ISSN 2786-6661
eISSN 2786-667X

MEDICINE / МЕДИЦИНА

UDC: 616.8-009.7:616.741:616.833.5]-036.86-07:615.8
https://doi.org/10.32345/USMYJ.3(157).2025.8-16

Received: June 10, 2025
Accepted: September 09, 2025

Assessment of functional impairment in patients with chronic non-specific low back pain depending on the dominant type of pain

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Abstract: *Chronic non-specific low back pain is a musculoskeletal disorder that has a significant tendency to spread among working-age people throughout their lives worldwide. Lower back pain is the leading cause of disability worldwide among people of working age and is a significant social and economic burden on the healthcare system. In patients with chronic low back pain, assessment of functional impairment is of important clinical significance, as it allows for evaluation of the complexity of the course, the effectiveness of treatment, and the prognosis for the disease. To assess the degree of functional impairment in patients with chronic non-specific low back pain depending on the dominant type of pain. A retrospective single-center pilot study was conducted and included patients with chronic non-specific low back pain who underwent rehabilitation in the rehabilitation department of the Bogomolets National Medical University. All participants were divided into three groups depending on the dominant type of pain: with a predominance of nociplastic pain, with a predominance of neuropathic pain, and with a predominance of nociceptive pain. The subjects underwent an assessment of socio-demographic and anthropometric indicators, pain status, and functional impairment using the Oswestry Disability Index (ODI) questionnaire, and subjective assessment of stress level (PSS-10). Among 102 subjects with chronic non-specific low back pain, 63% were women and 37% were men of working age, with a mean age of 39.0±12.3 and 40.4±10.5 years, respectively. Among the subjects, nociceptive pain was dominant in 53.9% (CI 44.1-63.6%), nociplastic pain was present in 22.5% (CI 14.9-31.2%), 15.7% (CI 9.2-23.4%) had neuropathic pain, and in 7.8% (CI 3.4-13.9%) of the subjects, the dominant type of pain could not be determined. In the group of patients with a dominant nociplastic type of pain, the ODI dysfunction index was 27.2±14.0%, which corresponds to moderate dysfunction. In the group with a dominant neuropathic type of pain, this indicator was 22.0±12.1%, which also indicates moderate impairment. Among patients with nociceptive type of pain, the ODI indicator corresponded to minimal impairment, 13.6±10.7%, the difference was significant compared to the group of patients with dominant nociplastic and neuropathic pain, respectively ($p<0.001$, $p=0.009$). Most patients with chronic non-specific low back pain with a dominant nociplastic type of pain have moderate functional impairment. In this group of patients, low back pain most significantly limits functioning during sitting, standing, social and sexual life, and traveling. Most patients with nociceptive and neuropathic type of pain have minimal functional impairment.*

Key words: Low Back Pain; Persons With Disabilities; Chronic Pain; Disability Evaluation; Pain Management.

ISSN 2786-6661
eISSN 2786-667X

Introduction

Pain is a complex and multifaceted sensation of discomfort that is an important protective mechanism for the human body. The International Association for the Study of Pain (IASP) defines pain as an unpleasant sensory and emotional experience associated with actual or potential tissue damage. Pain is always a personal experience that is influenced to varying degrees by biological, psychological, and social factors and their interaction with each other [1]. Low back pain is the most common clinical form of musculoskeletal pain. According to the World Health Organization (WHO), the prevalence of this problem in 2020 reached 619 million people worldwide; the number of cases is projected to increase to 843 million by 2050 [2]. Most cases of lower back pain, 80-90%, are non-specific pain that is not associated with specific diseases and occurs against a background of degenerative changes in the structures of the spine. Chronic non-specific low back pain (CNSLBP) lasts more than three months and is a multifactorial disease that develops as a result of the interaction of biological, psychological, and social factors [3]. The biological sensation of pain in the lower back can be maintained by various mechanisms that underlie the types of pain. Nociceptive pain is maintained by actual or potential damage to non-nervous tissue and is caused by the activation of nociceptors, neuropathic pain is caused by damage or disease of the somatosensory nervous system, and nociplastic pain occurs due to altered nociception [4]. It is known that low back pain is the leading cause of disability worldwide among people of working age and is a significant social and economic burden on the healthcare system [5].

According to the UK National Health Service, the socioeconomic burden associated with lower back pain is nearly £5 billion per year. In the US, the cost of treating lower back and neck pain was $134 billion in 2016 [6]. Studies have found that the ability to perform everyday activities tends to be limited in 30-50% of people with chronic pain, with most individuals experiencing limitations in walking, performing household tasks, and participating in social activities. Factors such as female gender, older age, depressive mood, and certain psychosocial factors associated with less social support have been linked to functional impairment and higher disability rates in people with chronic pain [7]. In patients with chronic low back pain, assessment of functional impairment is of important clinical significance, as it allows for evaluation of the complexity of the course, the effectiveness of treatment, and the prognosis for the disease. It has been established that identifying factors that contribute to functional impairment and the development of disability in patients with chronic low back pain is crucial for the development of effective interventions. Multidisciplinary strategies for the treatment of chronic lower back pain help reduce disability and improve quality of life [8]. One effective tool for assessing functional impairment in patients with chronic low back pain is the Oswestry Disability Index (ODI), which assesses the extent to which low back pain limits a person's daily activities [9]. This questionnaire shows a strong correlation with the WHO Disability Assessment Scale (WHODAS 2.0), especially in the area of physical functioning, indicating that both instruments can be used as complementary tools for comprehensive disability assessment in patients with chronic low back pain [10]. This questionnaire also correlates with the Roland-Morris questionnaire and the visual analog pain scale, confirming its validity as an indicator of functional status and pain intensity [11]. There are no data in the literature on the assessment of the severity of functional impairment in patients with chronic low back pain depending on the dominant type of pain. Thus, the study data are of scientific and clinical interest and will allow optimizing the management of chronic low back pain, taking into account the mechanisms of pain formation.

Aim

To assess the degree of functional impairment in patients with chronic non-specific low back pain depending on the dominant type of pain.

Materials and methods

A retrospective single-center pilot study was conducted and included patients with CNSLBP who underwent rehabilitation in the rehabilitation department of the Bogomolets National Medical University. Patients were included in the study only with their voluntary informed consent, and

ISSN 2786-6661
eISSN 2786-667X

the subjects were informed about the purpose of the study. The study was conducted as part of the research work of the Department of Physical Rehabilitation and Sports Medicine of the Bogomolets National Medical University (NMU), 2024-2026. "Comprehensive physical therapy for patients with diseases and injuries of the musculoskeletal system and nervous system," State registration number: 0124U000230. All participants underwent an assessment of socio-demographic and anthropometric parameters, evaluation of pain status, and subjective assessment of stress level. To determine the dominant type of pain, the criteria for pain phenotyping in patients with chronic low back pain were used [12]. A detailed collection of complaints and medical history revealed signs of a dominant type of pain. Patients with a dominant nociceptive type of pain were characterized by the following signs: deep, dull, aching, shooting pain, clear localization of pain, without irradiation. Patients with a dominant neuropathic type of pain were characterized by the following symptoms: burning, shooting, electric shock-like pain, tingling, numbness, and pain radiating along dermatomes. Patients with a dominant nociplastic type of pain were characterized by the following signs: pain without clear localization, pain irradiation not associated with dermatomes, signs of distress, anxiety, depression, fatigue, and sleep disturbances, increased sensitivity to touch in the area of pain. To assess the degree of functional impairment in patients with CNSLBP, the Oswestry Disability Index (ODI) questionnaire was used, which has undergone cross-cultural adaptation and validation in Ukraine. The questionnaire consists of 10 questions covering the following areas: pain intensity, self-care, lifting objects, walking, sitting, standing, sleeping, sexual life, social life, and travel. Each question has 6 answer options ranging from 0 to 5, where 0 means no limitations in functioning due to lower back pain and 5 means severe limitations in functioning due to lower back pain. If all 10 questions are answered, the total score is calculated as follows: the sum of the scores obtained is divided by 50 and multiplied by 100%. A result of 0% to 20% indicates minimal impairment, and the patient can perform most daily activities. A result of 21% to 40% indicates moderate functional impairment, difficulty sitting, standing, and walking. There are limitations in social life and travel, and the patient may be unable to work. A result of 41% to 60% indicates severe impairment, with pain remaining the main problem and significantly affecting daily life. A result of 61% to 80% indicates very severe limitations, with lower back pain affecting all aspects of the patient's life. A result of 81% to 100% means that patients are bedridden [13]. To assess the subjective level of stress, the PSS-10 (Perceived Stress Scale) self-report questionnaire was used. This instrument consists of 10 items aimed at identifying how various life situations affect emotional state and individual perception of stress. The questions of the scale refer to the respondent's feelings and thoughts over the past month. The total score is interpreted as follows: 0-13 points – low stress level, 14-26 points – moderate stress level, 27-40 points – high stress level [14]. Statistical methods. The Shapiro-Wilk test was used to assess the normality of the distribution. Descriptive statistics were presented as the mean (μ) and standard deviation (σ), and the 95% confidence interval (CI) for qualitative variables was calculated using Fisher's angular transformation method. To compare two groups, the Student's t-test and Wilcoxon's W-criterion were used; to compare more than two groups, analysis of variance (ANOVA) with post-hoc tests was used.-hoc Tukey test, Kruskal-Wallis criterion with post-hoc Dunn test (with Bonferroni correction), and Pearson's $\chi 2$. Spearman's criterion (r) was calculated to assess the correlation. A value of $p<0.05$ was considered statistically significan.

Results

The study included 102 patients with CNSLBP who underwent outpatient rehabilitation. Among individuals with chronic low back pain, 63% were women and 37% were men of working age, with a mean age of 37.7±13.9 years. According to the assessment of the dominant type of pain, it was found that the nociceptive type of pain prevailed in the majority of the study participants (53.9%, CI 44.1-63.6%). The dominant nociplastic type of pain was observed in 22.5% (CI 14.9-31.2%),

ISSN 2786-6661
eISSN 2786-667X

and neuropathic pain was observed in 15.7% (CI 9.2-23.4%). Only in 7.8% (CI 3.4-13.9%) of the subjects, it was not possible to determine the dominant type of pain. The average pain intensity score on the VAS was 5.5±1.5 in the group with dominant nociplastic pain, 4.7±1.2 in the group with dominant nociceptive pain, and 5.6±1.6 in the group with dominant neuropathic pain.

Assessment of social indicators showed that most of the subjects had higher education (78%), an average income (68%), and were married (56%). Anthropometric data showed that most people with chronic low back pain were overweight, with an average BMI of 25.4±4.7 kg/m^2. It should be noted that, according to the survey results, in the category of patients with a dominant nociplastic type of pain, the stress level (PSS-10) was 24.3±5.0 (CI 22.1-26.5). In the category of patients with a nociceptive type of pain, this indicator was 18±6.2 (CI 16.4-19.7), and in the category of patients with a dominant neuropathic type of pain, it was 15.3±6.3 (CI 11.9-18.7). It was established that the stress level differed significantly between the groups ($p<0.001$), with a clear difference found between the nociplastic/nociceptive and nociplastic/neuropathic pain groups, respectively ($p<0.001$), while no statistically significant difference was found between the nociceptive and neuropathic pain groups ($p=0.130$). The obtained data indicate that an elevated stress level is a characteristic feature of patients with nociplastic pain, confirming the role of psycho-emotional factors in the development of this pain phenotype. The group of patients with a dominant nociplastic type of pain had the lowest level of physical activity, only 26.1% of the subjects having sufficient physical activity, which meets the WHO requirements [15]. A similar trend was observed among patients with a dominant nociceptive and neuropathic pain type, with sufficient physical activity observed in 36.4% and 37.5% of individuals, respectively. In the group of patients with a dominant nociplastic type of pain, the ODI functional impairment index was 27.2±14.0% (CI 21,2-33,3) which corresponds to moderate dysfunction. In the group with a dominant neuropathic type of pain, this indicator was 22±12.1% (CI 15,6-28,4), which also indicates moderate impairment. Among patients with nociceptive type of pain, the ODI indicator corresponded to minimal impairment, 13.6±10.7% (CI 10,8-16,5), the difference in values was significant compared to the group of patients with dominant nociceptive and neuropathic pain, respectively ($p<0.001$, $p=0.009$). The distribution of patients into groups depending on the degree of functional impairment is shown in figure 1.

Among patients with a dominant nociplastic type of pain, 57% had moderate functional impairment, while among those with nociceptive and neuropathic types of pain, 80% and 50% had

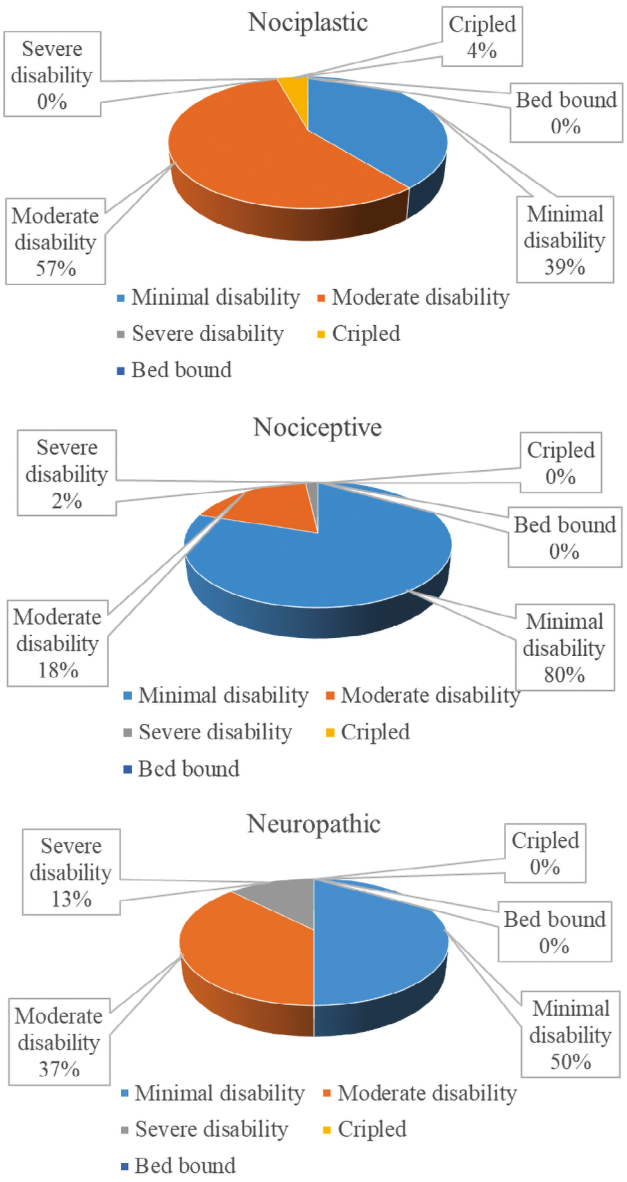

Fig. 1. The distribution of patients into groups depending on the degree of functional impairment

ISSN 2786-6661
eISSN 2786-667X

minimal functional impairment, respectively. However, it was found that among patients with neuropathic pain, 13% had severe functional impairments. A detailed analysis of the ODI questionnaire sections in patients with chronic low back pain revealed a number of interesting differences between the groups depending on the dominant type of pain, tab. 1.

Self-care impairment due to low back pain was more common in patients with a dominant nociplastic type of pain, which was statistically significant compared to patients with a nociceptive type of pain (p=0.007). Limitations in lifting objects due to low back pain showed a similar trend among individuals with a dominant nociplastic and neuropathic types of pain and were statistically significant compared to individuals with a dominant nociceptive type of pain (p=0.002, p=0.001, respectively). Restrictions during walking were more pronounced in the group with a dominant neuropathic type of pain and had a significant difference from the group with a nociceptive type of pain (p=0.042). The indicator of limitations during sitting and standing due to lower back pain was more pronounced among individuals with nociplastic pain, with a significant difference compared to individuals with nociceptive pain (p=0.001, p=0.013), respectively.

Patients with nociplastic pain experienced significant limitations in their sexual life due to lower back pain; the difference between the nociceptive and neuropathic pain groups was significant (p<0.001, p=0.052, respectively). Low back pain significantly limits the social life and traveling of patients with nociplastic pain; the difference compared to the nociceptive and neuropathic pain groups were significant (p=0.003, p=0.039; p<0.001, p=0.030, respectively). Low back pain caused greater sleep limitations in patients with nociplastic pain, but a statistically significant difference was observed only in the nociceptive pain group (p=0.016).

Discussion. Chronic low back pain is a common chronic condition affecting people of working age and is a leading cause of disability and absence from work, placing a significant socioeconomic burden on the healthcare system. Chronic low back pain has a significant impact on a person's ability to perform daily activities and leads to significant limitations in work capacity and functioning. The consequences of chronic low back pain are not only related to physical discomfort, but also affect mental health, social activity, and participation. The interaction between physical and social limitations and psychological factors further complicates the course and treatment of this problem. The main goal of managing this problem is not only to reduce the intensity of pain, but also to restore functioning [16,17].

In our study, we aimed to assess the degree of functional impairment in patients with CNSLBP depending on the dominant pain type. Our study found that among patients

Table 1. Detailed analysis of the ODI questionnaire sections in patients with chronic low back pain

Measure	Nociplastic pain n=23	Nociceptive pain n=55	Neuropathic pain n=16	p
Self-care	1.4±1.8 p=0.007*	0.7±1.7 p=0.323**	0.9±1.5 p=0.219***	0.028
Lifting objects	3.5±2.8 p=0.002*	1.5±1.8 p=0.813**	3.5±2.1 p=0.001***	0.001
Walking	1.1±1.2 p=0.051*	0.7±1.2 p=0.772**	1.3±1.2 p=0.042***	0.049
Sitting	4.2±1.9 p=0.001*	2.5±1.8 p=0.185**	3.5±2.6 p=0.249***	0.005
Standing	4.2±2.4 p=0.013*	2.7±2 p=0.104**	2.9±2.4 p=0.896***	0.045
Sexual life	1.7±2.2 p<0.001*	0.4±1.2 p=0.215**	1.1±2.1 p=0.052***	0.001
Social life	2.1±2 p=0.003*	0.9±1.5 p=0.640**	1.8±1.8 p=0.039***	0.006
Traveling	2.9±2.3 p<0.001*	0.9±1.4 p=0.076**	1.6±1.3 p=0.030***	0.001
Pain intensity you feel	4.3±2 p<0.001*	2.1±1.8 p=0.206**	3.6±1.8 p=0.010***	0.001
Sleep	2.0±1.6 p=0.016*	1.2±1.3 p=0.763**	1.9±1.7 p=0.125***	0.037

Notes: Comparison between by W-Wilcoxon test: (p=)
1)"*" - Nociplastic vs Nociceptive; 2)"**" - Nociplastic vs Neuropathic; 3)"***" - Nociceptive vs Neuropathic.

ISSN 2786-6661
eISSN 2786-667X

with a dominant nociplastic type of pain, most individuals had moderate functional impairment and a higher degree of functional impairment compared to those studied in other groups. It is known that a number of factors influence the development of functional impairment in patients with chronic low back pain. It has been proven that various psychological factors such as depression, anxiety, and distress not only intensify the sensation of pain but also have a significant impact on the development of disability in patients with chronic low back pain. The above-mentioned psychological factors contribute to the development of restrictive behavior, kinesiophobia, and a decrease in social and physical activity, which subsequently becomes the basis for functional impairment and the development of disability [18]. The results of a systematic review confirm a moderate association between depression, anxiety, and the development of disability in patients with chronic low back pain. In this study, researchers concluded that psychosocial factors should be taken into account in the rehabilitation management of this problem, in addition to more traditional interventions based on physical exercise and patient education [19].

Thusly, the results of our study confirm the above statements, since patients with nociplastic pain are characterized by psychological problems. A study by Chhaya Verma et al. (2018) demonstrated that lower levels of physical activity were associated with higher levels of disability and functional limitations [20]. This hypothesis is confirmed by the results of our study, as it was found that among individuals with nociplastic pain, the majority did not have adequate levels of physical activity. In most individuals with a dominant nociplastic pain type, lower back pain led to functional limitations when sitting or standing and disrupted their sexual and social lives. It is likely that when the mechanism of chronic low back pain is based on psychological problems, this leads to a significant limitation of activity and participation in social life, and this hypothesis has been confirmed by scientific studies [21,22]. In contrast, among individuals with a dominant neuropathic type of pain, we found limitations during walking. In our opinion, this may be due to the fact that individuals with neuropathic pain experience pain irradiation in the lower extremities, which may contribute to impaired walking function and the development of limitations during walking.

Conclusions

In this retrospective single-center pilot study, patients with chronic non-specific low back pain and a dominant nociplastic pain type demonstrated significantly greater functional impairment (mean ODI 27.2±14.0%) than those with nociceptive (13.6±10.7%) or neuropathic pain (22.0±12.1%) ($p<0.001$ and $p=0.009$, respectively). Nociplastic pain was also associated with higher perceived stress levels (mean PSS-10 24.3±5.0), highlighting the importance of psychoemotional factors in this pain phenotype. These results support the integration of biopsychosocial assessment, including pain phenotyping and evaluation of psychological comorbidities, into the management of chronic low back pain. Future multicenter longitudinal studies with larger cohorts are needed to confirm these findings and develop optimized, mechanism-based rehabilitation programs.

Perspectives of subsequent scientific research

Development of rehabilitation management strategies for patients with chronic nonspecific low back pain depending on the dominant type of pain

Financing

This study did not receive external funding.

Conflicts of Interest

The authors certify the absence of conflicts of interest.

Consent to publication

Informed consent was obtained from all subjects in accordance with the Declaration of Helsinki and ethical commission submission.

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A – Research concept and design, B – Collection and/or assembly of data, C – Data analysis and interpretation, D – Writing the article, E – Critical revision of the article, F – Final approval of article

ISSN 2786-6661
eISSN 2786-667X

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Оцінка порушення функціонування пацієнтів з хронічним неспецифічним болем у попереку залежно від домінуючого типу болю

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Анотація: *неспецифічний хронічний біль у попереку є захворюванням опорно-рухового апарату, що має значні тенденції до поширення серед осіб працездатного віку протягом усього життя у в усьому світі. Біль у попереку є основною причиною непрацездатності у всьому світі серед осіб працездатного віку та є значним соціальним та економічним тягарем для системи охорони здоров'я. У пацієнтів з хронічним болем у попереку оцінка порушення функціонування має важливе клінічне значення, дає можливість оцінити складність перебігу, ефективність лікування та прогноз стосовно даного захворювання. Оцінити ступінь порушення функціонування пацієнтів з хронічним неспецифічним болем у попереку залежно від домінуючого типу болю. В дослідження були включені пацієнти з хронічним неспецифічним болем у попереку, які проходили реабілітацію у відділенні реабілітації Університетської клініки Національного медичного університету імені О.О. Богомольця. Всі учасники залежно від домінуючого типу болю були поділені на три групи: з переважанням ноципластичного типу болю, з переважанням нейропатичного типу болю, з переважанням ноцицептивного типу болю. У досліджуваних була проведена оцінка соціально-демографічних, антропометричних показників, оцінка больового статусу, оцінка порушення функціонування за опитувальником The Oswestry Disability Index (ODI) та суб'єктивна оцінка рівня стресу (PSS-10). Серед 102 досліджуваних із хронічним неспецифічним болем у попереку 63% жінки та 37% чоловіки, працездатного віку, середній вік склав 39.0±12.3 та 40.4±10.5 років, відповідно. Серед досліджуваних у 53.9% (CI 44.1-63.6%)*

ISSN 2786-6661
eISSN 2786-667X

переважав ноцицептивний тип болю, у 22.5% (CI 14.9-31.2%) ноципластичний тип болю, у 15.7% (CI 9.2-23.4%) нейропатичний тип болю, у 7.8% (CI 3.4-13.9%) досліджуваних не вдалося визначити домінуючий тип болю. У групі пацієнтів з домінуючим ноципластичним типом болю показник порушення функціонування ODI склав 27.2±14.0%, що відповідає помірним порушенням. У групі з домінуючим нейропатичним типом болю даний показник склав 22.0±12.1%, що також вказує на помірні порушення функціонування. Серед пацієнтів з ноцицептивним типом болю показник ODI відповідав мінімальним порушенням функціонування, 13.6±10.7%, різниця значення була значущою у порівнянні з групою пацієнтів з домінантним ноципластичним та нейропатичним типом болю, відповідно ($p<0.001$, $p=0.009$). Висновки. Більшість пацієнтів з хронічним неспецифічним болем у попереку з домінуючим ноципластичним типом болю мають помірні порушення функціонування. У даного контингенту пацієнтів біль у попереку найбільше обмежує функціонування під час сидіння, стояння, соціального та сексуального життя, подорожей. Для більшості пацієнтів з ноцицептивним та нейропатичним типом болю характерні мінімальні порушення функціонування.

Ключові слова: біль у попереку, особи з інвалідністю, хронічний біль, оцінка інвалідності, менеджмент болю.