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Non-motor symptoms in Parkinson's disease: Recognition, diagnosis, and implications for comprehensive management

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Abstract

Introduction: Parkinson's disease is traditionally defined by motor symptoms such as bradykinesia, rigidity, and tremors. However, non-motor symptoms are now recognized as central contributors to disability, often preceding motor onset and remaining underdiagnosed.

Materials and methods: This narrative review is based on a focused literature analysis of non-motor symptoms in Parkinson's disease, including neuropsychiatric, cognitive, sensory, sleep, and autonomic domains. Articles were selected for clinical relevance and pathophysiological insights.

Results: The reviewed literature indicates that non-motor symptoms are highly prevalent and significantly impact quality of life in Parkinson's disease. These symptoms often correlate with disease progression and motor fluctuations. Various management strategies have been described, although underdiagnosis remains common due to limited screening in routine clinical practice.

Conclusions: Early identification and targeted treatment of non-motor symptoms are critical for optimizing clinical outcomes, improving patient quality of life, and reducing healthcare burdens. Comprehensive clinical assessments and the integration of multidisciplinary care models are essential to meet the complex needs of patients with Parkinson's disease.

Keywords: Affective symptoms, Early diagnosis, Cognitive dysfunction, Parkinson's disease, Sleep-wake disorders, Therapeutic interventions.

Síntomas no motores en la enfermedad de Parkinson: reconocimiento, diagnóstico e implicaciones para un manejo integral

Resumen

Introducción: la enfermedad de Parkinson se ha definido tradicionalmente por síntomas motores como bradicinesia, rigidez y temblores. Sin embargo, los síntomas no motores son reconocidos actualmente como contribuyentes centrales a la discapacidad, a menudo precediendo al inicio motor y permaneciendo infradiagnosticados.

Materiales y métodos: esta revisión narrativa se basa en un análisis focalizado de la literatura sobre los síntomas no motores en la enfermedad de Parkinson, abarcando aspectos neuropsiquiátricos, cognitivos, sensoriales, del sueño y del sistema nervioso autónomo. Se seleccionaron artículos por su relevancia clínica y aportes sobre la fisiopatología.

Resultados: la literatura revisada indica que los síntomas no motores son altamente prevalentes y tienen un impacto significativo en la calidad de vida de los pacientes con enfermedad de Parkinson. Estos síntomas suelen correlacionarse con la progresión de la enfermedad y las fluctuaciones motoras. Se han descrito diversas estrategias de manejo, aunque el subdiagnóstico persiste debido a la escasa evaluación sistemática en la práctica clínica habitual.

Conclusiones: la identificación temprana y el tratamiento específico de los síntomas no motores son fundamentales para optimizar los resultados clínicos, mejorar la calidad de vida del paciente y reducir la carga para el sistema de salud. Se requiere una evaluación clínica integral y un enfoque multidisciplinario para abordar estas manifestaciones complejas.

Palabras clave: diagnóstico precoz, disfunción cognitiva, enfermedad de Parkinson, intervención temprana, síntomas afectivos, trastornos del sueño-vigilia.

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Introduction

Parkinson's disease (PD) is a progressive neurodegenerative disorder classically associated with motor symptoms, including bradykinesia, tremor, and rigidity. However, beyond these motor manifestations, PD is increasingly recognized for a wide range of non-motor symptoms that contribute substantially to overall disease burden. Over the past three decades, PD has become the fastest-growing neurological condition globally, affecting approximately 5–7.3% of individuals over the age of 65 (1). The neuropathological hallmarks of PD include the degeneration of dopaminergic neurons in the *substantia nigra pars* compacta, resulting in striatal dopamine depletion, along with the presence of intracellular α-synuclein aggregates forming Lewy bodies (2).

Non-motor symptoms can appear during the prodromal phase, preceding the onset of classical motor signs, and persist throughout the disease course (3–5). These symptoms encompass a broad spectrum, including neuropsychiatric disturbances, cognitive decline, autonomic dysfunction, sleep disorders, and sensory-perceptual abnormalities. The most common non-motor symptoms and features in PD are shown in Figure 1. Recognizing their clinical relevance, the Movement Disorder Society (MDS) diagnostic criteria for PD incorporate olfactory loss as a supportive criterion, while also considering the absence of common non-motor features beyond five years of disease as a red flag (6).

The underdiagnosis of non-motor symptoms, due to gaps in their assessment and treatment, leads to poor disease control, diminished quality of life, and complications at various stages of the disease (7). A thorough understanding of non-motor symptoms is therefore essential for accurate diagnosis, timely therapeutic intervention, and the development of comprehensive, individualized care strategies. This review synthesizes current evidence on the clinical presentation, assessment, and management of non-motor symptoms in PD, underscoring their critical role in shaping patient outcomes.

Figure 2 provides an overview of the most commonly used diagnostic tools and therapeutic approaches for the most prevalent non-motor symptoms in patients with PD.

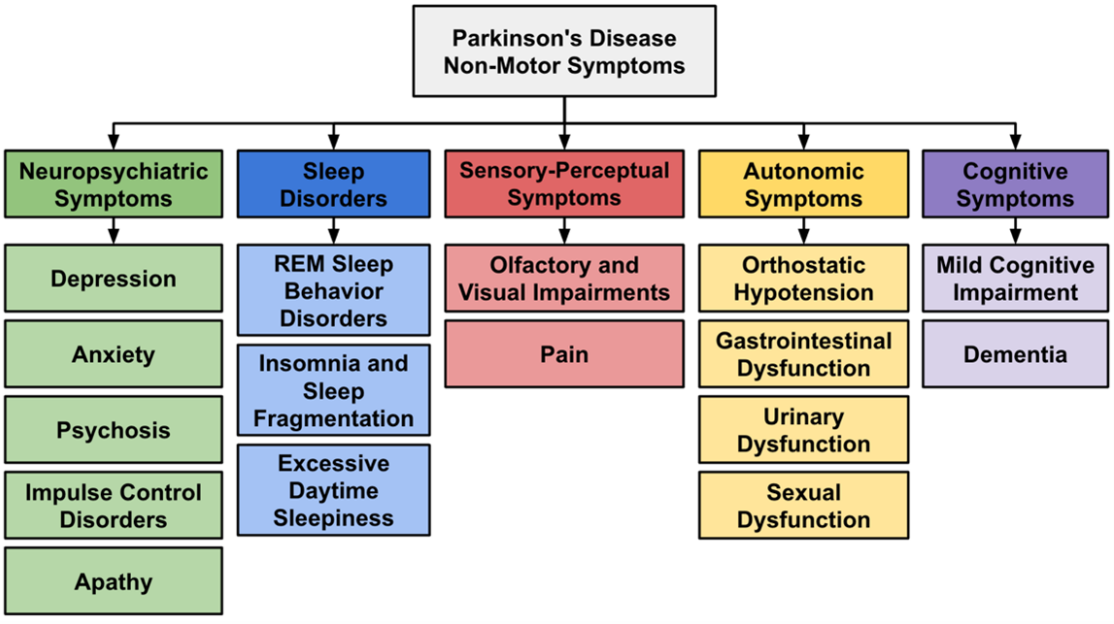

Figure 1. Most common non-motor symptoms and features in Parkinson's disease

Source: Own elaboration.

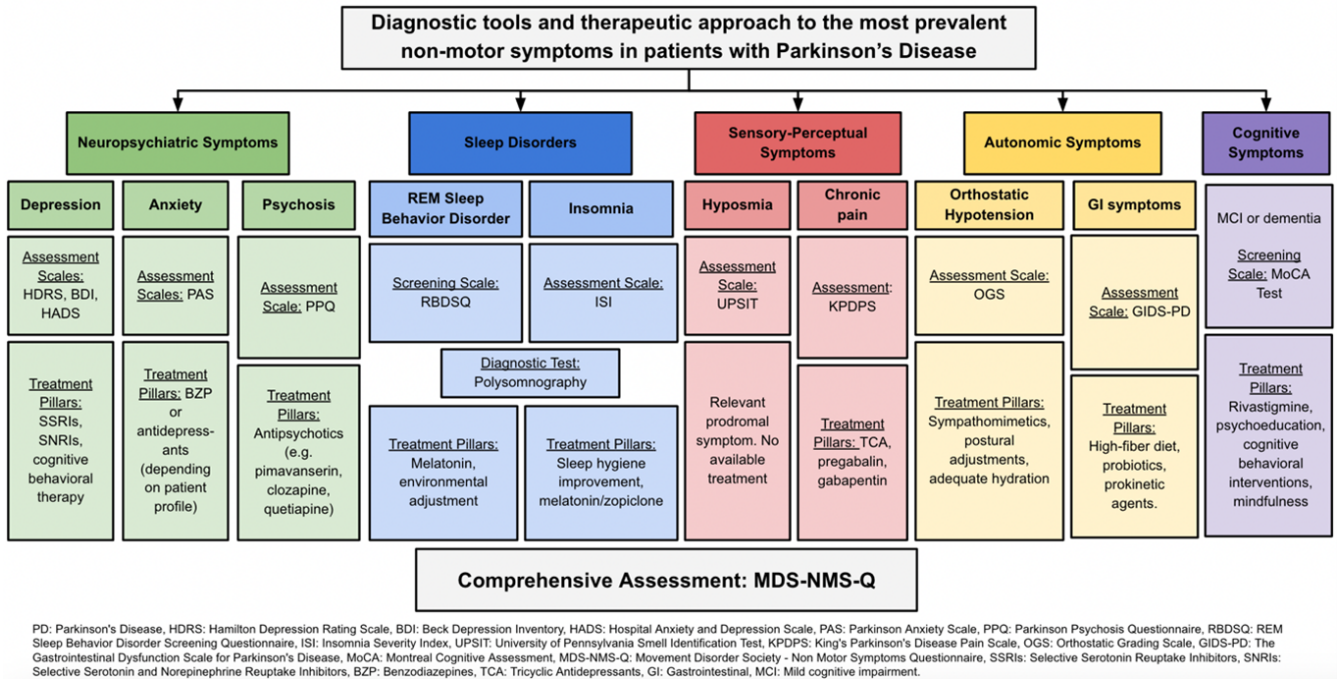

Figure 2. Most commonly used diagnostic tools and therapeutic approaches for the most prevalent non-motor symptoms in patients with Parkinson's disease

Source: Own elaboration.

Materials and methods

A comprehensive literature search was conducted using PubMed, EMBASE, and SciELO databases. The search strategy combined Medical Subject Headings (MeSH), Emtree terms, and relevant free-text keywords, including "Parkinson Disease" and specific terms for each non-motor symptom, such as "Depression", "Anxiety", "Psychosis", "Disruptive, Impulse Control, and Conduct Disorders", "Apathy", "Sleep Wake Disorders", "Dyssomnias", "REM Sleep Behavior Disorder", "Sensation Disorders", "Pain", "Autonomic Nervous System Diseases", "Hypotension, Orthostatic", "Gastrointestinal Diseases", "Urinary Bladder, Neurogenic", "Urinary Incontinence", "Sexual Dysfunction, Physiological", and "Cognitive Dysfunction". The complete systematic search strategy, separated by database and organized by each group of non-motor symptoms, is detailed in Appendix A.

An initial set of studies was identified through database queries, and additional relevant literature was retrieved using a snowball approach, which involved screening the reference lists of selected articles and tracking citations of key publications.

Studies were included if they addressed the prevalence, assessment, diagnosis, clinical impact, or management of non motor symptoms in PD, regardless of study design. Selection was based on the authors' criteria, not systematically. Articles published in English, Spanish, and Portuguese were considered eligible. Studies focusing only on motor manifestations or unrelated topics and without full-text access or available only in abstract form were excluded.

A total of 110 studies were selected according to the mentioned criteria, based on their relevance to non-motor symptomatology in PD and their contribution to understanding its clinical implications and therapeutic approaches. The quality of the included studies (grouped by subsection) was stratified according to the Oxford Centre for Evidence-Based Medicine classification and is detailed in Appendix B. The flowchart outlining the search strategy is presented in Figure 3.

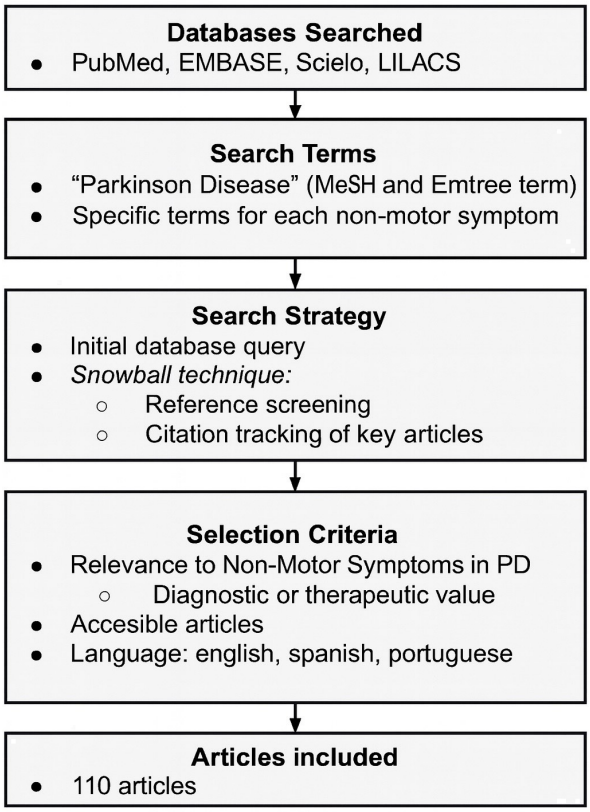

Figure 3. Flowchart of the article search and selection strategy

Source: Own elaboration.

1. Neuropsychiatric symptoms

1.1 Depression

In PD, depression manifests in subtypes such as minor depression, dysthymia, and others (8,9). Major depressive disorder affects approximately 17% of PD patients, minor depression 22%, and dysthymia 13% (10). While numerous studies have addressed depression in PD, many patients exhibit depressive symptoms without meeting the criteria for a specific depressive disorder (11). Subsyndromal depression in PD includes excessive pessimism, rumination, and hopelessness, which are common in this condition (12). Anxiety often coexists with depressive disorders, requiring thorough evaluations in PD patients. These symptoms can emerge during the prodromal stages and tend to worsen in advanced stages (13). Depression is the most common neuropsychiatric symptom prior to diagnosis (14) and is associated with non-motor fluctuations during "off" periods in PD (13,15).

Evaluating depression in PD is challenging due to overlapping symptoms (8), emotional responses to diagnosis, and medication side effects (16). Early assessment in primary care is crucial, with tools such as the Hamilton Depression Rating Scale, Beck Depression Inventory, and Hospital Anxiety and Depression Scale aiding in screening depressive symptoms in PD. Non-pharmacological interventions such as cognitive-behavioral therapy (CBT) and aerobic exercise have shown utility (17,18). Pharmacological options include selective serotonin reuptake inhibitors (SSRIs), serotonin-norepinephrine reuptake inhibitors (SNRIs), and tricyclic antidepressants (TCAs), each with varying efficacy and side-effect profiles (16,19). SNRIs are considered the safest option for depressive symptoms but do not improve other PD symptoms (16,19). Medications like pramipexole (dopamine agonist), primarily used for motor symptoms, may also benefit patients with specific depressive symptoms (20). First-line pharmacological management recommendations include SSRIs or SNRIs at standard doses, with regular evaluations for efficacy and adverse effects (21).

1.2 Anxiety

Anxiety is characterized by excessive worry and distress, which may become pathological in the absence of a clear stimulus. According to the DSM-5, while anxiety symptoms are common and may be transient, an anxiety disorder is diagnosed when these symptoms are persistent, excessive, and cause significant impairment in social, occupational, or other important areas of functioning, which may occur in PD (9,22). Anxiety symptoms are common in PD patients (22) and can manifest as generalized anxiety disorder (apprehension, fear, worry), separation anxiety disorder, selective mutism, specific phobias, social anxiety disorder, and panic disorder, among others (9). Anxiety frequently coexists with depression and may emerge during the prodromal stage of PD, becoming more prevalent during "off" periods (13,23).

Early evaluation in primary care is essential due to the negative impact of anxiety on quality of life. Assessment tools like the Parkinson Anxiety Scale, which specifically evaluates persistent and episodic anxiety through 12 items, are helpful for clinical screening (24). Although current evidence is limited, higher doses of antidepressants, particularly SSRIs, have been associated with adequate responses in

treating anxiety in PD (25,26). Non-pharmacological strategies such as CBT have been shown to have an impact on this symptom (27).

1.3 Psychosis

Psychotic disorders in both the general population and PD include symptoms such as hallucinations, delusions, and alterations in language (e.g., impaired discourse organization, reduced verbal fluency, and difficulties with pragmatic language use) and thought (9,28). Hallucinations may present as fleeting phenomena and illusions (45%), visual hallucinations (15%), or non-visual hallucinations (35%) (29). Their prevalence increases in advanced PD stages (30), typically beginning with fleeting perceptions or feelings of presence that progress to hallucinations as the disease evolves (30). The Parkinson Psychosis Questionnaire is used to assess the frequency and severity of these symptoms (24).

Treatment involves reducing dopaminergic therapy, particularly dopaminergic agonists, identifying potential triggers such as infections, and avoiding pro-hallucinatory medications, including anticholinergics (24). When pharmacological intervention is required, pimavanserin has demonstrated efficacy in reducing psychotic symptoms in PD. (31). Alternative options include quetiapine and clozapine (32,33), and rivastigmine may be beneficial in cases associated with dementia (34). Electroconvulsive therapy can be useful in severe cases (35). Other strategies such as CBT, psychoeducation, and environmental modifications (e.g., minimizing sensory overload and improving lighting, among others) can also be beneficial (36,37).

1.4 Impulse control disorders (ICDs)

Defined in the DSM-5 as the inability to resist impulses that may harm the patient or others, these disorders encompass behaviors such as pathological gambling, compulsive shopping, and binge eating (9). Other characteristic behaviors include punding (engagement in purposeless repetitive motor activities) and hobbyism (excessive preoccupation with hobbies or activities) (24). The prevalence of ICDs in PD is approximately 14%, with a 5-year cumulative incidence of up to 46% (38,39).

The primary risk factor is the use of dopaminergic agonists, followed to a lesser extent by levodopa and amantadine (40). The Questionnaire for Impulsive-Compulsive Disorders Rating Scale, along with the MDS Non-Motor Symptoms – Questionnaire (MDS-NMS-Q), aids in evaluating these symptoms in PD (24,41). Primary interventions involves reducing dopaminergic agonists and monitoring withdrawal symptoms (42).

1.5 Apathy

Apathy in PD manifests as a loss of motivation without cognitive impairment, characterized by reduced goal-directed behavior and thought. Its prevalence ranges between 15 and 70% in PD patients (24). Assessment tools include the Apathy Evaluation Scale (AES), Apathy Scale, and Apathy Inventory, with the AES-12PD being specific for PD (43). Treatment options are limited; evidence suggests that cholinesterase inhibitors and levodopa during "on" periods may be beneficial (44,45).

2. Sleep disorders

Up to 71% of PD patients are affected by sleep disturbances, significantly impacting their quality of life (46). These symptoms occur at all stages of the disease and are associated with other psychiatric and cognitive manifestations (47).

2.1 Rapid Eye Movement (REM) Sleep Behavior Disorder

REM behavior disorder (RBD) is characterized by the loss of REM sleep atonia, allowing patients to physically act out their dreams (48). It is a key prodromal symptom, appearing 10–15 years before a PD diagnosis (49,50). Studies show that over 90% of patients with isolated RBD progress to PD or other α-synucleinopathies, with PD being the most common (51,52). RBD is confirmed via polysomnography and treated with melatonin (up to 12 mg) or clonazepam (0.25–4 mg) to regulate the sleep cycle, alongside environmental modifications to prevent injuries (48,53). Early detection is crucial for patient safety and quality of life.

2.2 Insomnia and sleep fragmentation

Insomnia in PD involves difficulty initiating or maintaining sleep, affecting 30–80% of patients (54). Initiation insomnia is linked to psychiatric disorders, while maintenance insomnia—affecting 70% of PD patients—is the most common, exacerbated by nocturnal "off" periods due to symptoms like pain, sweating, and nocturia (50). Other triggers

include obstructive sleep apnea syndrome, restless legs syndrome, and periodic limb movement disorder, which cause sleep fragmentation and excessive daytime sleepiness (EDS) (50). The Insomnia Severity Index aids in diagnosing and monitoring insomnia. Initial treatment includes melatonin (3–5 mg), adjustments in dopaminergic medications, and sleep hygiene measures (47,53).

2.3 Excessive daytime sleepiness

EDS, affecting approximately 35% of PD patients, is characterized by the need for daytime naps, often linked to dopaminergic dysfunction and insomnia (55,56). The Epworth Sleepiness Scale, with scores above 10, is commonly used to identify EDS (47). Management strategies involve stimulants like coffee and evening exercise, which promote wakefulness and provide antioxidant benefits (57). Modafinil or methylphenidate is reserved for specific cases, with risk assessments (48). Non-pharmacological treatments such as bright light therapy and sleep hygiene measures can help regulate circadian rhythms, improving sleep schedules (58). Identifying coexisting insomnia and EDS can substantially improve patients' quality of life.

3. Sensory-perceptual symptoms

The majority of PD patients experience sensory-perceptual disturbances, which are often underdiagnosed and receive limited clinical attention, despite potentially preceding motor symptoms by up to five years. This highlights their value for early detection (59).

3.1 Olfactory and visual impairments

Olfaction and vision are the most commonly affected senses in PD, with alterations reported in up to 80% of patients (60,61). Hyposmia, which may precede motor symptoms by several years, indicates disease progression and suggests invasion of Lewy bodies into olfactory circuits (60,62). Studies indicate that this symptom results from the loss of cholinergic and dopaminergic neurons in the olfactory bulb (60). Assessment tools include the University of Pennsylvania Smell Identification Test (63,64).

Visual changes include difficulties with contrast sensitivity, color discrimination, diplopia, and blurry vision, affecting up to 82% of patients (65). Dopaminergic cell loss in the retina, associated with a reduction in synaptic contacts with melanopsin-containing retinal ganglion cells, has been linked to visual dysfunction and impaired contrast sensitivity in PD (66).

3.2 Pain

Pain affects up to 85% of PD patients, with both nociceptive and neuropathic pain fluctuating during "on" and "off" periods, being associated with an increase of pain when dopamine levels drop, as there is increased rigidity, bradykinesia, and abnormal postures, which may contribute to mechanical strain and inflammation (67). The pathophysiology of pain in PD involves complex, multifactorial disruptions in dopaminergic, glutamatergic, serotonergic, noradrenergic, and cholinergic systems that alter pain modulation, perception, and transmission throughout disease progression (67).

Neuropathic pain, which may result from small fiber neuropathy, manifests as burning or prickling sensations, particularly during "off" periods and on the more affected side (68,69). Management includes tricyclic antidepressants and neuromodulators such as pregabalin and gabapentin (67). Options like lidocaine (off-label) and safinamide might be effective in cases of inadequate response and persistence of radicular pain (70,71). Safinamide has demonstrated a reduction in pain levels when used as an adjunct to levodopa, especially during "off" periods (72). Regarding other strategies, physical exercise, yoga, or tai chi might help to improve pain (73). Evaluation involves a detailed anamnesis and the use of the MDS-NMS-Q to assess pain severity and its psychological impact (41). More advanced diagnostic methods, such as microneurography and evoked potentials, may also be employed but are not routinely used due to high costs (67,68).

4. Autonomic Symptoms

4.1 Orthostatic hypotension (OH)

Orthostatic hypotension in PD refers to a drop in blood pressure upon standing, associated with α-synuclein deposits and loss of efferent sympathetic neurons (74). It affects up to 30% of patients, increasing the risk of falls (75). Distinguishing neurogenic from non-neurogenic OH is essential, as the former reflects the underlying pathophysiology of PD, while the latter often stems from reversible factors such as dehydration or physical deconditioning (76). Dopaminergic treatment may exacerbate OH (77).

This symptom in PD is clinically diagnosed by a sustained drop of ≥20 mmHg systolic or ≥10 mmHg diastolic within 3 minutes of standing, after ruling out other causes. The MDS-NMS-Q and the Orthostatic Grading Scale are useful tools for diagnosis (41,78). Non-pharmacological strategies include lifestyle modifications, such as postural adjustments, adequate hydration, and avoiding large meals (76). Pharmacological treatment, when needed, involves sympathomimetic agents such as droxidopa, midodrine, and fludrocortisone (79).

4.2 Gastrointestinal dysfunction

Gastrointestinal (GI) symptoms in PD, such as dysphagia, early satiety, and constipation, often emerge early and are linked to α-synuclein accumulation in the GI tract (80). The frequency of these symptoms in PD patients varies: dysphagia may develop in more than 80% of patients as the disease progresses (81); sialorrhea affects up to 80% (82); and symptoms of gastroparesis (such as nausea, vomiting, and abdominal bloating) occur in up to 45% of patients (83), impacting nutrition and quality of life. Small intestinal bacterial overgrowth, observed in around 50% of patients, exacerbates GI symptoms and may worsen motor dysfunction (84).

Management includes probiotics to regulate intestinal microbiota, dietary adjustments emphasizing high fiber intake, coffee intake, and adequate hydration (85–87). Additional treatments involve prokinetic agents like domperidone, though dopamine D2 receptor antagonists that cross the blood-brain barrier, such as metoclopramide, are contraindicated in PD (88). Domperidone should be administered with caution, as it has been associated with cardiac electrophysiological abnormalities and an increased risk of mortality (89). In severe cases, laxatives may be employed, with careful monitoring of levodopa absorption and efficacy (90). Other treatment strategies, such as gastric electrical stimulation or botulinum toxin injections into the pyloric or anal sphincters and submandibular glands, have been studied but currently have limited evidence (83,86).

4.3 Urinary dysfunction

Approximately 27-85% of PD patients experience urinary dysfunction early on, with detrusor hyperactivity linked to central dopaminergic degeneration, autonomic dysfunction, and impaired inhibitory control by the basal ganglia (91-93). Symptoms include increased frequency and incontinence, which are associated with increased fall risk and potentially worse motor and cognitive prognosis (94). The International Consultation for Incontinence Questionnaire and the Over Activity of the Bladder Questionnaire facilitate clinical evaluation (95). Management includes antimuscarinic agents, α-3 adrenergic agonists, intravesical botulinum toxin, and lifestyle adjustments such as scheduled voiding and controlled fluid intake (93,96). Deep brain stimulation of the subthalamic nucleus may also improve detrusor hyperactivity and nocturia (97).

4.4 Sexual dysfunction

Sexual dysfunction affects over 50% of early-stage PD patients and includes reduced libido, erectile and ejaculatory disorders, and vaginal dryness, primarily due to dopaminergic depletion (92). Tools like the International Index of Erectile Function and Female Sexual Function Index assess these symptoms (98). Management is individualized and may involve CBT and sex therapy and pharmacological treatment such as sildenafil and apomorphine (for erectile disorder in men) (98).

5. Cognitive symptoms

Cognitive impairment in PD spans from early to advanced stages. Between 24.5% and 31.1% of patients develop dementia, rising to 46% after 10 years and up to 83% after 20 years post-diagnosis (99,100). Approximately 20% of patients exhibit mild cognitive impairment (MCI) at diagnosis (99). Risk factors include hallucinations, advanced age, low educational attainment, and depression, with up to 40% of cases potentially preventable through early lifestyle interventions (101,102). Mitochondrial dysfunction, amyloid deposition, and cerebrovascular alterations contribute to cognitive decline, alongside dysfunction in frontotemporal neural networks (99). Affected domains include visuospatial, attentional, memory, and executive functions (103).

Cognitive phenotypes in PD include subjective cognitive decline (SCD), MCI, and dementia. SCD refers to self-perceived decline without objective impairment on standardized tests (104). MCI involves deficits in one or more cognitive domains, with preserved functional independence (103). Dementia is characterized by impairment in at least two domains, severe enough to interfere with daily life beyond the impact of motor symptoms (99,105).

The Montreal Cognitive Assessment (MoCA) is the

most commonly used screening tool for cognitive impairment in PD, offering good sensitivity for early deficits and guiding the need for further neuropsychological evaluation (99,106). Treatments include rivastigmine for PD dementia, while non-pharmacological strategies are employed for MCI, though long-term outcomes remain uncertain (107). Psychoeducation, cognitive-behavioral interventions, and mindfulness-based approaches show promising results, but their efficacy remains under investigation (108,109). Physical exercise, especially resistance and aerobic training, improves memory, attention, and processing speed, positively impacting quality of life (110).

Conclusions

PD presents a multidimensional clinical challenge, with non-motor symptoms contributing substantially to functional decline, reduced quality of life, and increased healthcare complexity. These symptoms, spanning neuropsychiatric, cognitive, autonomic, and sensory domains, require continuous and personalized management beyond initial diagnosis. Tools like the MDS-NMS-Q (41) provide structured frameworks for symptom evaluation, while domain-specific instruments support more precise clinical assessment and therapeutic decision-making. Moreover, motor fluctuations deserve particular attention, as "off" and "on" periods in PD can contribute to the exacerbation of non-motor symptoms.

Despite growing awareness of the relevance of non-motor symptoms, significant gaps persist in their systematic assessment and integration into routine care. Advancing multidisciplinary, patient-centered strategies requires not only early detection but also ongoing reassessment and therapeutic plans tailored to evolving patient needs. Future research should focus on identifying and validating biomarkers capable of detecting and monitoring non-motor symptoms at early stages, facilitating prompt and targeted interventions.

In parallel, the development of disease-modifying therapies suitable for early use, along with more effective and individualized symptomatic treatments, remains a key objective for improving long-term outcomes. Enhancing the understanding and management of non-motor symptoms is essential to advance the quality of care in PD, not only by improving clinical outcomes but also by alleviating the broader personal and societal burden associated with the disease (7).

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AI disclosure statement. The authors declare that no artificial intelligence (AI) was used in the creation or writing of this article.

Data availability statement. The authors declare that there are no open-access data available in repositories. For any inquiries or requests related to the article, please contact the corresponding author.

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Supplementary material

Appendix A. Search queries for each database

Search date: April 2025

PubMed

1. **Neuropsychiatric Symptoms**
   a. (Parkinson's disease[Title/Abstract]) AND (Depression[Title/Abstract]) AND (Anxiety[Title/Abstract]) Filters: in the last 10 years
   b. (Parkinson's disease[Title/Abstract]) AND (Psychosis[Title/Abstract]) Filters: in the last 10 years
   c. (Parkinson's Disease[Title/Abstract]) AND ("Impulse Control Disorders"[Title/Abstract] OR Compulsive Behavior[MeSH]) Filters: in the last 10 years
   d. (Parkinson's disease[Title/Abstract]) AND (Apathy[Title/Abstract]) Filters: in the last 10 years
2. **Sleep disorders**
   a. (Parkinson's disease[Title/Abstract]) AND (Sleep Wake Disorders[Title/Abstract] OR Dyssomnias[Title/Abstract] OR REM Sleep Behavior Disorder[Title/Abstract]) Filters: in the last 10 years
3. **Sensory-Perceptual Symptoms**
   a. Parkinson's disease[Title/Abstract] AND (Sensation Disorders[MeSH] OR Autonomic Nervous System Diseases[MeSH]) Filters: in the last 10 years
4. **Autonomic Symptoms**
   a. Parkinson's disease[Title/Abstract] AND Hypotension, Orthostatic[MeSH] Filters: in the last 10 years
   b. Parkinson's disease[Title/Abstract] AND Gastrointestinal Diseases[MeSH] Filters: in the last 10 years
   c. Parkinson's disease[Title/Abstract] AND (Urinary Bladder, Neurogenic[MeSH] OR Urinary Incontinence[MeSH]) Filters: in the last 10 years
   d. Parkinson's disease[Title/Abstract] AND Sexual Dysfunction[MeSH] Filters: in the last 10 years
5. **Cognitive Symptoms**
   a. Parkinson's disease[Title/Abstract] AND (Cognitive Dysfunction[MeSH] AND Dementia[Title/Abstract]) Filters: in the last 10 years

Embase

1. **Neuropsychiatric Symptoms**
   a. ('parkinson disease':ti,ab AND depression:ti,ab AND anxiety:ti,ab) AND [2015-2025]/py
   b. ('parkinson disease':ti,ab AND psychosis:ti,ab) AND [2015-2025]/py
   c. ('parkinson disease':ti,ab AND ('impulse control disorder':ti,ab OR 'compulsive behavior'/exp)) AND [2015-2025]/py
   d. ('parkinson disease':ti,ab AND apathy:ti,ab) AND [2015-2025]/py
2. **Sleep disorders**
   a. ('parkinson disease':ti,ab AND ('sleep wake disorder':ti,ab OR dyssomnia:ti,ab OR 'rem sleep behavior disorder':ti,ab)) AND [2015-2025]/py
3. **Sensory-Perceptual Symptoms**
   a. ('parkinson disease':ti,ab AND olfactory impairment'/exp) AND [2015-2025]/py
   b. 'parkinson disease':ti,ab AND 'visual impairment' AND [2015-2025]/py
   c. 'parkinson disease':ti,ab AND 'pain' AND [2015-2025]/py
4. **Autonomic Symptoms**
   a. 'parkinson disease':ti,ab AND 'orthostatic hypotension'/exp AND [2015-2025]/py
   b. ('parkinson disease':ti,ab AND 'gastrointestinal disease'/exp) AND [2015-2025]/py
   c. ('parkinson disease':ti,ab AND ('neurogenic bladder'/exp OR 'urinary incontinence'/exp)) AND [2015-2025]/py
   d. ('parkinson disease':ti,ab AND 'sexual dysfunction'/exp) AND [2015-2025]/py
5. **Cognitive Symptoms**
   a. ('parkinson disease':ti,ab AND 'cognitive disorder'/exp AND dementia:ti,ab) AND [2015-2025]/py

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1. "Parkinson's disease" AND (depression OR depressão OR depresión) AND (anxiety OR ansiedade OR ansiedad)
2. "Parkinson's disease" AND (psychosis OR psicose OR psicosis)

3. "Parkinson's disease" AND ("impulse control disorder" OR "transtorno do controle do impulso" OR "trastorno del control de impulsos" OR "compulsive behavior" OR "comportamento compulsivo" OR "conducta compulsiva")
4. "Parkinson's disease" AND (apathy OR apatia)
5. "Parkinson's disease" AND ("sleep disorder" OR "distúrbio do sono" OR "trastorno del sueño" OR dyssomnia OR dissonia OR "REM sleep behavior disorder")
6. "Parkinson's disease" AND ("olfactory disorder" OR "olfactory dysfunction" OR "smell disorder" OR "transtorno olfativo" OR "disfunção olfativa" OR "trastorno olfativo" OR "disfunción olfativa")
7. "Parkinson's disease" AND (pain OR "chronic pain" OR "neuropathic pain" OR dor OR "dor crônica" OR "dor neuropática" OR dolor OR "dolor crónico" OR "dolor neuropático")
8. "Parkinson's disease" AND ("orthostatic hypotension" OR "hipotensão ortostática" OR "hipotensión ortostática")
9. "Parkinson's disease" AND ("disfagia")
10. "Parkinson's disease" AND ("sialorrea")
11. "Parkinson's disease" AND ("neurogenic bladder" OR "bexiga neurogênica" OR "vejiga neurógena" OR "urinary incontinence" OR "incontinência urinária" OR "incontinencia urinaria")
12. "Parkinson's disease" AND ("sexual dysfunction" OR "disfunção sexual" OR "disfunción sexual")
13. "Parkinson's disease" AND ("cognitive dysfunction" OR "disfunção cognitiva" OR "disfunción cognitiva") AND (dementia OR demência OR demencia)

Appendix B. quality stratification of included studies based on Oxford Centre for Evidence-Based Medicine Classification

Subsection	Oxford Centre for Evidence Based Medicine Classification									
	1a	**1b**	**1c**	**2a**	**2b**	**2c**	**3a**	**3b**	**4**	**5**
Neuropsychiatric symptoms	7	5	0	7	5	1	0	2	1	9
Sleep disorders	1	0	0	2	2	0	0	1	0	7
Sensory/perceptual symptoms	0	2	0	0	0	0	0	3	0	11
Autonomic symptoms	2	0	0	2	0	0	1	1	0	20
Cognitive dysfunction	2	1	0	2	3	0	0	0	0	4
Total (n=102)	12	8	0	13	10	1	1	7	1	51

Note. Articles cited in the introduction section not included.

Source: Own elaboration.