

**Characterization of pain in patients with Parkinson's disease: a descriptive cross-sectional study**

**Caracterização da dor em pacientes com doença de Parkinson: um estudo transversal descritivo**

**Caracterización del dolor en pacientes con enfermedad de Parkinson: estudio descriptivo transversal**

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## **Abstract**

Parkinson's disease affects the central nervous system, causing dysfunctional dopamine production. This directly affects the motor system, leading to the loss of voluntary movements, joint stiffness, limb tremors, and imbalance. Palliative treatments are applied to alleviate symptoms of the disease and improve quality of life. Considering functional changes and symptoms that are generated by Parkinson's disease, pain is also a debilitating factor that can severely affect the individual. The present study investigated the mean age, duration of involvement, body locus incidence, and interference with quality of life by pain in patients with Parkinson's disease. We applied a one-dimensional, subjective, and qualitative Visual Analog Scale and the multidimensional and interpretative Wisconsin Brief Pain Inventory. The study was conducted with 36 participants of both genders (mean age: 65.5 years for men and 72.0 years for women). The incidence of pain was detected in 87.5% of the participants. We found that pain occurred more frequently in the upper limbs and interfered with the performance of general activities. Treatment by a multidisciplinary team in all dimensions of the disease is needed to alleviate patients' pain and consequently improve their quality of life.

**Keywords:** Quality of life; Neurodegenerative disease; Palliative treatment; Visual Analog Scale; Wisconsin Brief Pain Inventory.

## **Resumo**

A doença de Parkinson afeta o sistema nervoso central, causando uma produção disfuncional de dopamina. Isso afeta diretamente o sistema motor, levando à perda de movimentos voluntários, rigidez articular, tremores nos membros e desequilíbrio. Tratamentos paliativos são aplicados para aliviar os sintomas da doença e melhorar a qualidade de vida. Considerando as alterações funcionais e os sintomas gerados pela doença de Parkinson, a dor também é um fator debilitante que pode afetar gravemente o indivíduo. O presente estudo investigou a idade média, o tempo de envolvimento, a incidência do locus corporal e a interferência na qualidade de vida pela dor em pacientes com doença de Parkinson. Aplicamos a Escala Visual Analógica unidimensional, subjetiva e qualitativa e o Inventário

Breve de Dor de Wisconsin, multidimensional e interpretativo. O estudo foi realizado com 36 participantes de ambos os sexos (idade média: 65,5 anos para os homens e 72,0 anos para as mulheres). A incidência de dor foi detectada em 87,5% dos participantes. Verificamos que a dor ocorreu com maior frequência nos membros superiores e interferiu no desempenho das atividades gerais. O tratamento por equipe multidisciplinar em todas as dimensões da doença é necessário para aliviar a dor do paciente e, conseqüentemente, melhorar sua qualidade de vida.

**Palavras-chave:** Escala Visual Analógica; Doença neurodegenerativa; Inventário de Dor de Wisconsin; Qualidade de vida; Tratamento paliativo.

### **Resumen**

La enfermedad de Parkinson afecta el sistema nervioso central, provocando una producción disfuncional de dopamina. Esto afecta directamente al sistema motor, provocando la pérdida de movimientos voluntarios, rigidez articular, temblores en las extremidades y desequilibrio. Se aplican tratamientos paliativos para aliviar los síntomas de la enfermedad y mejorar la calidad de vida. Teniendo en cuenta los cambios funcionales y los síntomas que genera la enfermedad de Parkinson, el dolor también es un factor debilitante que puede afectar gravemente al individuo. El presente estudio investigó la edad media, la duración de la afectación, la incidencia del locus corporal y la interferencia con la calidad de vida por el dolor en pacientes con enfermedad de Parkinson. Se aplicó una Escala Analógica Visual unidimensional, subjetiva y cualitativa y el Inventario Breve de Dolor de Wisconsin multidimensional e interpretativo. El estudio se realizó con 36 participantes de ambos sexos (edad media: 65,5 años para los hombres y 72,0 años para las mujeres). La incidencia de dolor se detectó en el 87,5% de los participantes. Encontramos que el dolor se presenta con mayor frecuencia en las extremidades superiores e interfiere con la realización de actividades generales. Es necesario el tratamiento por parte de un equipo multidisciplinario en todas las dimensiones de la enfermedad para aliviar el dolor de los pacientes y, en consecuencia, mejorar su calidad de vida.

**Palabras clave:** Calidad de vida; Enfermedad neurodegenerativa; Escala analógica visual; Inventario breve de dolor de Wisconsin; Tratamiento paliativo.

## 1. Introduction

Parkinson's disease is a chronic degenerative disease that causes central nervous system degeneration, with neuronal loss in the substantia nigra that leads to changes in the region of basal nuclei. Although studies indicate factors that accelerate the emergence of Parkinson's disease, such as aging, its origin has not yet been discovered (Alexander, 2004). This disease is characterized by postural changes that lead to changes in gait and balance, and patients may show muscle and cognitive deficits, such as alienation and depression. These changes can progress to cardiac and respiratory dysfunction and many classic signs and symptoms, such as stiffness, bradykinesia, facial masking, postural changes, and resting tremor (Samii et al., 2004; Bloem et al., 2001). All of these bodily changes result in susceptibility to falls, functional limitations, and other disabilities. Parkinson's disease can also cause difficulties in performing normal daily activities that can become progressively worse, causing permanent disabilities in more advanced phases of the disease. Patients can also experience pain, which can be observed in early stages and limits quality of life (Navarro-Peternella and Marcon, 2012). Thus, individuals with Parkinson's disease acquire motor and physical problems and experience psychological and social changes (Grover et al., 2010).

Many research advances have improved treatments for Parkinson's disease. Drug therapies and other methods are decreasing the need for neurosurgical interventions and have provided several benefits for the patient (George et al., 2009). Nonetheless, there are only palliative treatments for Parkinson's disease that only alleviate its signs and symptoms because the disease is incurable. With regard to drug treatment, levodopa is the most commonly used drug, which must be combined with other pharmacological approaches, such as levodopa decarboxylase inhibitors, dopamine receptor agonists, monoamine oxidase B inhibitors, catechol-O-methyltransferase inhibitors, and anticholinergic and anti-glutamatergic drugs. Over the past two decades, patient care and palliative care have been highlighted more broadly in the health field, with the goal of controlling and relieving stressful symptoms, including pain (Raza et al., 2019).

Although drug therapy is essential, physiotherapy also plays an important role in the treatment of Parkinson's disease. For example, physical exercises that are specific to certain stages of the disease can maintain muscle activity and consequently preserve patients' independence (Lim et al., 2017). Physical therapists have been encouraged to seek a better understanding of the harmful processes that are associated with pain and develop alternative

techniques for its treatment. Standards for pain measurement are needed to help physiotherapists to evaluate the disease, type of pain, degree of functional limitation, and impact on the patient. Therefore, it is essential to identify and classify specific types of pain and their impact on the quality of life of patients who are affected by Parkinson's disease so that complementary therapies can be applied (Redecker et al., 2014).

Among several pain and quality of life assessment instruments, two can be safely used for Parkinson's disease patients. One such instrument is the Visual Analog Scale, which is a one-dimensional form that is used to measure pain at a specific moment in time. It consists of 11 points on a horizontal line (measured in centimeters), where 0 on the left indicates no pain and 10 on the right indicates unbearable pain (Gallagher, 2001). Another instrument is the Wisconsin Brief Pain Inventory, which assesses limitations of daily activities and the effectiveness of treatments. This instrument covers such domains as work, sleep, and walking ability. Scores on this instrument allow therapists to better understand the patient's condition (Atkinson et al., 2010).

The present study evaluated the degree of pain and its influence on daily activities in Parkinson's disease patients who were receiving palliative care. For measurement purposes, the patients' pain conditions were assessed using a one-dimensional, subjective, and qualitative Visual Analog Scale and the multidimensional and interpretative Wisconsin Brief Pain Inventory. To carry out this research, internationally validated protocols were followed, and important rules of scientific methodology were followed, as proposed by Pereira et al. (2018).

## **2. Material and Methods**

### **2.1 Experimental design**

A descriptive cross-sectional survey was performed using face-to-face interviews of patients with Parkinson's disease who were receiving palliative care under supervision of the Family Health Program in the city of Dois Vizinhos, Paraná, Brazil, which generally treats patients with neurodegenerative diseases. Ethical approval was obtained from the joint Ethics Committee Involving Human Research of União de Ensino do Sudoeste do Paraná, UNISEP (protocol no. 20533513.7.0000.5230).

## **2.2 Subjects**

Thirty-two patients of both sexes were randomly selected from medical records of healthcare facilities in the municipality of Dois Vizinhos, Paraná, Brazil, who voluntarily agreed to participate in the study. Patients were included if they were able to provide informed consent, had a proven medical diagnosis of Parkinson's disease, were registered in public health programs that treated the disease, were over 18 years old and under 85 years old, received conservative medical treatment, and had sufficient cognitive faculties to answer the questionnaires. Patients were excluded if they had diagnoses of other neurological or psychiatric diseases, had visual or auditory deficits that prevented completion of the instruments, or were unable to provide consent.

## **2.3 Study instruments**

Basic demographic data for each patient, clinical data, daily living activities, and eligibility criteria were gathered. Practical training of the examiners was performed to minimize the occurrence of errors that could reduce reliability of the instruments. The evaluation of all participants followed the same order and were made at the patients' homes by a physical therapist. Pain was measured quantitatively using a Visual Analog Scale to determine the incidence and degree of pain involvement. The Wisconsin Brief Pain Inventory was used to assess the locus of pain and the intensity and type of pain.

### **2.3.1 Visual Analog Scale**

Pain intensity was evaluated using a VAS. The patients were asked to express their level of pain by making a mark on a 10 cm horizontal line. A score of 0 on the extreme left indicated no pain. A score of 10 on the extreme right indicated unbearable pain. The scores allowed the categorization of pain intensity: mild pain (0-4.4), moderate pain (4.5-7.4), and severe pain (7.5-10; Gallagher, 2001).

### **2.3.2 Wisconsin Brief Pain Inventory**

The patients were interviewed and underwent application of the Wisconsin Brief Pain Inventory (Ferreira et al., 2011). This instrument consists of nine items that measure pain,

locations on the body that are affected by pain, pain intensity (sensory dimension), medications and other treatments, improvements that are caused by medications and other treatments, and interference with life by pain (reactive dimension).

## 2.4 Statistical analysis

Initially, the Shapiro-Wilk normality test was performed, which indicated that the data did not fit a Gaussian distribution model. The data are expressed as medians and interquartile ranges (IQRs). For comparisons between sexes and numerical scores on the Wisconsin Brief Pain Inventory, the Mann-Whitney U test was used. The  $\chi^2$  test was used to identify associations between the worst pain scores in the last 24 h (Wisconsin Brief Pain Inventory) and dependent variables (time of disease evolution, treatment, marital status, quality of life, and pain location), with Fisher's exact test and Yates' correction when the expected value was less than 5. Spearman's correlations between Wisconsin Brief Pain Inventory and Visual Analog Scale scores were also assessed. The analyses were performed using SPSS 25.0 software. The level of significance was  $p \leq 0.05$ .

## 3. Results

Age, the time of Parkinson's disease evolution, pain intensity scores based on the Wisconsin Brief Pain Inventory, and interference with quality of life by pain in 37 participants are shown in Table 1. The median data and respective IQRs of the analyzed variables were not significantly different between men and women ( $p \geq 0.05$ ). For the observed scores of worst pain in the last 24 h for both sexes (median = 7, IQR = 2-5.5, and median = 7, IQR = 3-8, for men and women, respectively) and pain interference scores at work for men (median = 8, IQR = 4.5-10) were worrisome, given that the instrument's parameters denote a score of 0 for no pain and 10 for greatest pain imaginable or pain interference.

**Table 1.** Age and Wisconsin Brief Pain Inventory scores between sexes.

<b>Variable</b>	<b>Men (n = 18)</b>	<b>Women (n = 19)</b>	<b>p</b>
Age (years)	65.5 (59.50-78.25)	72.0 (64-80)	0.37
Time of disease evolution (years)	4 (2-5,5)	4 (3-8)	0.68
Worst pain score in the last 24 h	7 (4.5-8)	7 (3-8)	0.86
Lowest pain score in the last 24 h	3 (2-5)	3 (2-3)	0.89
Current pain score	2 (0-5)	0 (0-5)	0.55
Pain relief score with treatment	7 (4-9.5)	8 (5-10)	0.49
<b>Pain interference in the last 24 h</b>			
General activity	5.5 (0-8)	8 (5-9)	0.05
Humor	5.5 (2-8)	6 (4-9)	0.46
Walkability	6.5 (4.5-8.25)	6 (4-9)	0.77
Workability	8 (4.5-10)	6 (3-10)	0.42
Relationships with other people	3 (0-6.25)	5 (0-8)	0.25
Sleep	3 (0-6.75)	5 (5-6)	0.64
Ability to appreciate life	1 (1-8)	4 (4-7)	0.70

The data are expressed as median and interquartile range. Source: Authors.

Associations between the worst pain in the last 24 h based on the Wisconsin Brief Pain Inventory and duration of the disease, effects of treatment, marital status, and quality of life variables are presented in Table 2. Although no significant associations were found between any of the analyzed variables (all  $p > 0.05$ ), most patients who reported moderate or severe pain in the last 24 h (69.2%,  $n = 18$ ) had a shorter illness duration ( $\leq 5$  years). For quality of life variables, most of these same individuals reported that moderate or severe pain in the last 24 h interfered with general activity (76.9%), mood (65.4%), walkability (76.9%), and workability (80.8%).



**Table 2.** Association between worst pain reported in the last 24 h and dependent variables ( $n = 37$ ).

		Worst pain score in the last 24 h ( $n$ [%])		
		Absent or mild	Moderate or severe	$p$
<b>Evolution time</b>	$\leq 5$ years	8 (72.7)	18 (69.2)	1.00
	$\geq 6$ years	3 (27.3)	8 (30.8)	
<b>Treatment</b>	Relief	7 (63.6)	21 (80.8)	0.40
	No relief	4 (36.4)	5 (19.2)	
<b>Marital state</b>	Married	7 (63.6)	18 (69.2)	1.00
	Single	4 (36.4)	8 (38.8)	
<b>General activity</b>	No interference	4 (36.4)	6 (23.1)	0.44
	Interference	7 (63.6)	20 (76.9)	
<b>Humor</b>	No interference	3 (27.3)	9 (34.6)	1.00
	Interference	8 (72.7)	17 (65.4)	
<b>Walkability</b>	No interference	4 (36.4)	6 (23.1)	0.44
	Interference	7 (63.6)	20 (76.9)	
<b>Workability</b>	No interference	4 (36.4)	5 (19.2)	0.40
	Interference	7 (63.4)	21 (80.8)	
<b>Relationships with other people</b>	No interference	4 (36.4)	14 (53.8)	0.47
	Interference	7 (63.6)	12 (46.2)	
<b>Sleep</b>	No interference	6 (54.5)	13 (50.0)	0.80
	Interference	5 (45.5)	13 (50.0)	
<b>Ability to appreciate life</b>	No interference	7 (63.6)	16 (61.5)	1.00
	Interference	4 (36.4)	10 (38.5)	

Source: Authors.

With regard to pain intensity in the last 24 h, the participants were asked to locate pain in different parts of the body, based on the Wisconsin Brief Pain Inventory. Associations between the worst pain reported and its location were evaluated. A significant association was found between moderate or severe pain and the upper limbs (69.2%;  $n = 18$ ,  $p = 0.03$ ). Additionally, although the association was not significant, a high proportion of individuals reported both moderate and severe pain ( $n = 21$ ) and mild pain ( $n = 8$ ) in the lower limbs (Table 3).

**Table 3.** Association between worst pain reported in the last 24 h and location of pain ( $n = 37$ ).

		Worst pain score in the last 24 h ( $n$ [%])		
		Absent or mild	Moderate or severe	<i>p</i>
<b>Head</b>	No	7 (63.6)	18 (69.2)	1.00
	Yes	4 (36.4)	8 (30.8)	
<b>Neck</b>	No	9 (81.8)	25 (96.20)	0.20
	Yes	2 (18.2)	1 (3.8)	
<b>Shoulders</b>	No	10 (90.9)	21 (80.8)	0.64
	Yes	1 (9.1)	5 (19.2)	
<b>Chest</b>	No	10 (90.9)	26 (100)	0.29
	Yes	1 (9.1)	0 (0)	
<b>Abdomen</b>	No	9 (81.8)	24 (92.3)	0.56
	Yes	2 (18.2)	2 (7.7)	
<b>Back</b>	No	7 (63.6)	19 (73.1)	0.69
	Yes	4 (36.4)	7 (26.9)	
<b>Upper limbs</b>	No	8 (72.7)	8 (30.8)	0.03
	Yes	3 (27.3)	18 (69.2)	
<b>Hip</b>	No	9 (81.8)	22 (84.6)	1.00
	Yes	2 (18.2)	4 (15.4)	
<b>Lower limbs</b>	No	3 (27.3)	5 (19.2)	0.67
	Yes	8 (72.7)	21 (80.8)	

Source: Authors.

To quantitatively assess pain, a Visual Analog Scale was used, which evaluated the incidence and degree of pain involvement. A median score of 6 (IQR = 2.5-8.0) was found among the participants. Men had a median score of 5.5 (IQR = 1.5-8.0). Women had a median score of 7 (IQR = 3.0-8.0). Although scores were generally higher in women, no significant sex differences were found ( $p = 0.56$ ).

Correlations between VAS scores and Wisconsin Brief Pain Inventory scores are presented in Table 4. A significant and moderate correlation was found between mean pain ( $r = 0.549$ ) and worst pain ( $r = 0.534$ ) ( $p < 0.05$ ). A significant, but weak correlation was found between weak pain ( $r = 0.365$ ) ( $p = 0.03$ ). There was no significant correlation for current pain scores.

**Table 4.** Correlation between Visual Analog Scale (VAS) scores and Wisconsin Brief Pain Inventory scores ( $n = 37$ ).

Wisconsin Inventory	Brief	P. VAS	
		<i>r</i>	<i>p</i>
Average pain		0.549	0.000
Worst pain (24 h)		0.534	0.001
Weak pain (24 h)		0.365	0.026
Current pain		0.229	0.173

Source: Authors.

#### 4. Discussion

The main objective of the present study was to evaluate the degree of pain and its influence on daily activities in Parkinson's disease patients who were receiving palliative care and regularly used anti-Parkinson's disease medications. The results showed that pain was related to the performance of daily living activities. The secondary objective was to characterize pain using complementary pain instruments. Most of the patients reported pain in the last 24 h. Musculoskeletal pain in the upper limbs was the most common type of pain, and general activities were the most affected by pain.

Among the risk factors for neurodegenerative diseases, age makes the greatest contribution. Sex also plays an important role in the risk and prognosis of these diseases, which can interfere with the cause, frequency, symptoms, responses to treatment, and clinical outcomes (Rocca et al., 2014). The incidence of Parkinson's disease is 1.5-times higher in men than in women (Wooten et al., 2004; Taylor; Cook and Counsell, 2004). In its early stages, Parkinson's disease is milder, especially the expression of non-motor symptoms. The mechanisms that lead to this difference in the manifestation of the disease in different sexes is not fully understood but appears to involve sociocultural differences, biological, genetic, hormonal, and reproductive factors, and structural and functional differences in the dopaminergic pathway (Gillies et al., 2014; Smith and Dahodwala, 2014; Regitz-Zagrosek, 2012). However, according to Reek et al. (2020), sex is more strongly associated with cognitive performance than the motor phenotype. In the present study, no difference in prevalence was observed between sexes, and no correlation was found between this parameter and walkability, workability, sleep, or pain scores. However, the occurrence of pain in the last 24 h more strongly compromised general activity in women.

The present study also found that pain was highly prevalent in Parkinson's disease patients. Among non-motor symptoms of Parkinson's disease, pain is one of the most common symptoms, which negatively impacts patients' quality of life (Geroin et al., 2016). The prevalence of pain ranges from 67% to 85%. Musculoskeletal pain is the most common type of pain, including cramps and joint pain. The pain condition appears to be associated with severe stiffness and bradykinesia, but it can also be attributable to lower mobility of the affected limbs and joints and an abnormal posture (Broen et al., 2012; Sage, 2004; Granovsky, 2013). In the present study, VAS pain scores were moderately correlated with average pain scores and worse pain, but not with the weak pain and pain obtained through Wisconsin Brief Pain Inventory. Worst pain scores in the last 24 h were associated with the upper limbs, and the occurrence of pain compromised general activity, especially in women. These results indicate that musculoskeletal pain hampers some daily functions, such as writing, dressing, turning over in bed, and performing hygiene practices (Mattos et al., 2019).

Despite the high incidence of pain in patients with Parkinson's disease, only about 50% of patients generally receive pharmacological treatments or physical therapy to relieve their condition (Beiske et al., 2009). This reflects the lack of specific diagnostic procedures and the relatively poor multidisciplinary approach to pain management in patients with Parkinson's disease (Beiske et al., 2009). This gap in patient care can be overcome by a multidisciplinary team that includes multiple medical specialties and rehabilitation specialists, such as physiotherapists (Geroin et al., 2016). This multidisciplinary approach can benefit patients. Physical therapy can improve pain by modulating dopaminergic and non-dopaminergic pain inhibitory pathways and promote neuroplasticity (Allen et al., 2015). Additionally, an increase in mobility can reduce pain through a decrease in mechanical contributions to recurrent and persistent pain (Hodges, 2011).

Clinical evidence convincingly shows that physical activity and supervised rehabilitation are beneficial, economical, and low-risk interventions that can improve health and the quality of life of Parkinson's disease patients by improving motor and non-motor symptoms (Bhalsing et al., 2018). Rehabilitation should be emphasized in the treatment of Parkinson's disease patients because such an intervention can be beneficial, although a relatively low percentage of such patients undergo rehabilitation (Reuter et al., 2011; Buhmann et al., 2017). Among conservative treatments, physiotherapy for Parkinson's disease patients seeks to maintain quality of life and functionality and reduce the incidence of falls through exercises that stimulate the patient as much as possible. Physiotherapeutic treatment aims at postural reeducation to achieve pain relief. Attenuating and delaying the maximum onset of symptoms is of paramount importance to maintain patients' functionality (Ferraz et al., 2018; Bhalsing et al., 2018).

## 5. Final Considerations

Considering the dimensional nature of Parkinson's disease, the presence of pain needs to be investigated. The presence of pain in the last 24 h interfered with general activities. Multidisciplinary interventions are needed to assess and treat Parkinson's disease patients in all of its dimensions to improve patients' quality of life. From the results of this research, the horizon for the assessment of pain in a patient with Parkinson's Disease is broadened. Also, knowing the pain and its impact on the patient's quality of life, it is possible to seek new treatment strategies for the patient, aiming to promote the well-being of the patient as a whole.

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