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ORIGINAL ARTICLE

Influence of Functional Disability on Quality of Life in Patients With Atypical Parkinsonism

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Highlight:
(1) Parkinsonism is defined as a neurological syndrome with four cardinal symptoms.
(2) Parkinson's Syndrome (PS), also known as atypical parkinsonism.
(3) Refers to a group of neurodegenerative movement disorders.

ABSTRACT

Objective: To evaluate the level of functional capacity and its association with the quality of life (QoL) in patients with atypical parkinsonism (AP). *Methods*: This is a cross-sectional study involving a clinical assessment by a physician and a physiotherapist to confirm the diagnosis of AP and complete the clinical analysis; Timed Up and Go (TUG) test, handgrip strength, Parkinson's Disease Quality of Life Questionnaire (PDQ-39), Hoehn & Yahr (H&Y) scale, Frontal Assessment Battery (FAB), and Montreal Cognitive Assessment (MoCA). *Results*: Twenty-one elderly patients with AP were recruited, with a predominance of males (76%). Functional impairment was observed in 80% of patients with a TUG > 20 seconds, and 57% had dynapenia. Stratifying patients with and without dynapenia, we found that those with dynapenia had worse QoL according to the PDQ-39 questionnaire (p = 0.04). Additionally, a significant negative correlation was found between the dynamometer values of the dominant limb (Kgf) and QoL in patients with AP (R = -0.449 and P = 0.049); a significant positive correlation was observed where the severity of AP assessed by the Hoehn & Yahr scale directly influenced functional capacity as measured by the TUG test (R = 0.580 and P = 0.009), and a significant correlation between MoCA and FAB (R = 0.867 and P = 0.001). These findings were supported by significant results in linear regression, which determined the direct influence of functionality on QoL in these patients. *Conclusion*: The severity of AP negatively impacts functionality, consequently impairing QoL in patients diagnosed with AP.

Keywords: parkinsonism; quality of life; gait; functionality; strength.

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INTRODUCTION

Parkinsonism is defined as a neurological syndrome with four cardinal symptoms: bradykinesia, muscle rigidity, resting tremor, and impaired postural reflexes[1]. The pathophysiology of Parkinsonian syndromes is based on the death of dopaminergic neurons in the substantia nigra, leading to dopamine depletion in the nigrostriatal pathways, ultimately resulting in underactivation of the thalamocortical loop of the basal ganglia[2].

Parkinson's Syndrome (PS), also known as atypical parkinsonism, refers to a group of neurodegenerative movement disorders that resemble idiopathic Parkinson's Disease (PD) but have distinct clinical and pathophysiological features. Distinctive characteristics of PS include early-onset dementia, hallucinations, dysautonomia, gaze palsy, myoclonus, pyramidal tract signs, and alien limb phenomena. Unlike PD, these conditions have a limited response to levodopa and generally poor prognosis. The most common PS conditions are Dementia with Lewy Bodies (DLB), Multiple System Atrophy (MSA), Corticobasal Degeneration (CBD), and Progressive Supranuclear Palsy (PSP)[1,3].

Balance disorders, reduced functional capacity, gait disturbances, and decreased quality of life (QoL) are common in Parkinsonian syndromes and significantly affect the functionality of individuals. Recognizing these axial features can provide important and often early clues to the underlying disorder's nature, helping to distinguish between PD and the various forms of atypical parkinsonism[4]. Careful assessment of axial features is also essential to initiate appropriate treatment strategies that can reduce disabilities and consequently improve the QoL of this population.[4]

Performing functional activities depends on multiple factors, including lower limb strength, coordination, balance, sensory integration, and endurance[5]. However, little is known about the impact of functionality on the QoL of patients with atypical parkinsonism (AP).

Therefore, it is crucial to evaluate functionality using dynamometry and the Timed Up and Go (TUG)[6] test, as well as QoL using the Parkinson's Disease Quality of Life Questionnaire (PDQ-39)[7] in these patients. Identifying factors that influence QoL is essential for understanding the disease course and seeking strategies to promote the physical and psychological well-being of these individuals, thereby facilitating the planning of targeted therapeutic interventions for patients with AP. To date, there are no studies that have associated QoL with functionality in patients with AP[8].

Therefore, our objective was to evaluate the level of functional capacity and its association with QoL in patients with AP.

METHODOLOGY

Study design and ethical aspects

This is a cross-sectional study designed following the STROBE guidelines. The study also adhered to the Declaration of Helsinki and was approved by local ethics committees (protocol number: 2.536.323/2018). All patients were recruited from the Hospital de Clínicas de Porto Alegre/RS. All volunteers signed a written informed consent before participation.

Subjects

All patients were under follow-up at the Movement Disorders Outpatient Clinic at the Hospital de Clínicas de Porto Alegre, with a diagnosis of AP. Evaluations were conducted between January and December 2021. To be included, patients had to have a medical diagnosis of Multiple System Atrophy (MSA)[9], Progressive Supranuclear Palsy (PSP)[10], Corticobasal Degeneration (CBD)[11], Dementia with

Lewy Bodies (DLB)[12], or Atypical Parkinsonism. Exclusion criteria included patients without a clinical diagnosis of AP and those with a clinical diagnosis of Alzheimer's dementia.

Protocol and measurements

Each patient completed the comprehensive assessment process over two days in the following sequence: 1) Clinical evaluation by a physician and physiotherapist to confirm the diagnosis of AP and complete the clinical analysis; 2) Timed Up and Go (TUG), handgrip strength, PDQ-39, and Hoehn & Yahr scale.

Timed Up and Go (TUG)

The TUG is a mobility test that measures the time it takes for a participant to rise from a chair, walk three meters, turn around, walk back, and sit down. The measure used for the test is time in seconds[13]. The TUG has high reliability and validity for PD, with inter- and intra-examiner reliability indices (ICC) of 0.99. A time of 16 seconds or more in the elderly indicates a risk of falls[14].

Handgrip Dynamometry:

Muscle strength was assessed by measuring handgrip strength using a dynamometer (Jamar Hydraulic Dynamometer, Bolingbrook, IL, USA). Participants were asked to hold the dynamometer at their maximum strength, following the recommendations of the American Society of Hand Therapy: volunteers were seated in a standard height chair without armrests, with the shoulder adducted, elbow flexed at 90°, forearm in a neutral position, and wrists in 15° extension[15]. Three attempts on both hands were performed with one-minute rest between each. The mean value of each hand was used in the analysis. Dynapenia was considered when patients had cut-off values of <30 kg/f for men and <20 kg/f for women[16,17].

Eight-item Parkinson's Disease Questionnaire (PDQ-39)

The PDQ-39 is a specific questionnaire for PD, and it is one of the most widely used for QoL assessment. This questionnaire was developed in the UK and has been translated into 30 languages [18]. The questionnaire consists of 39 questions across eight different domains: 1) mobility (10 items), 2) activities of daily living (6 items), 3) emotional well-being (6 items), 4) stigma, which assesses the social difficulties of PD (4 items), 5) social support (3 items), 6) cognition (4 items), 7) communication (3 items), 8) bodily discomfort (3 items). The scoring of each question ranges from zero to four, where: 0 – never, 1 – occasionally, 2 – sometimes, 3 – often, 4 – always; and the total score ranges from 0 (no problem) to 100 (maximum problem), so a low score indicates better health status and QoL[18].

Hoehn & Yahr Scale: Severity and Progression of PD

This scale was developed in 1967 and is currently the most widely used to assess the general status of PD patients. In its original form, it comprises five stages of classification to assess the severity of PD and essentially covers global measures of signs and symptoms that allow classifying the individual regarding the level of disability[19].

Frontal Assessment Battery (FAB)

The cognitive battery evaluates frontal lobe function, incorporating various clinical assessments to screen for frontotemporal dementia, including word generation with the letter S, similarities, Luria's test, grasp reflex, and Go-No-Go test. The maximum score for each subtest is 3 points, and the total test score is calculated by summing the scores of the six subtests (maximum score = 18)[20].

Montreal Cognitive Assessment (MoCA)

The Montreal Cognitive Assessment was developed as a brief screening tool for mild cognitive impairment. It allows access to different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructive abilities, abstraction, calculation, and orientation. The total score is 30 points; a score of 26 or more is considered normal[21,22].

Statistical Analysis

Initially, the Shapiro-Wilk normality test was performed. If the data distribution was parametric, descriptive analysis of continuous numerical data was expressed as mean and standard deviation; if non-parametric, it was expressed as median and interquartile range. Qualitative variables were expressed as absolute and relative frequency. In inferential analysis, correlations between parametric variables were performed using Pearson's correlation test, and for non-parametric variables, Spearman's correlation test was used. A linear regression model was employed to determine the effect of clinical variables on parameters such as functionality and QoL. The t-student test was used to compare groups. A significance level of 5% ($p \leq 0.05$) was considered. All analyses were performed using SPSS (Statistical Package for the Social Sciences) 20.0 for Windows.

RESULTS

Initially, we recruited 50 patients, but due to strict exclusion criteria, we only evaluated 21 patients with a positive diagnosis of AP (Figure 1).

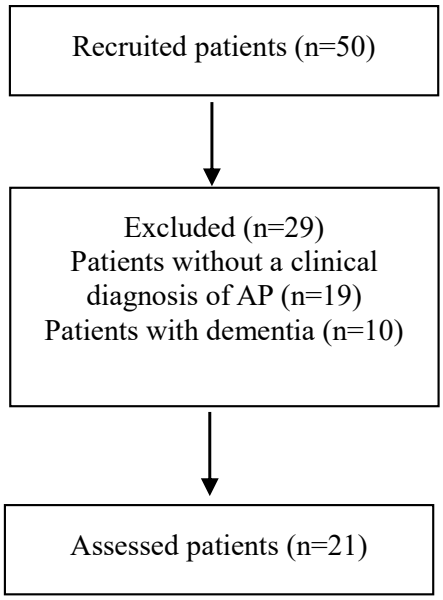

Figure 1 – Study Assessment Flowchart

In Table 1, the characteristics of the evaluated patients are described. A total of 21 elderly patients with AP were recruited, with a predominance of males (76%) and MSA as the most common type of AP.

Table 1 – Clinical Characteristics of Assessed Patients

Variables	N=21
Idade (anos)	66±6
Gender, n (%)	
Male	16 (76)
Female	5 (24)
Type of AP, n (%)	
PSP	7 (33)
MSA	9 (43)
DLB	3 (14)
CBD	2 (10)

Multiple System Atrophy (MSA); Progressive Supranuclear Palsy (PSP); Corticobasal Degeneration (DCB); Dementia with Lewy Bodies (DLB); Atypical parkinsonism (PA).

The functional characteristics and questionnaire results of the evaluated patients are presented in Table 2, where we observed a predominance of functional impairment, with a TUG > 20 seconds in 80% of patients, and muscle strength reduction through dynapenia in 57% of them.

Table 2 – Functional Variables and Questionnaires of the Evaluated Patients

Functional Capacity	N=21
Capacidade funcional	
TUG (s)	43±32
TUG >20 s	16 (80)
Dynamometry, Kgf	
Dominant	24±16
Non-dominant	19±15
Dynamopenia, n (%)	
Sim	12 (57)
Quality of life	
PDQ-39	93±17
Hoehn & Yahr Scale	3.2±1.2
FAB	9±3
MOCA	16±8

TUG: timed up and Go; PDQ39: Eight-item Parkinson's Disease Questionnaire; DP: doença de Parkinson; FAB: Frontal assessment battery, MOCA: Montreal Cognitive Assessment.

Stratifying the patients with and without dynapenia (Figure 1), we found that those with dynapenia had worse QoL according to the PDQ-39 questionnaire, emphasizing the influence of muscle strength on QoL in patients with AP (p = 0.04).

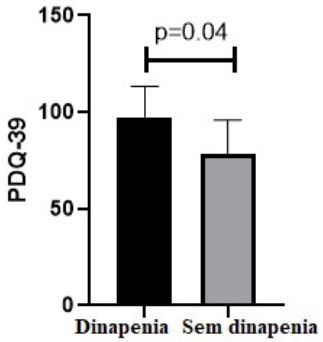

Figure 1 – Comparison of Patients with and without Dynamopenia Regarding Quality of Life in Patients with Parkinson's Disease. PDQ-39: Eight-item Parkinson's Disease Questionnaire; Student's t-test.

We found a significant negative correlation between dynamometer values in the dominant limb (Kgf) and QoL by PDQ-39 in patients with AP (R = -0.449 and P = 0.049) (Figure 2A), demonstrating that poorer functionality impacts the QoL of these patients.

In Figure 2B, we found a significant positive correlation, where the severity of PD assessed by the Hoehn & Yahr scale directly influences the functional capacity response by the TUG test in patients with AP (R = 0.580 and P = 0.009). Finally, there was a significant correlation between MoCA and FAB (R = 0.867 and P = 0.001), demonstrating that the greater the patient's dementia, the greater the impairment in their activities of daily living (Figure 2C).

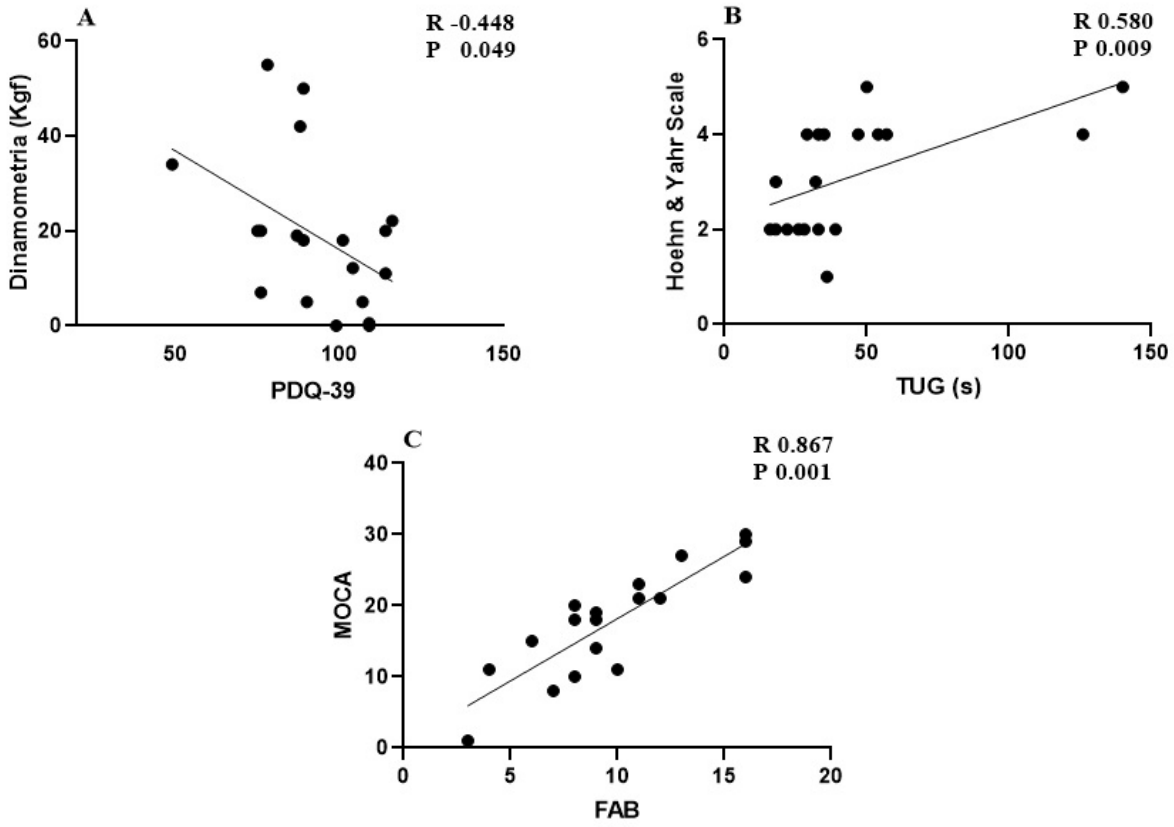

Figure 2 – Correlation between Dominant Limb Dynamometry (Kgf) and Quality of Life by PDQ-39 in Patients with Parkinson's Disease (2 A); Severity of Parkinson's Disease by Hoehn & Yahr Scale and TUG (2 B); and MOCA with FAB (2 C). Pearson Correlation.

Corroborating the correlation results, we found significant results in linear regression, where we determined the direct influence of functionality through dynamometry on QoL in these patients (Table 3).

Table 3 – Linear regression to determine the influence of functionality through dynamometry on quality of life.

Variables	β coefficient	Error	*p-value*
Constant	57.6	19.0	0.008
PDQ39	0.46	0.20	0.049

R^2 adjusted =0.15; F=4.29 (p=0.040).

We also found the direct influence of the Hoehn & Yahr Scale, which is a prognostic predictor in AP patients on the TUG time, demonstrating that the severity of AP negatively impacts functionality (Table 4).

Table 4 – Linear regression to determine the influence of the Hoehn & Yahr Scale on functionality through the Timed Up and Go (TUG) test (s).

Variables	β coefficient	Error	*p-value*
Constant	2.18	0.389	<0.001
TUG (s)	0.02	0.007	0.009

R^2 adjusted =0.29; F=8.56 (p=0.009).

DISCUSSION

The objective of this study was to evaluate the level of functional capacity and associate it with the quality of life of patients with AP. Therefore, with our results, it was possible to positively respond to the hypothesis and the study objective. It is worth noting that this is the first study to evaluate the effect of AP on the relationship of variables such as TUG, dynamometry, PDQ-39, Hoehn & Yahr Scale, MoCA, and FAB, demonstrating the novelty of this research.

Our main findings indicate that functionality directly impacts the QoL of patients with AP and that the severity of AP directly influences the functional capacity response in these patients. These results were confirmed through correlation analysis and linear regression.

Neurodegeneration plays a role in the development of dynapenia through the evaluation of handgrip strength and in movement disorders. Chronic diseases are among the leading causes of dynapenia, as well as aging. In patients with PD, motor damage, rigidity, and motor dysfunctions such as dyskinesia increase energy expenditure and affect body composition[23]. Dynapenia reflects the loss of muscle strength related to aging, which leads to functional impairment of the skeletal muscle system and is associated with decreased physical performance and reduced QoL[16].

Motor disorders in the upper limbs caused by PD can lead to changes in dexterity patterns and loss of control in movements such as reaching and grasping. This can decrease the speed of performing sequential and bimanual tasks, as well as asymmetric tasks that require greater motor complexity to manage these changes. Handgrip strength can also be affected in PD, resulting in significant functional decline for the upper limbs[24].

Handgrip strength is primarily used to estimate musculoskeletal function through good reproducibility for measuring voluntary maximal grip strength, being considered a good index for muscle strength, and can also reflect impairment of functional capacity[15,16,25]. Therefore, assessing handgrip strength, which is considered a global measure of functional capacity and also allows the identification of dynapenia in these patients, is of utmost importance, as it directly impacts QoL, as demonstrated in Figure 1A and Table 2.

When it comes to evaluating QoL, it is considered a difficult task, as it is abstract and subjective, involving personal, social, professional, emotional, historical, and cultural aspects. There are several instruments to evaluate QoL, among them the PDQ-39, a specific questionnaire for evaluating individuals with PD, translated and validated for Brazilian Portuguese, and considered easy to apply. This questionnaire estimates how factors such as mobility, activities of daily living, emotional well-being, stigma, social support, cognition, communication, and bodily discomfort interfere with the individual's perception of their QoL[26].

PD is characterized by various motor dysfunctions, such as bradykinesia, rigidity, freezing of gait, resting tremor, and postural reflex impairment, as well as neuropsychological dysfunctions, such as depression, fatigue, cognitive decline, and sleep disorders, all of which negatively affect the QoL of patients[27]. The motor symptoms of AP progressively restrict independent performance in daily living activities, leisure activities, and self-care, consequently reducing QoL[26].

Zhao et al. (2021) found in their study that patients with PD had lower QoL compared to healthy controls in most dimensions, especially in physical function and mental health domains. Poor QoL in life directly impacted the functional outcomes of patients with PD. These findings are consistent with our results, where we identified that handgrip strength directly influenced QoL (Figure 1A and Table 2).

The TUG is used to evaluate physical performance and correlates with mobility and gait speed[28]. The TUG can be significantly associated with functional impairment and scales such as the Unified Parkinson's Disease Rating Scale and Hoehn & Yahr in PD patients[29].

An impaired TUG is also considered a marker for PD severity. Individuals with impaired TUG (≥10 seconds) have a 28% higher risk of PD compared to individuals with normal TUG. Yoo et al. (2020) found a robust association in individuals with abnormal TUG (≥20 seconds), who had a higher risk of PD compared to individuals with normal TUG[29].

The TUG is promising for identifying early PD because it consists of a sequence of sit-to-stand, walking, turning, and sitting tasks, each of which is eventually affected by PD, especially when performed in sequence. The TUG can identify functional limitations in patients with PD and also emphasized its correlation with Hoehn & Yahr stages[30].

This emphasizes the clinical applicability of our results, where the TUG was related to the Hoehn & Yahr scale, demonstrating that disease severity directly influences the functional capacity of these patients. This scale is used to stratify patients. Stage 4 is characterized by severe disability with the ability to stand and walk without help, and patients in stage 5 are wheelchair-bound and bedridden without assistance[31].

Both the FAB and MoCA detect cognitive impairment, the difference between the questionnaires being that MoCA is considered more specific and sensitive to detect cognitive impairment, while FAB is more feasible for evaluating patients with physical impairment. Simple modifications in the performance of tasks assessed by the questionnaires were effective in identifying patients with cognitive changes and motor disabilities. The relationship between FAB and MoCA can effectively screen for dementia, cognitive, and behavioral impairment in patients with AP[32].

CONCLUSION

The severity of AP negatively impacts functionality and consequently impairs QoL in patients diagnosed with AP. Physiotherapeutic interventions are of great importance to minimize the progression of AP and reduce the disease's impact on the patient's life.

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Matheus Zschornack Strelow: Patient recruitment.

Ida Vanessa Doederlein Schwartz: Data collection.

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Carlos Roberto de Mello Rieder: Research conduction, investigation process, and patient recruitment.

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