

Severity of central sensitization in patients with chronic low back pain

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ABSTRACT

Background: Low back pain develops into Chronic Low Back Pain (CLBP) due to the contribution of various psychosocial factors in approximately 10-20% of all patients. CLBP is classified into three groups namely neuropathic, nociceptive and central sensitization (CS). CS results in pain due to hyper-responsive nociceptive neurons and recruitment of sub-threshold or normal stimuli.

Objective: To determine the frequency of central sensitization in patients with chronic low back pain

Methods: A descriptive cross-sectional observational study was conducted on 388 patients with CLBP, aged between 18 to 44 years, using non-probability convenient sampling. Patients were recruited from Ghurki Trust and Teaching Hospital, whereas, adults with a history of spinal surgery within the last 12 months, use of NSAIDs/analgesics, and coexisting neurological, respiratory, cardiac, or rheumatic disorder were excluded. The participants were requested to fill the Central Sensitization Inventory (CSI) questionnaire which has a test-retest reliability of 0.817.

Results: Out of 388 participants, 22.7% (n=88) of the participants demonstrated subclinical central sensitization. Mild central sensitization was reported by 33.0% (n=128) participants, 20.6% (n=80) demonstrated moderate central sensitization scores on the CSI. Whereas, severe central sensitization was found in 13.4% (n=52) participants and 10.3% (n=40) of the participants reported extreme central sensitization category based on their scores on the CSI.

Conclusion: Mild central sensitization was reported frequently among patients with chronic low back pain.

Keywords: Central Sensitization, Central Sensitization Inventory, Chronic low back pain, Low back pain.

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Introduction:

Pain in the area between the 12th lower costal margin and the inferior gluteal folds is considered to be low back pain. It leads to the highest number of Years Lived with Disability (YLD) than any other condition and ranks at fourth place in relation to the burden of disease.(1,2) It is a highly prevalent condition worldwide, with females affected more than men and had a greater incidence among higher age groups.(3-5)

Low back pain develops into chronic low back pain in approximately 10% to 20% of all affected individuals, which is known as pain exceeding the time

duration of 3 to 6 months.(6) The global prevalence of chronic low back pain in individuals between 24 to 39 years of age was 4.2%, whereas a prevalence of 19.6% was found in those with ages between 20 to 59 years old.(7-9)

Various predictors including work-related dissatisfaction, high workload, increased psychological distress, mood disorders like anxiety and depression, smoking and obesity, have all been recognized for chronic low back pain.(10) As far as the heterogeneous nature of clinical presentations of chronic low back pain is concerned, it was classified into 3 categories: Nociceptive Pain: Result of noxious stimulation of peripheral nerve endings, Neuropathic Pain: Arising from nerve entrapment or nerve root inflammation, and Central Sensitization Pain.(11)

Central Sensitization results in pain due to hyper responsive nociceptive neurons and recruitment of subthreshold or normal stimuli. This can be clinically detected by determining the presence of hyperalgesia and allodynia.(12-14) Testing for the presence of Waddell signs has proven their utility in this respect.

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These signs point the clinician towards an alteration of behavioral and psychosocial response in any given patient.(15)

The term "central sensitization" was first used by Woolf, where it was described as a syndrome of hypersensitivity characterized by an exaggerated response to a stimulus resulting from a low nociceptive threshold.(16) Two mechanisms were put forward by Woolf to describe the process of central sensitization, the first mechanism involved the recruitment of subthreshold sensory inputs by previously ineffective synaptic junctions resulting in activation of a nociceptive circuit. The second mechanism occurring simultaneously includes central augmentation of the pain response resulting from amplified neuronal activity. A combination of these two processes generates an excessive pain response known as central sensitization.(17,18)

Central sensitization affects pain intensity experienced by patients which is linked to changes in the CNS, as well as cognitive and psychological factors.(19-21) Other symptoms which may be attributed to the presence of central sensitization include cognitive dysfunction, headaches, dizziness, sleep disturbances and fatigue.(17)

Pain Neurophysiology Education is a recently developed approach that targets central sensitization by inducing a change in the patient's beliefs towards their pain.(22,23) Negative attitudes and behaviors related to pain, such as fear-avoidance behavior and catastrophizing has diminished with the assistance of this technique. Lower pain ratings and disability has also been reported in patients who have received pain neurophysiology education.(24,25) Cognitive Behavioral Therapy as part of a pain psychology program should be incorporated in altering pain perception related to central sensitization.(26)

This study may help to fill the existing gaps in knowledge and improve understanding pertaining to the phenomenon of central sensitization (CS) and will facilitate physical therapists in the recognition of symptoms and signs of CS in patients suffering from Chronic Low Back Pain (CLBP). As the previous literature provides insufficient knowledge regarding CS among patients with CLBP, it would set a background for physical therapists in the assessment of patients with central sensitization type of chronic low back pain, so that they may be able to differentiate it from pain due to a musculoskeletal source. Hence, the results of this study

would provide a greater understanding of the presentation of CS in CLBP and help clinicians to classify CS in the patients with CLBP, potentially resulting in targeted interventions and better outcomes.

Methods:

It was a descriptive cross-sectional observational study, conducted at Ghurki Trust and Teaching Hospital, Lahore, from June 2020 till December 2020 after approval from the Lahore College of Physical Therapy's ethical board. 388 participants were recruited to participate in this study using non-probability convenience sampling technique. The study was approved by the ethical board of Lahore College of Physical Therapy (LCPT/DPT/16/540).

Adults aged between 18 to 44 years, reported low back pain for 24 weeks or more, moderate to high-intensity pain, disproportionate pain after normal tissue healing time, use of antipsychotic drugs prescribed by a physician, and 3 or more Waddell signs positive out of 5 were included in the study (Waddell signs- superficial and non-anatomic tenderness over a wide area of lumbar skin to light touch or pinch, axial loading and acetabular rotation simulation with a positive sign considered if pain occurs in first 30° of rotation, distracted straight leg raise (SLR) discrepancy which is deemed positive when pain is reported by the patient on formal SLR examination in supine position and marked decrease in pain on distracted SLR in sitting position and the examiner extends the knee. An exaggerated painful response to such a stimulus was considered overreaction, which is not reproduced on providing same stimulus at a later time and regional weakness and sensory disturbance). Whereas, adults with a history of spinal surgery within the last 12 months, use of NSAIDs/analgesics, and coexisting neurological, respiratory, cardiac, or rheumatic disorder were excluded.

The participants were requested to fill out the Central Sensitization Inventory (CSI) questionnaire with assurance to maintain their anonymity and complete protection of their provided data. The CSI has a test-retest reliability of 0.817 and Cronbach's alpha of 0.879. (27) It is a self-report type of questionnaire consisting of 25 items. Each item is rated from 0 (never) to 4 (Always) on a Likert scale and the total score of all items is calculated out of 100. A score of 0 to 29 will place the participant in the Subclinical category, 30 to 39 score falls into the Mild category, 40 to 49 is Moderate, 50 to 59 would be labeled as Severe and a score of 60 to

100 would be categorized as Extreme central sensitization. The CSI 25 questions are further divided into sub-categories which are physical symptoms, emotional distress, headache/jaw symptoms and other symptoms. Psychosocial factors are mentioned in emotional distress symptoms which include questions related to stress that make symptoms worse, for instance, feeling sad or depressed, having anxiety attacks, poor memory, and difficulty in concentrating.

Data was entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 21. Data was presented using frequency tables, pie charts and bar charts

Results:

Out of 388 participants, the minimum age was 18 years and maximum was 44 years with a mean age of 30.3 and standard deviation (SD) of 8.18. Gender distribution is shown in figure 1 where 236 participants were females and 152 were males.

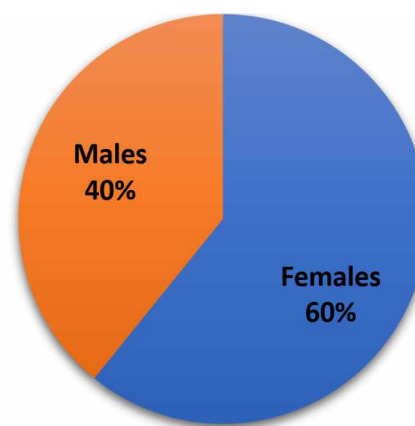


Figure 1: Gender distribution of the participants

Central sensitization among patients with chronic low back pain was assessed with CSI as shown in Table 2. The table showed the CS was classified into following domains on the basis of symptoms such as physical, emotional distress, headache, jaw symptoms, skin problems and feeling lethargic in the morning.

Table 1: Central Sensitization Inventory

Symptom	Questions	Never n(%)	Rarely n(%)	Sometime n(%)	Often n(%)	Always n(%)
Physical Symptom	Muscle stiff/achy	36(9.3)	72(18.6)	140(36)	76(19.6)	64(16.5)
	Pain all over body	56(14.4)	92(23.7)	152(39)	40(10.3)	48(12.6)
	Do not sleep well	24(6.2)	148(38)	124(32)	56(14.4)	36(9.4)
	Pelvic pain	184(48)	80(20.4)	80(20.4)	24(6.1)	20(5.1)
	Tension in neck & shoulder	32(8.2)	88(22.7)	132(34)	76(19.6)	60(15.5)
Emotional Distress	Anxiety Attacks	108(28)	44(11.2)	132(34)	84(21.6)	20(5.2)
	Difficulty concentrating	56(14.4)	104(26.9)	120(30.9)	64(16.5)	44(11.3)
	Stress makes symptoms worse	84(21.6)	68(17.6)	124(32)	56(14.4)	56(14.4)
	Sad or depressed	20(5.3)	96(24.8)	156(40)	88(22.7)	28(7.2)
	Poor memory	80(20.6)	96(24.6)	112(29)	60(15.5)	40(10.3)
Headache/Jaw Symptom	Sensitive to bright lights	144(37.1)	64(16.5)	96(24.7)	60(15.5)	24(6.2)
	Headaches	8(2)	108(28)	108(28)	160(41)	4(1)
	Pain in jaw	160(41)	132(34)	40(10.3)	56(14.7)	0(0)
	Certain smells make dizzy	184(47.5)	76(19.5)	40(10.3)	48(12.4)	40(10.3)
Other symptoms	Un-fresh in morning	20(5.2)	40(10.3)	228(58.8)	76(19.6)	24(6.1)
	Skin problems	112(29)	92(23.7)	84(21.6)	84(21.6)	16(4.1)

Participants of the study (n=388) completed the provided CSI questionnaire and were divided into subclinical, mild, moderate, severe, and extreme central sensitization categories according to the total score. Thus, 22.7% of the participants (n=88) demonstrated subclinical scores of central sensitizations. Whereas 33% of the participants (n=128) reported mild central

sensitization, 20.6% of the participants (n=80) demonstrated moderate central sensitization. However, severe central sensitization were found in 13.4% of the participants (n=52) and 10.3% (n=40) participants showed extreme central sensitization based on their scores on the CSI as shown in figure 2.

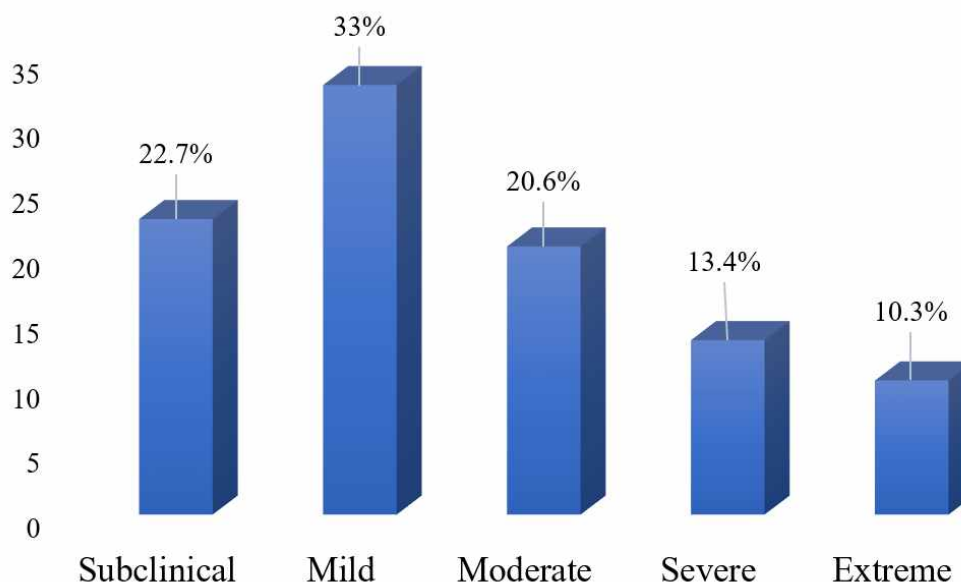


Figure 2: Bar Chart showing severity of central sensitization

Discussion:

Central Sensitization (CS) is a phenomenon in which the central nervous system becomes hypersensitive to pain, leading to increased pain perception and reduced pain thresholds. It is believed to be a factor which can contribute in developing and maintaining such chronic pain conditions as CLBP.(28) The current study is focused on determining the severity of central sensitization among patients with chronic low back pain. The study was first of its kind to be conducted in Pakistan as it emphasized the occurrence of central sensitization symptoms among patients suffering from chronic low back pain. Conclusion drawn from the present study indicates a wide variety of symptoms present in individuals with CLBP which points towards the phenomenon of central sensitization and mild central sensitization was reported in 33% of the participants.

Neblett R et al in 2015 carried out a study to evaluate whether a new screening tool called the central

sensitization inventory (CSI) may help clinicians to identify people with central sensitization (CS). The CSI is a screening tool developed to notify medical professionals that a patient's presenting symptoms may be connected to a CSS and that further examination for a CSS should be taken into account in order to begin the most appropriate assessment and treatment plan. Thus, it was reported that in terms of sensitivity, the CSI accurately recognized 82.8% of CS patients as having a CS with a positive likelihood ratio of 2.93%, while 54.8% of non-CS patients were correctly identified as not having a CSS (i.e., specificity). Although there is a large likelihood of false positives when evaluating patients with complicated pain and psychophysiological illnesses, the CSI is still a valuable and reliable tool for assessing individuals for the possibility of a CS.(29) However, in the current study, CSI was used to determine the severity of central sensitization as CSI has a test-retest reliability of 0.817 and a Cronbach's alpha of 0.879 and it reported the presence of mild CS in majority of the participants.

Cristina Roldán-Jiménez et al. in 2020 conducted a cross-sectional study on Central Sensitization in Chronic Musculoskeletal Pain Disorders (CMPD) in different populations. This study calculated the percentage of patients with various CMPDs who also symptoms have linked to CS. Despite the fact that participants had average subclinical CSI total scores, participants with scores greater than 40 were discovered across a variety of CMPD, age, and BMI categories. High CSI scores had the greatest impact on people with LBP and neck discomfort in particular. In view of these findings, doctors are advised to use the CSI in CMPDs in addition to their assessment for better therapeutic decision-making.(30) Whereas, in the present study it was reported that 34% of the patient sometimes had tension in their neck and shoulder and 15.5% always had it. Moreover, 36% patients felt that their muscles were stiff sometimes and 16.5% always felt that their muscles were stiff and 12.6% always felt pain all over the body.

K Aoyagi, et al. in 2019 conducted a study on Subgroup of Chronic Low Back Pain Patients with Central Sensitization. This study concluded that patients with CS had more severe pain, greater disability, higher level of depression and anxiety compared to patients without CS.(31) Thus, in the current study, 34% reported to sometimes experience and 21.6% often had anxiety attacks, while whereas, 40% patients stated sometimes having and 22.7% often had depression.

A cross-sectional study was carried out by E Huysmans et al. in 2018. The studies reported that cognitive and behavioral factors such as catastrophizing, pain behavior, kinesiophobia and pain intensity are associated with the presence of central sensitization. This is suggestive of the contribution of such factors to the persistence of pain and increased disability levels in chronic low back pain patients.(32) Hence, the current study 58.5% sometimes and 19.6% had often felt lethargic in the morning and 30.9% sometimes and 16.5% often had difficulty in concentration.

JR Clark et al. in 2019 conducted a qualitative study and reported that central sensitization is found to be associated with poor outcomes in the population. Certain personal characteristics are found in these individuals, for instance, emotional and physical hypersensitivity, learning difficulties, history of trauma (either physical or emotional), anxiety and memory

problems. The present study has also extracted similar findings with analysis of the answers provided by patients on the CSI.(33) Whereas, in the current study participants reported that stress makes symptoms worse in 32% patients sometimes and 14.4% stress makes symptoms were always worse.

In 2019 DM Klyne et al. reported that transition of acute low back pain into chronic low back pain can be averted by swift intervention which specifically targets the mechanism of central sensitization found in such patients in order to achieve better outcomes. However, several patients recover from the acute phase without developing central sensitization.(34) However, in the current study, the patient recruited had CLBP and majority of them reported mild central sensitization.

In 2017 D Goubert et al. reported that pain response augmentation was a characteristic of central sensitization. Altered pain processing is found in patients with mild to severe chronic low back pain by assessment of pain pressure thresholds in manual algometry testing.(35) Hence, as reported in the current study, 12.6% always had pain all over the body.

Small sample size, data collected from a single setting and use of non-probability convenience sampling, affects the strength and generalizability of the results. Moreover, the study only identifies symptoms of central sensitization by use of a self-report questionnaire. Future studies conducted on a larger scale on multiple settings with diverse age groups could provide a greater amount of information about the presence of central sensitization symptoms in chronic low back pain patients. Quantitative data collected by tools such as Digital Pressure Algometer, Cold Pressure Test or Quantitative Sensory Testing could improve understanding related to central sensitization. Moreover, studies should be conducted to measure factors affecting scores of the CSI and the effects of CS on functional activities and activities of daily living of participants.

Conclusion:

This study investigated the severity of central sensitization in patients with chronic low back pain and found symptoms of pain in areas other than the lower back region, including jaw pain, pelvic pain and generalized body pain. The scores of all participants led to the conclusion that mild central sensitization was reported frequently among patients with chronic low

back pain.

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Conflict of Interest: One of the authors of this article is also a member of the Institutional Review Board that provided ethical approval

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Authors contribution:

Pervaiz R: Study conception and design, data collection.

Faisal S: Drafting of article, data analysis and interpretation, critical review.

Safdar N: Assembly of data, statistical expertise.

Saleem F: Writing assistance, literature search.

Asim HM: Final approval and guarantor.

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