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Analysis of Influencing Factors for Chronic Low Back Pain with Cognitive Impairment

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Abstract

Background: Cognitive impairment (CI) is a common complication in chronic low back pain (CLBP) patients, and its progression increases the risk of dementia. However, there is currently a lack of predictive indicators for CLBP-CI. Previous studies have shown that routine blood indexes have predictive value for Alzheimer's disease, but their relationship with CLBP-CI remains unclear. This study aims to explore the correlation between routine blood indexes and provide evidence of disparities in chronic pain and cognitive impairment between two groups of individuals with low back pain, as well as establish the foundation for longitudinal experimental studies aimed at developing effective interventions for cognitive impairment in individuals with chronic low back pain.

Methods: This cross-sectional study was conducted at West China Hospital, Sichuan University. The Montreal Cognitive Assessment (MoCA) was conducted to divide patients into the CLBP-CI or CLBP-nCI group. Statistical analysis was performed to examine the differences between chronic low back pain patients with cognitive impairment and those without cognitive impairment. All statistical tests were conducted at a significance level of $\alpha=0.05$ for two-sided testing.

Results: The prevalence of chronic low back pain with cognitive impairment in this study demonstrates age-related disparities, with a higher prevalence observed among older individuals ($P=0.009$). A statistically significant difference in white blood cell count was observed between individuals with chronic low back pain and cognitive impairment ($P=0.004$).

Conclusion: Age and white blood cell count may serve as influential factors in the development of chronic low back pain with cognitive impairment. This finding can aid healthcare professionals in implementing early intervention and treatment for individuals experiencing this condition.

Keywords

Cognitive Impairment, Chronic Low Back Pain, White Blood Cell Count, Influencing Factors

Introduction

Chronic pain refers to persistent or recurrent pain lasting for a duration exceeding three months [1]. Chronic pain presents a prevalent and intricate issue, with lower back pain (LBP) representing a significant proportion among chronic pain patients. A systematic review published in 2012 estimated the prevalence of LBP at 38.9% [2]. Furthermore, there has been a consistent increase in the prevalence of chronic lower back pain over the past few years [3].

Cognition represents the most intricate function of the brain [4]. Dementia is the primary cause of disability in the global population aged 65 and older, including within China, posing significant challenges for policymakers, healthcare professionals, and families [5]. Mild cognitive impairment (MCI) is characterized by subjective and objective evidence of a decline in cognitive function from previous levels, representing a clinical pre-transitional stage between healthy cognitive aging and dementia, impacting 10-15% of individuals aged 65 and older [1]. Although 20-30% of patients with MCI may experience a return to normal cognitive function during subsequent follow-up [6], the annual rate of progression to dementia in individuals with MCI ranges from 5% to 10%, significantly surpassing the general population's annual incidence rate of 1% to 2% [7]. Chronic pain and self-assessment have been linked to an increase in objectively measured cognitive deficits [8,9]. According to a report, an epidemiological analysis of a large community and patients attending pain clinics estimated that at least 50% of individuals with pain reported experiencing cognitive issues [10]. A substantial proportion of patients exhibit cognitive impairments in objective assessments [11].

This article aims to provide evidence of disparities in chronic pain and cognitive impairment between two groups of individuals with low back pain, as well as establish the foundation for longitudinal experimental studies aimed at developing effective interventions for cognitive impairment in individuals with chronic low back pain.

Methods

Ethical Approval:

All procedures performed in studies involving human participants were in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study plan was approved by the Ethics Committee of West China Hospital, Sichuan University (ethics approval number: 2021 review (221)) and registered in the Chinese Clinical Trial Registry (registration number: ChiCTR2100047290).

Study Design and Study Setting:

This study was a single-center, cross-sectional study conducted on chronic low back pain patients at the Department of Pain Medicine, West China Hospital, Sichuan University from October 2020 to February 2023. We conducted an epidemiological survey on eligible chronic low back pain patients.

Patients:

A total of 64 patients with lumbar pain were included in the survey after excluding those who did not complete the questionnaire or were deemed ineligible. The final analysis comprised responses from all 63 participants.

The inclusion criteria are as follows:

(1) Willing participation in this study and provision of informed consent, with willingness to undergo follow-up.

(2) Aged 18 years or older.

(3) VAS score > 0.

(4) Patients diagnosed with lumbar spine diseases experiencing pain for a duration exceeding 3 months.

(5) Individuals who have not previously participated in other clinical trials.

The exclusion criteria are as follows:

(1) Poor general health condition, inability to objectively describe symptoms, or presence of severe infections, respiratory failure, heart failure, etc., hindering active cooperation.

(2) Previous diagnosis of dementia, Alzheimer's disease, cerebral ischemia, brain injury, central infection, epilepsy, Parkinson's disease, Huntington's disease, amyotrophic lateral sclerosis, cerebellar ataxia, and other neurological diseases.

(3) Refusal to participate.

Measurement and Data Collection:

On the day of admission, this study employed a questionnaire scale to evaluate the Montreal Cognitive Assessment (MoCA) of patients meeting the specified inclusion and exclusion criteria. Based on the MoCA scale scores, participants were stratified into two cohorts: the LBP-CI group characterized by cognitive impairment and the LBP-nCI group without cognitive impairment. Meanwhile, we collected several common demographic factors, including age, gender, height, weight, body mass index (BMI), and educational level. Additionally, we recorded the degree of pain (VAS score), duration of pain, main diagnosis, and medications used. Then, we collected the patient's basic vital signs, completed a blood test, checked coagulation function, and performed biochemical tests. After extracting and inputting the data, we conducted statistical analysis and interpretation.

Utilizing a custom-designed case report form, the survey encompassed demographic data such as age, gender, body mass index (BMI), and educational attainment. As the study focused on hospitalized patients, we also conducted data collection and analysis of their hematological parameters from routine hospital admission tests.

The assessment of pain intensity in this study was conducted using the Visual Analog Scale (VAS) [12]. Due to its precision, simplicity, and high sensitivity, the VAS scale has been extensively utilized for assessing pain, quality of life, and anxiety. It comprises a 100-millimeter straight line with one end denoted as 0 (indicating the complete absence of pain) and the other end marked as 10 (representing unbearable pain). The intermediate section denotes varying degrees of pain. Patients subjectively assess their level of pain by marking the line according to their perception from the left endpoint. In this study, we will consider utilizing centimeters as the unit of measurement for reporting VAS scores within the 0-10 range [13]. A score of 0 indicates the absence of pain, while a score of 1-3 denotes mild pain, 4-6 signifies moderate pain, and 7-10 represents severe pain [14].

The study employed the MoCA scale for cognitive impairment screening [15]. The Montreal Cognitive Assessment (MoCA) comprises 28 items, encompassing eight domains of cognitive function: executive function, attention, memory, language abilities, visuospatial skills, abstract thinking, calculation, and orientation. It is scored on a 30-point scale with higher scores indicative of superior cognitive function. The optimal cut-off scores for screening cognitive impairment based on the subject's level of education are as follows: 19 points for those with 6 or fewer years of education, 22 points for those with 7-12 years of education, and 24 points for those with more than 12 years of education [16]. In this study, the duration for patients to complete the MoCA scale was approximately 15 minutes.

Statistical Analysis:

The data for this study were recorded, a database was established, and data analysis was conducted using Excel software and SPSS 27.0 software. Statistical analysis was performed to examine the differences between chronic low back pain patients with cognitive impairment and those without cognitive impairment. All statistical tests were conducted at a significance level of $\alpha=0.05$ for two-sided testing.

Results

A total of 62 people were surveyed, and data were collected for this study. The average age was 48.86 years (SD = 12.63). In terms of gender distribution, there were 33 female patients (53.23%) and 29 male patients (46.77%). The educational levels of the patients in this study were as follows: 3 (4.83%) were illiterate, 10 (16.13%) had completed primary school, 42 (67.74%) had completed middle school, and 7 (11.29%) had completed college or higher education. The study, in accordance with the BMI classification standard of the World Health Organization, observed the following distribution: 1 patient classified as underweight (<18.5 kg/m^2), accounting for 1.61%; 24 patients classified as normal weight (18.5-24 kg/m^2), accounting for 38.71%; 29 patients classified as overweight (24-28 kg/m^2), accounting for 46.77%; and 9 patients classified as obese (≥28 kg/m^2), accounting for 14.51%. The VAS scores of chronic low back pain patients in this study were categorized as follows: 1-3 points (8 individuals, 12.90%), 4-6 points (36 individuals, 58.07%), and 7-10 points (18 individuals, 29.03%). The detailed general information is presented in **Table-1**.

In this survey, 32 patients with CLBP-CI were identified, constituting 51.61% of the total study cohort. The intergroup variations between the two cohorts under investigation are delineated in **Table-2**. (1) Age: The average age of patients with chronic low

Table-1: General Information of Chronic Low Back Pain Patients

Variable	Classification	Total number of people	Percentage Occupied (%)
Gender	Male	29	46.77
	Female	33	53.23
Age (years)	20-39 years	15	24.19
	40-59 years	39	62.9
	60 years old and above	8	12.9
Educational level	Illiterate	3	4.84
	primary School	10	16.13
	middle school	42	67.74
	college or higher education	7	11.29
BMI（kg·m⁻²）	Emaciated （<18.5)	1	1.61
	Normal（18.5-24）	24	38.71
	Overweight （24-28)	29	46.77
	Obesity （≥28）	9	14.51
Visual Analogue Scale (VAS)	1-3 score	8	12.9
	4-6 score	36	58.07
	7-10 score	18	29.03

Data is presented in frequency and percentage; BMI: Body Mass Index; VAS score: Visual Analog Scale score.

Table-2: Distinction of Two Groups of Patients

	CLBP-CI （n=32）	CLBP-nCI （n=30）	*P*
Gender[n(%)]			0.445
Male	13 （44.83）	16 （55.17）	
Female	19 （57.58）	14 （42.42）	
Age (Year)	55.62 ± 12.57	44.40 ± 13.05	**0.009***
Educational level [n(%)]			0.08
Illiterate	0 （0.00）	3 （100.00）	
Primary school	8 （72.73）	3 （27.27）	
Middle school	22 （53.66）	19 （46.34）	
college or higher education	2 （28.57）	5 （71.43）	
BMI ($Kg·m^{-2}$)	24.77 ± 2.73	25.17 ± 3.34	0.6
VAS (Score)	5.91 ± 1.97	5.13 ± 1.70	0.1
Pain Duration (Month)	46.56 ± 45.47	52.50 ± 64.58	0.68
White blood cell count (10^9/L)	5.22 ± 1.06	6.52 ± 2.22	**0.004***
Red blood cell count (10^9/L)	4.42 ± 0.48	4.63 ± 0.58	0.117
Hemoglobin（g/L）	132.88 ± 14.10	132.30 ± 21.16	0.9
Platelet count（10^9/L）	195.03 ± 88.26	191.67 ± 66.28	0.866
Monocyte Percentage (%)	8.64 ± 1.58	8.23 ± 1.72	0.339
Lymphocyte Percentage (%)	32.73 ± 7.39	32.11 ± 8.87	0.764
Neutrophil Percentage (%)	55.49 ± 7.32	56.76 ± 9.65	0.56

*BMI: Body Mass Index (Body Mass Index); VAS: Visual Analog Scale. *P < 0.05* back pain and cognitive impairment was 53.03 years (SD=12.20). The prevalence of chronic low back pain with cognitive impairment in this study demonstrates age-related disparities, with a higher prevalence observed among older individuals (P=0.009). (2) Gender: There were 19 female patients (57.58%) with chronic low back pain combined with cognitive impairment, while there were 13 male patients (44.83%). The results of this study indicate that there is no statistically significant difference in the prevalence of chronic low back pain combined with cognitive impairment between genders (P=0.445). (3) Educational Level: The prevalence of chronic low back pain combined with cognitive impairment was 0% for illiterate patients, 72.73% for those with primary education, 53.66% for individuals with secondary education, and 28.57% for patients with a university degree or higher. This study found no statistically significant difference in the prevalence of chronic pain combined with cognitive impairment across different educational levels (P=0.08). This study indicates that there is no statistically significant difference in the prevalence of chronic low back pain combined with cognitive impairment across various body mass index categories (P=0.600). (5) The VAS Score did not show a statistically significant difference in the prevalence of chronic low back pain combined with cognitive impairment (P=0.100). (6) A statistically significant difference in white blood cell count was observed between individuals with chronic low back pain and cognitive impairment (P=0.004).

Discussion

Recently, there has been a growing body of evidence indicating a correlation between chronic lower back pain and cognitive impairment, both of which are prevalent health concerns associated with aging [17]. Research has indicated an increasing prevalence of chronic lower back pain and cognitive impairment with age, and a clear positive correlation between the two has been established [1,18]. In other words, there is a higher likelihood of cognitive impairment in patients with chronic back pain, and conversely, individuals with cognitive impairment are more likely to experience chronic back pain [19]. This correlation is particularly pronounced within the elderly demographic.

The study findings suggest that age should be comprehensively taken into account in the prevention and treatment of chronic low back pain and cognitive impairment, with the development of targeted interventions. Additionally, greater emphasis should be placed on monitoring changes in low back pain and cognitive function among the elderly population, while implementing timely interventions to enhance their quality of life and health status.

Age-related research on chronic low back pain and cognitive impairment holds significant theoretical and practical implications. Through a thorough exploration of the interaction mechanisms between these conditions, more effective strategies and methods for preventing and treating these diseases can be developed.

The etiology of chronic low back pain, a prevalent health issue, is multifaceted. In recent years, there has been growing interest in exploring the potential association between chronic low back pain and cognitive impairment, as well as levels of white blood cells [20]. Research indicates that individuals suffering from chronic lumbar pain exhibit elevated levels of white blood cells compared to the general population [20,21]. This increase may be associated with the specific types of white blood cells and the inflammatory response triggered by low back pain, given that white blood cells play a crucial role in inflammation. Moreover, the rise in white blood cell levels could also be linked to the intensity and duration of low back pain in patients; however, further research is needed to elucidate the precise mechanism.

Therefore, the primary objective of this study is to investigate the age-related correlation between chronic low back pain and cognitive impairment, as well as to analyze the association between chronic low back pain and white blood cell levels. The aim is to offer a fresh perspective and foundation for the clinical diagnosis and treatment of chronic low back pain.

The study has several limitations. Firstly, it is a cross-sectional survey, lacking temporal correlation of disease progression, which weakens the evidence for causal inference. Secondly, potential bias may exist in the data collection for the illiterate group based on educational level due to inadequate communication with patients. Thirdly, the MoCA scale used to assess cognitive state did not include clinical examinations such as imaging and lacked a gold standard for diagnosing cognitive impairment.

Conclusion

Age and white blood cell count may serve as influential factors in the development of chronic low back pain with cognitive impairment. This finding can aid healthcare professionals in implementing early intervention and treatment for individuals experiencing this condition. Furthermore, future research should focus on conducting larger-scale surveys and high-quality clinical studies to further investigate the contributing factors of chronic low back pain with cognitive impairment, as well as the diagnostic value and clinical significance of blood plasma biomarkers.

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Conflict of Interest

The authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

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