

ORIGINAL ARTICLE

Medicine Science 2025;14(3):891-6

Investigation of functional disability, depression and quality of life according to pain intensity in patients with cervical radiculopathy

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Received 14 May 2025; Accepted 10 June 2025

Available online 01 September 2025 with doi: 10.5455/medscience.2025.05.129

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Abstract

Cervical radiculopathy (CR) causes pain, numbness, and weakness in the neck, shoulders, arms, and hands. Pain is an important symptom affecting patients. This study aimed to compare neck disability, functional disability, depression, and quality of life according to pain severity in patients with CR and to examine the relationship between them. Sixty-three patients with CR with mild pain (25 patients, 43.44±10.42 years) and moderate/severe pain (38 patients, 43.97±11.11 years) according to the visual analog scale (VAS) were included. Disability (Neck disability index (NDI)), functional disability (Cervical radiculopathy impact scale (CRIS)), depression (Beck depression inventory (BDI)), and quality of life (Short form-12 (SF-12)) were evaluated. The groups' baseline features were similar ($p>0.05$). The moderate/severe pain group had statistically significantly higher NDI, CRIS-symptoms, CRIS-actions and activities, and BDI scores than the mild pain group ($p<0.05$). The moderate/severe pain group had statistically significantly lower SF-12 general health, physical functioning, role-physical, bodily pain, vitality, and mental health subparameter scores than the mild pain group ($p<0.05$). Also, there was a correlation between VAS and NDI, CRIS and BDI, and a negative correlation was found with SF-12 subparameters ($p<0.05$). CR patients with moderate/severe pain had increased neck and functional disability, higher levels of depression, and worse quality of life compared to patients with mild pain. Furthermore, increased pain intensity was associated with increased disability, depression, and worse quality of life. Therefore, pain and associated factors should be assessed in patients with CR for appropriate management.

Keywords: Cervical radiculopathy, pain, disability, depression, quality of life

Introduction

Cervical radiculopathy (CR) is a pathology characterized by compression of spinal nerve roots or nerve root inflammation due to cervical disc herniation or degenerative cervical spine [1]. CR can stimulate pain receptors in the cervical spine's soft tissues and joints, leading to sensory and motor changes in the upper extremity. Generally, numbness and tingling in the upper extremities, muscle weakness, and pain in the arms, hands, neck, and scapular region are observed [2]. CR is more common in males, but its prevalence has been reported to be 1.21 to 5.8 per 1,000. Therefore, it is a disease that should be scrutinized [3].

In patients with CR, the first symptom is pain. Additionally radiating to the extremities, pain can be seen axially in the neck,

causing significant limitations [4]. Psychosocial factors lead to the development of chronic pain in patients with neck and shoulder pain and may cause disability in patients [5]. Increased neck and arm pain in patients with CR may lead to increased neck disability [6]. Radiculopathy is also characterized by a history of functional limitations and continues to have mild to moderate morbidity in patients in the long term [7]. The pain and numbness caused by CR in the upper extremity can affect patients' daily living activities and cause functional limitations [6,8]. However, it has been reported that the relationship between functional limitation caused by CR and clinical symptoms has not been investigated sufficiently [7]. In addition, the level of functional limitation is unknown due to pain, which is an important problem affecting the daily life activities of patients

CITATION

Ferat M, Apaydin AS. Investigation of functional disability, depression and quality of life according to pain intensity in patients with cervical radiculopathy. Med Science. 2025;14(3):891-6.



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[1,2]. Reducing functional limitations is important in increasing patients' independence and should be investigated.

Neck pain, whether accompanied by radicular symptoms or not, adversely affects physical and mental health. Mental health problems can worsen the prognosis of musculoskeletal disorders [9]. A study reported that cervical degenerative disc disease increases depression and anxiety, and more severe neck pain increases susceptibility to depression and anxiety [10]. In patients with CR, increasing disability is associated with an increase in depression [11]. Since pain and disability are related in patients with CR, increasing pain intensity may also affect depression levels [6]. However, when the literature is examined, depression levels according to pain severity are unknown. Quality of life represents the individual's overall physical, mental, and social well-being and is affected by radicular symptoms [12]. Studies have reported that quality of life is affected by the problems that cause CR and that an increase in pain is associated with a worsening quality of life [6,8]. Therefore, it should be examined in CR patients to improve their quality of life.

In the literature, attempts have been made to explain the relationship between pain, functional disability and quality of life in CR patients [6,8]. However, the relationship between pain and depression in CR is not clear. In addition, the current literature is limited to studies that systematically compare the disability, quality of life and depression levels of patients according to the severity of pain felt due to radicular symptoms. CR causes pain and significant limitations due to pain in patients from the moment it occurs [2,4,7]. Improving pain and related symptoms in patients is important for the independent continuation of daily life activities. Therefore, assessments based on pain severity may contribute to developing individualized treatment approaches in the clinical decision-making process. Thus, the pain and the problems it causes should be examined. In this context, we aimed to compare neck disability, functional disability, depression and quality of life in CR patients according to pain severity and to examine the relationship between these and pain severity.

Material and Methods

Participants

This cross-sectional study included patients diagnosed with CR from the neurosurgery clinic. 44 female and 19 male CR patients were included in the study. The study included patients who were older than eighteen, had CR diagnosed by a neurosurgeon due to compression of nerve roots in the cervical spine, had pain radiating to the neck or upper extremities that was confirmed by the diagnosis of magnetic resonance imaging (MRI), had sensations of paresthesia or numbness, and had appropriate radiological and clinical signs and symptoms. Patients with severe neurological deficits, those who had undergone cervical surgery within the last 12 months, those with spinal malignancy, those with another chronic neurological disease, and those who were pregnant were excluded from the study. The study was conducted according to the Declaration of Helsinki. The Karabük University Non-Interventional Clinical Research Ethics Committee approved the

study (No: 2025/2264, Date: 25.04.2025), and informed consent was provided verbally and in writing by each subject.

Study Design

Demographic and clinical information of CR patients participating in the study was determined. The severity of pain perceived by the patients in their extremities, neck disability (Neck Disability Index (NDI)), functional disability (Cervical Radiculopathy Impact Scale (CRIS)), depression (Beck Depression Inventory (BDI)), and quality of life (Short Form-12 (SF-12)) were evaluated. The patients were then divided into two groups according to the severity of pain they experienced: mild and moderate/severe.

Outcome Measures

Visual Analog Scale

Pain intensity was assessed with a Visual Analog Scale (VAS) consisting of a 10 cm long line. A score of 0 is defined as "no pain", while a score of 10 is defined as "unbearably severe pain". The patient was instructed to identify the position on the line that most accurately depicted the degree of upper extremity discomfort they were experiencing at the moment as a result of CR. According to the VAS, pain is classified as 0-3 mild, 4-6 moderate, and 7-10 severe [13]. Patients were classified as mild and moderate-severe according to the severity of pain they generally felt in their extremities.

Neck Disability Index

Neck disability was assessed using the NDI. NDI includes 10 subsections including concentration, personal care, sleep, pain intensity, weightlifting, reading, headache, work life, driving, and leisure activities. The scale requires a minimum of 0 and a maximum of 50 points, with higher scores indicating worse disability [14].

Cervical Radiculopathy Impact Scale

CRIS was used to assess functional limitations. The scale has a total of 21 questions and 3 subheadings. The first heading consists of nine items covering symptoms, neck pain, shoulder, arm/hand/fingers, tingling, loss of strength, and stiffness in the neck. Six items under the energy and postures section and six things under the third subheading are about functional limits brought on by pain and symptoms during actions and activities. An increase in the score obtained from the scale indicates an increase in functional disability [15].

Beck Depression Inventory

BDI was used to determine the presence of depression and level of depression in individuals. BDI consists of 21 questions, each with four options and scored between 0 and 3. It is a scale that questions how the individual feels in terms of generalized anxiety symptoms, such as feelings of distress, including the same day, in the last week. The total score of the inventory is between 0 and 63, and the level of depression increases as the score increases [16].

Short Form-12

Quality of life was assessed using the SF-12. SF-12 is a test consisting of 12 questions that evaluates the patient's quality of life. It consists of eight subparameters: physical functioning, general health, physical role, vitality, social functioning, emotional role, bodily pain, and mental health. Each subparameter can be scored with a minimum of 0 and a maximum of 100 points. Quality of life is positively correlated with a higher score on the scale [17].

Statistical Analysis

The data analysis was conducted using SPSS 25.00. The sample size, 62 individuals, was determined from a previously studied [6] sample for the relationship between pain and functional disability, with 80% power, $\alpha=0.05$, and $d=0.386$ effect size.

The Shapiro-Wilk test was used to assess the normal distribution of the data. The chi-square test was used to compare categorical data. The mean and standard deviation were used to represent regularly distributed quantitative variables, and the median

and interquartile range (IQR25-75%) were used to represent non-normally distributed ones. When comparing the groups, numerical data that was normally distributed was subjected to an Student t-test, whereas data that was not normally distributed was subjected to a Mann-Whitney U test. The relationship between the parameters was tested with Spearman correlation analysis. Very strong correlation was defined as $r>0.89$, strong correlation as 0.70-0.89, medium correlation as 0.40-0.69, and weak correlation as 0.20-0.39 [18]. Statistical significance was evaluated at $p<0.05$ level.

Results

Sixty-five patients with CR were included in this cross-sectional study. Two patients were excluded because they did not want to participate. The study included 63 patients, with 25 participants experiencing mild pain and 38 patients reporting moderate to severe pain. 72% of patients in the mild pain group and 68.4% in the moderate/severe pain group were female. The demographic features of the participants are presented in Table 1. The groups' initial features were similar ($p>0.05$).

Table 1. Demographic features of the participants

	Mild pain (n=25)	Moderate/severe pain (n=38)	Total (n=63)	p
	X±SD/Median (IQR _{25-75%})	X±SD/Median (IQR _{25-75%})	X±SD/Median (IQR _{25-75%})	
Age, years	43.44±10.42	43.97±11.11	43.76±10.76	0.849
Gender, n (%)				
Female	18 (72)	26 (68.4)	44 (69.8)	0.762
Male	7 (28)	12 (1.6)	19 (30.2)	
Weight, kg	64 (58-74)	71 (65-78)	68 (61-77)	0.053
Height, cm	163.08±8.64	164.21±8.35	163.76±8.42	0.606
BMI, kg/m²	25.21±3.32	26.40±3.43	25.93±3.41	0.135
Dominant side, n (%)				
Right	21 (84)	30 (78.9)	51 (81)	0.617
Left	4 (16)	8 (21.1)	12 (19)	
Affected side, n (%)				
Right	8 (32)	9 (23.7)	17 (27)	0.761
Left	12 (48)	21 (55.3)	33 (52.4)	
Bilateral	5 (20)	8 (21.1)	13 (20.6)	
Smoking, n (%)				
Current	11 (44)	16 (42.1)	27 (42.9)	0.985
Ex-smoker	4 (16)	6 (15.8)	10 (15.9)	
Non-smoker	10 (40)	16 (42.1)	26 (41.3)	
Duration of symptoms, month	15 (6.50-30)	21 (11.50-36)	18 (10-36)	0.373

BMI: body mass index, X: mean, SD: standard deviation, IQR: interquartile range

Moderate/severe pain group had statistically significantly higher VAS pain, disability, CRIS symptoms and CRIS actions and activities and BDI scores than the mild pain group ($p<0.05$). According to CRIS, the power of the study is 87.2%. The moderate/severe pain group had statistically significantly lower scores for

the quality-of-life subparameters role-physical, general health, vitality, physical functioning, bodily pain, and mental health than the mild pain group ($p<0.05$). There was no statistically significant difference between the groups regarding social functioning and role-emotional subparameters ($p>0.05$, Table 2).

Table 2. Group comparison by quality of life, depression, functional impairment, pain, and disability

	Mild pain (n=25)	Moderate/severe pain (n=38)	p
	X±SD/Median (IQR _{25-75%})	X±SD/Median (IQR _{25-75%})	
VAS pain	3 (2-3)	6 (4-7)	<0.001*
NDI	15 (11.50-21.50)	20.50 (16-27.25)	0.006*
CRIS-Symptoms	51.55±13.89	64.40±17.61	0.003*
CRIS-Energy and postures	55.83±24.29	65.02±25.41	0.158
CRIS-Actions and activities	22.17±18.19	35.19±26.68	0.037*
BDI	5 (4-7.50)	7.50 (5-10)	0.046*
SF-12			
General health	60 (20-70)	20 (0-60)	0.019*
Physical functioning	60 (30-70)	20 (0-40)	0.001*
Role-physical	60 (20-80)	20 (15-40)	0.008*
Bodily pain	60 (20-70)	20 (20-40)	0.002*
Social functioning	60 (20-80)	40 (20-60)	0.431
Vitality	60 (20-80)	40 (15-40)	0.004*
Mental health	60 (20-80)	40 (20-60)	0.027*
Role-emotional	40 (20-60)	40 (20-60)	0.539

VAS: Visual analog scale, NDI: Neck disability index, CRIS: Cervical radiculopathy impact scale, SF-12: Short form, X: mean, SD: standard deviation, IQR: interquartile range;*p<0.05

Table 3 shows the relationship between the parameters. In patients with CR, there was a positive significant correlation between VAS with NDI (r=0.537), CRIS symptoms (0.497), CRIS energy and posture (0.279), CRIS actions and activity (0.451), and BDI (r=0.437). There was a negative statistically significant correlation between VAS and general health (-0.290), physical functioning (-0.344), role-physical (-0.362), bodily pain (-0.350), and vitality (-0.309).

Table 3. The relationship between pain with disability, functional disability, depression and quality of life

	VAS	
	r	p
NDI	0.537**	<0.001
CRIS-Symptoms	0.497**	<0.001
CRIS-Energy and postures	0.279*	0.027
CRIS-Actions and activities	0.451**	<0.001
BDI	0.437**	<0.001
SF-General health	-0.290*	0.021
SF-Physical functioning	-0.344**	0.006
SF-Role-physical	-0.362**	0.004
SF-Bodily pain	-0.350**	0.005
SF-Social functioning	-0.183	0.151
SF-Vitality	-0.309*	0.014
SF-Mental health	-0.203	0.110
SF-Role-emotional	-0.131	0.305

VAS: Visual analog scale, NDI: Neck disability index, CRIS: Cervical radiculopathy impact scale, SF: Short form, r: correlation coefficients; *p<0.05, **p<0.01

Discussion

This study showed that CR patients with moderate/severe pain had increased neck and functional disability and higher levels of depression. It was also determined that patients with moderate/severe pain had worse quality of life. It was also associated with increased pain intensity, increased disability, depression, and worsened quality of life.

CR, which occurs as a result of disc herniation and narrowing of the spinal canal, can affect the neck by causing pain [1,2]. This condition can cause disability [5]. Self-reported disability outcomes provide important clinical information in the patient assessment process [19]. Axial neck pain is also seen in patients with CR, depending on the level of nerve root involvement, and may cause limitation [4]. Therefore, pain severity may have an effect on neck disability. Apaydin et al. reported that increased neck and arm pain in patients with CR was associated with moderate to weak neck disability [6]. Another study reported that neck disability increased as the severity of pain in the neck and extremities increased in patients with cervical spondylotic radiculopathy [8]. Additionally, Torad et al. reported that pain intensity was one of the most important predictors of neck disability in patients with cervical pain [20]. In this study, consistent with the literature, an increase in pain intensity was moderately associated with an increase in neck disability. In addition, in the current study comparing NDI according to pain severity, it was determined that those with moderate/severe pain had more neck disabilities. These results suggest that CR may contribute to increased disability by causing not only extremity pain but also pain in the neck. Neck movements form the basis of movements required for daily living activities [21]. It should be

evaluated during the clinical follow-up process in patients with CR, as the increased disability may affect neck functions and limit daily living activities.

Functional scales are used to identify the effects, symptoms and problems caused by CR and provide valuable information [22]. There is a need for a clear consensus on which test is adequate and proper in predicting prognosis. In addition, it is important to determine the functional limitation caused by not only neck pain but also extremity pain in radicular problems [7,22]. The results obtained from the CRIS developed in this context can provide clearer information about these patients [22]. A study reported that patients with CR had functional disabilities and that this did not differ between genders [6]. Pain may play an important role in functional disability, being one of the first symptoms to appear in patients with CR [4]. Previous studies have shown that increased arm pain in patients with CR is associated with increased functional disability according to the CRIS subparameters symptoms, energy and postures, and actions and activities [6,8,15]. Similar to the literature, in this study, the increase in pain intensity in patients with CR was associated with an increase in all subscale scores of the CRIS scale and increased functional disability. It was also determined that CR patients with moderate/severe pain had worse symptoms, and their activities and actions were more affected than CRIS patients. However, the groups had similar functional disabilities in the energy and posture subscales. The presence of pain affects individuals and is associated with changes in neck posture [23]. However, the energy and posture section questions fatigue, physical energy, and awareness. Therefore, it may be affected not only by the severity of pain but also by the lifestyle, general physical condition, and adaptation to pain [7,15,22]. The occurrence of similar energy and posture in different pain intensities may be due to the adaptation of individuals to pain, due to the chronic nature of the pain [24]. In addition, considering that activity levels may differ, perceived fatigue and physical performance may also contribute to explaining the similarity in energy and posture, and therefore should be examined. In addition, functional independence assessment should be included in the clinical follow-up process to preserve functionality in CR patients.

Information obtained by taking into account the biopsychosocial approach is important in determining the factors that cause neck pain and the risk factors that contribute to its progression [25]. Neuroplasticity changes, particularly those resulting from chronic pain, may occur as a result of the underlying processes in the development of depression [26]. Sang et al reported in their study that approximately one-third of cervical degenerative disc patients had depression and anxiety, and those with high-intensity pain were more prone to depression and anxiety [10]. Another study reported that people with neck pain with radiculopathy and people with neck pain without radiculopathy had worsening health, as mental health symptoms worsened [9]. According to these results, depression levels appear to be

related to neck pain. However, when the literature is reviewed, the relationship between extremity pain and depression levels in patients with CR is unknown. The present study determined that patients with CR had minimal depression, and patients with moderate/severe pain had higher depression levels. In addition, an increase in depression was linked to an increase in the severity of pain. The patients included in our study had chronic pain (>3 months). Depression symptoms may be more severe in patients with high levels of chronic pain [24]. Consequently, because of the pain and reduced activity levels, chronic pain can be unpleasant and cause catastrophizing, rumination, and feeling helpless, all of which can worsen depression [27]. The fact that CR patients in the present study also had chronic pain in their extremities explains the relationship between pain and depression. Since depression can affect mental processes and worsen the quality of life, it should definitely be evaluated in CR patients.

The health status perceived by patients indicates the quality of life. Quality of life contributes to the evaluation of the effects of functional limitations resulting from illness or injury on the activities of individuals [28]. CR may also affect the quality of life in patients due to increased pain, disability, and functional limitations [6,8]. Demirel showed that the presence of CR causes worse quality of life. In addition, the Nottingham Health Profile subparameters of physical activity, pain, energy level, emotional reaction, and social isolation were reported to be worse in the presence of radiculopathy [28]. No study in the literature examines the quality of life according to pain severity in patients with CR. This study showed that patients with moderate/severe CR had worse general health and more affected physical and mental health. At the same time, increased pain intensity was associated with worsening general health, physical function, and vitality. These results are consistent with studies in the literature examining factors associated with pain in patients with CR [6,8,28]. These results show for the first time that not only neck pain but also extremity pain worsens quality of life. However, in patients with CR, the sub-parameters of quality of life, social function and emotional role, were similar in the pain groups. This suggests that, considering the presence of chronic pain in the patients in our study, individuals may have developed stronger coping mechanisms against chronic pain, even if the pain is severe [24]. Thus, emotional readiness may allow them to continue their social lives. However, further studies are needed to fully examine the underlying causes.

This study has several limitations. The study was only carried out in one location, which can have an impact on how broadly the findings can be applied. Therefore, future studies can be conducted with multicenter and large sample sizes. Furthermore, because this study is cross-sectional, it might be challenging to determine a causal association between pain and other variables. Therefore, studies aimed at treatment may provide better results in confirming symptoms according to pain intensity.

Conclusion

CR patients with moderate/severe pain have more neck disability and functional disability in the extremities than patients with mild pain. In addition, CR patients with moderate/severe pain have increased depression levels and worsened quality of life. These results are related to the increase in pain intensity. Therefore, the perceived pain intensity of CR patients should be carefully evaluated during the clinical follow-up process and treated with appropriate approaches.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical Approval

The Karabük University Non-Interventional Clinical Research Ethics Committee approved the study (No: 2025/2264, Date: 25.04.2025), and informed consent was provided verbally and in writing by each subject.

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