musculoskeletal pain disorders. In view of the results obtained, pain physicians as well as physiotherapists must supplement their assessment for chronic musculoskeletal pain for improved decision making during management. The paucity of literature on CS in chronic pain warrants further high quality studies with greater sample size.

Ethical Clearance: Study protocol was approved by Institutional ethical committee of Sri Guru Granth Sahib World University, Fatehgarh Sahib. Approval Date: 25/10/2021, Approval number: SGGSWU/IEC/2021/06. Written informed consent was taken from all participants of the study.

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