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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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EXPLORING CLINICAL VARIATIONS AND CO-MORBID TRENDS IN PD-MCI GROUPS

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Abstract.

Background: Parkinson's Disease in Mild Cognitive Impairment (PD-MCI) is a complex condition characterized by a variety of cognitive problems that coexist with the physical symptoms of Parkinson's disease (PD).

Objective: This study aims to examine the different medical indicators and associated tendencies among different PD-MCI groups.

Methods: We investigated 132 people who had been given PD-MCI diagnoses. Utilizing SPSS, statistical evaluations are carried out.

Results: In overall PD-MCI variants, this investigation found that visuospatial ability and attentional/executive performance are the most impaired cognitive areas. It was also noticed that distinct PD-MCI groups had variances in their neurological characteristics, in multi domain amnesia (Non-Memory) PD-MCI patients exhibiting especially severe issues with unstable posture and walking.

Conclusion: The intricacy of PD- Mild Cognitive Impairment (MCI) is highlighted by those results, which also imply that the interplay between mental and physical signs may be controlled by a number of interrelated factors, such as particular cognitive areas, brain surfaces, and the general level of cognitive impairment.

Key words. Parkinson’s disorder (PD), medical signs, cognitive impairment, neurological characteristics.

Introduction.

Parkinson's Disease in Mild Cognitive Impairment (PD-MCI) is a challenging and complicated neurological condition that has attracted a considerable amount of attention in recent times due to its complexity and the profound impact it exerts on the lives of patients. PD-MCI is indicated by a decrease in cognitive abilities that exceeds what is associated with age-related cognitive decline but isn't severe to qualify for dementia criteria [1]. The condition affects a significant number of individuals with PD, an illness that leads to neurological symptoms such as shaking, stiffness, and movement disorders. However, the mental aspects of PD-MCI are overlooked, making it crucial to understand the clinical variations and movements associated with this condition for providing comprehensive care and therapy [2]. A thorough knowledge of PD-MCI requires acknowledging the notable variation in clinical manifestations of the illness. While memory loss characterizes this condition cognitive impairment can manifest in various ways among individuals. Some individuals experience memory issues, which are typical symptoms of PD-MCI and indicative of the onset of PD dementia. Others may face executive dysfunction, affecting their organizational skills, planning, and decision-making abilities. Additionally, the physical aspects of PD-MCI can involve visual and cognitive challenges. These variations not only pose challenges for diagnosis but also present specific difficulties in managing and providing care for those affected [3].

Moreover, it is essential to examine the interconnected patterns in PD-MCI. Other medical conditions may coexist with PD-MCI, impacting the overall medical status of individuals. For instance, depression is an associated condition in PD-MCI, up to 50% of patients experiencing depressive symptoms throughout the course of their disease. Depression not only influences the individual's overall quality of life can also contribute to cognitive impairment [4]. Similarly, anxiety is another coexisting condition in PD-MCI, potentially leading to cognitive decline by increasing stress and depleting cognitive reserve. Additionally, sleep disturbances, including sleep disruptions and Rapid Eye Movement (REM) sleep behaviour disorder co-occur with PD-MCI, exacerbating cognitive symptoms and compromising motor performance [5]. One of the biggest obstacles to comprehension in PD-MCI is its variety. A number of factors, such as the age at which PD initially manifested, the degree of the ailment, the patient's medical history, and a lewy body disease diagnostic, have been connected to diagnosis disparities among the PD-MCI group (2011). For instance, those with earlier onset PD may be more prone to memory issues with the cognitive deterioration rate may differ from those with later onset. Additionally, the stage of PD is linked an elevated risk of memory loss, with more prolonged disease course linked to higher likelihood of cognitive impairment. Various genetic variations can also influence cognitive function in PD-MCI. Notably, the presence of Lewy body disease, marked by an increase in abnormal alpha-synuclein protein, correlates with memory decline in PD. The number and location of Lewy body structures in the brain can result in a range of neurological symptoms in the PD-MCI population [6]. Alongside the diagnostic variations, the diverse patterns in PD-MCI impact patient care and treatment. Depressive disorders, a common comorbidity, remain unidentified and untreated despite their substantial influence on a patient's well-being. This not only complicates the patient's emotional state but also worsen memory loss and motor symptoms. Anxiety, another prevalent comorbidity, can contribute to ongoing stress, diminished cognitive performance, and heightened anxiety levels. Moreover, sleep issues are frequently overlooked, yet they can significantly affect both cognitive and physical symptoms. For instance, REM sleep disorder can lead to intense

and sometimes life-threatening recurring visions, disrupt sleep patterns, and impact overall cognitive performance [7,8]. Accurate and specialized strategies are necessary to provide effective treatment for individuals with PD-MCI. To customize evaluation and treatment, physicians must consider the medical variations and associated patterns in each individual's condition. Comprehensive assessment of issues requires mental tests that examine various cognitive domains. Moreover, recognizing and managing associated conditions like anxiety, insomnia, and depression is crucial for delivering comprehensive care. Addressing the complex interplay between memory loss and PD, this research aims to investigate clinical differences and comorbid trends in the PD-MCI group [9].

The study [10] compared the recruitment histories of two sets of patients to separate controls populations: well-being matched in age control participants and persons with Subjective Cognitive Impairment (SCI). The goal was to determine if there was a misbinding deficit in a late-onset Alzheimer's Disease (AD) and if PD had increased cognitive performance. Everyone took part in a Sensitive Short-Term Memory (STM) exercise that requires a fine-grained comprehension of object-location groupings. The study [11] examined cognitive and structural brain impairments in patients with Cognitively Normal Parkinson's Disease (PD-CN) and PD-MCI using Event-Related Potentials (ERP) P 300 and comprehensive Magnetic Resonance Imaging (MRI). There were 23 unaffected controls and twenty-three individuals with PD-CN who were matched. The reduced frontal P300 levels observed in PD-CN indicated that P300 magnitude might be a valuable diagnostic tool for identifying preclinical abnormalities before cognitive and structural changes occur in PD. The study [12] evaluated the cognitive abilities of healthy controls, PD patients with normal cognitive function, and PD patients with mild cognitive impairment (MCI). The Montreal Cognitive Assessment Test (MoCA) was used for categorization. Primary cognitive processes such as memory, attention, executive functioning, and visual processing were reduced in PD-MCI. The study found a high correlation between cognitive function and PD clinical characteristics. The research [13] aimed to investigate the relationship between the level of physical inactivity in PD sufferers' results on neuropsychological assessments assessing executive functions. Additionally, it analyzed the neural correlates of indifference in PD patients, building upon previously identifying in the field. The study's findings successfully confirmed the researchers' initial predictions. The study [14] employed qualitative motion factors and a machine learning (ML) technique to differentiate PD individuals either exhibiting or lacking MCI. The cognitive complex-task had the best average precision and clarity, whereas the movement task had the greatest mean sensitivity. The findings showcased the usefulness of gait analysis and ML in diagnosing MCI in PD individuals. The study [15] aimed to aid in the identification of MCI in PD patients by investigating brain connectivity indicators associated with MCI. This investigation utilized diffusion-based scanning and active-state MRI. To pinpoint the characteristics with sufficient discriminatory capacity for patient categorization, all indicators underwent a pertinent attribute selection method in cross-validation loops. The findings of this study provided early confirmation of abnormal structural and functional connections associated with MCI in PD patients. The paper [16] examined the Electroencephalography (EEG) characteristics of various sub-bands associated with MCI in individuals with initial-phase PD. Significant disparities in synchronization levels between the two groups were observed in the theta, gamma, and delta bands. The findings indicated the emergence of anomalies in EEG activity, particularly in the gamma, delta, and epsilon bands, during the initial phase of PD with MCI. The detection of these abnormalities was facilitated through power spectrum and cross-band connectivity studies. The study [17] was to use quantitative electroencephalography (QEEG) and low-resolution electromagnetic tomography (LORETA) research to investigate brainwave networks linked to cognitive problems in PD-MCI. 102 individuals from the Parkinson's Disease Cognitive Impairment Research (PaCoS) Cohort were chosen for the study. The findings of the research revealed consistent brainwave changes in PD-MCI patients across multiple techniques, confirming their authenticity and underscoring the significance of the results. The study [18] aimed to assess theoretical measurements of gray matter decline in PD-MCI and their connections to functional connectivity, along with graphical representations of these relationships. The researchers identified an association between visuospatial performance and the degree of the right supramarginal gyrus node. Their research suggested that the salience network areas in PD-MCI experienced a decline in operational connectivity and topological properties without undergoing structural harm. Additionally, their findings underscored the significance of multimodal hubs in the transition to MCI. The study [19] investigated whether MCI moderated the relationship between cognitive function and mental symptoms in PD. To explore this relationship and the moderating role of PD-MCI status, the researchers conducted linear regression analyses. Enhancing cognitive adaptability was identified as one of the most crucial therapeutic approaches for managing neuropsychiatric symptoms in PD. The article [20] provided more detail on the exploration of memory impairment and decline in thinking, as well as the associated clinical characteristics, among individuals with PD without dementia. Additionally, the researchers carried out a thorough evaluation of each group performed in a comprehensive PD-MCI diagnostic examination. This evidence supported distinct cognitive patterns in PD-MCI and encouraged further exploration of the clinical associations and imaging links of these patterns.

Our goal is to gather comprehensive data on a wide range of clinical aspects and comorbid conditions. Collaboration among neurological specialists, psychiatrists, and sleep specialists can be necessary for effectively treating these complex patterns.

Materials and Methods.

A predictive experimentation in 355 consecutive PD patients was performed over 2 ½ years in India. And 132 PD-MCI individuals from the study were investigated. Movement disorders neurologists that examined all the PD people found that they fulfilled the specifications of the United Kingdom (UK) PD Society Brain Trust. Unusual or secondary Parkinsonism that led to dementia diagnosis, and previous neurosurgical procedures are among the list of exclusions.

The medical history, current medications, demographics, and disease-specific markers, including the Hoehn and Yahr rating, the motor evaluation of the Unified Parkinson's Disease Rating Scale (UPDRS), and the UPDRS Section I Cognitive Disorders assessment, were all included in the clinical inquiry. The benchmark for quantifying (PD) treatments was the Levodopa Equivalent Daily Doses (LEDD).

Individual motor item scores were segregated into six components using established weighted factor loadings to examine the relationship between specific motor components of the UPDRS motor assessment and PD-MCI subgroups. These components included axial functioning/gait, resting tremor, stiffness, right and left bradykinesia, and postural tremor. The existence of diabetes, high blood pressure, high cholesterol, coronary artery disease, or cerebrovascular illness generated cumulative vascular risk scores (0–5).

The Mini Mental State Examination (MMSE) and the Hamilton Depression Rating Scale (HDRS) were two of several tests used in the neuropsychological evaluation, alongside various cognitive tests categorized into four groups: (a) attentional/ executive function, (b) declarative recall, (c) language, and (d) visual function. The cognitive tests included the Symbol Digit Modalities Assessment, the Digit Span assessment, a semantic fluency test for animal naming within one minute, three attempts for a list of words, and the Consortium to Establish a Registry for Alzheimer's Disease (CERAD).

Inclusion Criteria:

Parkinson's disease must be diagnosed with certainty using accepted clinical criteria in order for participation to take place. Instead of more severe cognitive impairment or dementia, participants should be labeled with mild cognitive impairment (MCI). According to accepted MCI criteria, this diagnosis should be made. Indicate the age range that will be covered to make sure the study is applicable to a certain group of people. Participants might, for instance, have to fall into a specific age range that is frequently impacted by PD-MCI.

Exclusion Criteria:

Exclude those who have dementia or significant cognitive impairment in order to concentrate on the PD-MCI population. People with other serious neurological conditions (such Alzheimer's disease) should not be included as they may skew the study's findings. Disqualify anyone with serious mental illnesses that could have an independent, substantial influence on cognitive performance from PD-MCI. People with unstable medical problems (apart from Parkinson's disease) that may impair cognitive function or cause difficulties during participation ought to be disqualified.

Cognitive Categorization.

Normative data were employed to convert the raw results of cognitive tests into z-scores. To accommodate variations in the number of tests conducted in each cognitive domain, z-scores from tests across all areas were averaged to derive domain scores. A z-score of ≤ -1.5 in a specific domain was utilized to define impairment. Only the intersecting pentagons item from the MMSE was utilized. PD participants were classified as having PD-MCI if their cognitive evaluation indicated a decline in cognition, with a z-score of ≤ -1.5 in any of the four cognitive areas or if they did not meet the MDS-PDD criteria. While not obligatory for a PD-MCI diagnosis, 87% of the study participants reported subjective cognitive issues. Cases of dementia (n=37) and those with intact cognition (n=192) were excluded from the study, resulting in a reduced sample from the original 355 PD individuals.

Subtypes of PD-MCI patients.

These methods resulted in the categorization of PD-MCI participants into four distinct subtypes: single domain amnesia (SDA), which exhibited memory dysfunction; MDA in which individuals experienced difficulties with memory as well as issues in several different cognitive areas; SDA (Non-Memory), where the condition indicated SDA (Non-Memory); and MDA, with individuals demonstrating impairment across multiple non-memory cognitive areas.

Single Domain Amnesia:

Amnesia is typically defined by partial or whole loss of memory; if the condition is classified as single domain, it may mean that only a single area of the brain is affected. This could involve retrograde or anterograde amnesia, which is the inability to create new memories.

Multi Domain Amnesia:

A more widespread or generalized kind of amnesia that affects several cognitive domains or memory types may be implied by the term multi domain amnesia. This may entail deficits in both short- and long-term memory, impacting different facets of cognitive abilities.

Contributing Factors	Description
Age	Cognitive decline is associated with advanced age, and this is also the case for those who have PD.
Disease Duration	The length of time a person has had PD may be associated with an increased risk of cognitive impairment.
Motor Symptoms Severity	The severity and progression of motor symptoms in PD may correlate with the degree of cognitive decline.
Neurotransmitter Changes	Alterations in neurotransmitter systems, particularly dopamine, are implicated in both motor symptoms and cognitive impairment in PD.
Genetic Factors	Certain genetic factors may increase the risk of cognitive impairment in individuals with Parkinson's Disease. Variations in specific genes have been associated with cognitive decline.

Statistical Analyses.

SPSS 18.0 was utilized for statistical analysis. The comparison of PD-MCI subtypes involved the Kruskal-Wallis test for discrete variables and one-way Analysis of Variance (ANOVA) for demographics and disease-related variables. Levene's test for homogeneity was conducted to assess variance equality, and non-parametric assessments were employed for continuous variables with differing variances. Bonferroni adjustments

were applied to address multiple comparisons considering the unequal sample sizes.

To compare the single- and multiple-domain PD-MCI types, separate t-tests or chi-square tests were employed. Multinomial logistic regression analyses assessing factors of the PD-MCI subtype designated the SDA (Non-Memory)type as the baseline. A criterion of $p < 0.05$ was established for statistical significance.

Cognitive Classification.

Cognitive test raw scores were normalized using normative data to explore clinical variations and comorbid patterns in PD-MCI groups. Domain-specific cognitive area scores were derived as the mean of the normalized scores, accounting for differences in the number of assessments with each domain. Impairment was defined as a normalized score of $\leq$ -1.5 in a specific domain. The MMSE was used for descriptive purposes, with the exception of the intersecting pentagons item.

Results.

Cognitive features of PD-MCI patients:

The research covered all four MCI subtypes, distributed as follows: SDA (Non-Memory) was identified in 30.8% of cases, MDA in 25.3%, SDA in 20.8%, and MDA (Non-Memory) in 25.5%. Notably, non- amnesia impairments were predominant, affecting 59% of patients. Within the PD-MCI group, approximately two-thirds exhibited deficits in a single area, including both amnesia and non- amnesia types. Visuospatial deviations were the most common (75.7%) within the SDCI category, followed by attentional/executive issues (25%) and linguistic challenges (10.2%). Among individuals with impairments across multiple domains, 79.6% had two domains implicated, 27.4% had three domains affected, and no cases of impairment were found across all four domains.

Contrast of PD-MCI subtype:

Figure 1 and Table 1 shows that there were no obvious variations in gender, age, and education within PD-MCI categories. The average UPDRS movement scores were greater in the two multi-domain groups compared to the mono-domain variants; across PD-MCI subtypes, there was no discernible difference in risk variables, LEDD in the PD duration, or UPDRS part three motor scores.

However, the Hoehn and Yahr rating revealed significant differences in motor performance between PD-MCI variants ($\chi 2$ [2,N=130]= 9.15,p=0.07). Particularly, the Hoehn and Yahr stages were notably more advanced in participants with MDA (Non-Memory) PD-MCI compared to those with SDA, PD-MCI subjects (p=0.07, multiple comparisons corrected). Furthermore, statistically notable variations were found between the PD-MCI categories in axial function, one of the six distinct UPDRS factors (F [2,119] = 2.73,p=0.07). Subjects with MDA (Non-Memory) exhibited poorer axial function compared to SDA (Non-Memory)subjects (p=0.09), as illustrated in Table 2 and Figure 2.

Extra-motor features, including depression and psychosis, did not display significant variations between PD-MCI subtypes. However, there was a notable difference in the frequency of antidepressant or anxiolytic medication usage, with MDA PD-MCI participants receiving treatment more than with MDA (Non-Memory) PD-MCI.

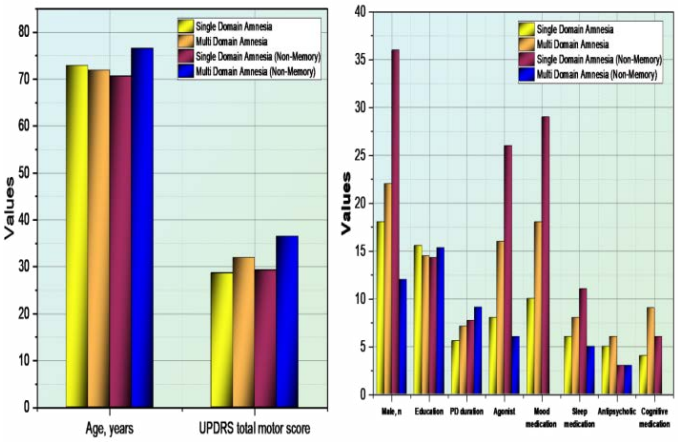

Figure 1. *.Clinical features of PD-MCI profiles.*

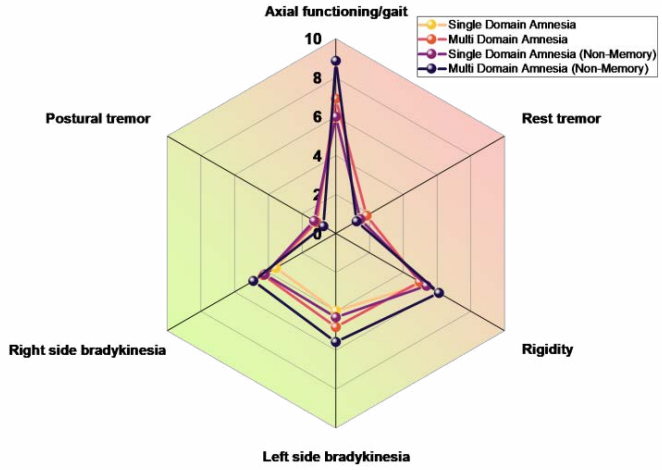

Figure 2. *Factor scores for PD-MCI subtypes in the UPDRS.*

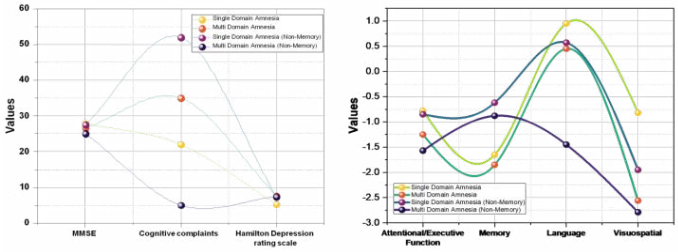

Figure 3. *Neurocognitive Scores for Different PD-MCI Subtypes.*

According to established standards, significant differences were observed between PD-MCI subtypes in terms of cognition and MMSE scores (F [2,126]=18.86,p < 0.0001), with participants with MDA (Non-Memory) PD-MCI exhibiting the lowest MMSE scores, as illustrated in Figure 3 and Table 3. Additionally, there was a notable tendency among MDA PD-MCI participants to use cognitive drugs more frequently($\chi 2$ [2,N=130] = 7.49,p=0.08).

Rather than formally categorizing PD-MCI types as single-domain or multiple-domain, we conducted a comparative analysis of cognitive impairment between single-domain and

Table 1. *Subtypes of PD-MCI's clinical features.*

Characteristics	Single Domain Amnesia (N=20)	Multi Domain Amnesia (N=40)	Single Domain Amnesia (Non-Memory) (N=30)	Multi Domain Amnesia (Non-Memory) (N=42)	probability value
Generation, Lifetime	72.85 (10.65)	71.85 (6.85)	70.55 (10.81)	76.52 (6.05)	0.28
Man, n (%)	18 (68.7)	22 (64.9)	36 (52.4)	12 (66.9)	0.56
Education, years	15.54 (3.45)	14.45 (3.42)	14.29 (2.52)	15.29 (3.09)	0.39
duration of PD, years	5.57 (4.25)	7.12 (4.12)	7.67 (5.19)	9.08 (7.22)	0.21
Parkinson's Motor Assessment Score	28.65 (11.23)	31.87 (11.12)	29.23 (12.18)	36.45 (11.08)	0.26
Hoehn &Yahr Staging (Midpoint and span)	2.0, 2–4	2.0, 2–5	3, 1–4	3, 2–5	0.07
Median and Range of Cardiovascular Risk Score- - Activator, number (%)	1.0, 0–5	1.0, 0–4	1.0, 0–4	1.5, 0–3	0.56
Activator, n (%)	8 (25.5)	16 (32.5)	26 (39.6)	6 (33.45)	0.68
Psychotropic Medication (Antidepressant/ Anxiolytic), n (%)	10 (33.45)	18 (45.7)	29 (34.9)	0 (0)	0.06
Sleep medication, n (%)	6 (16.9)	8 (16.6)	11 (14.9)	5 (25.45)	0.83
Antipsychotic, n (%)	5 (12.8)	6 (9.9)	3 (1.8)	3 (8.5)	0.27
Cognitive medication, n (%)	4 (8.5)	9 (22.9)	6 (6.8)	0 (0)	0.08
LEDD, mg/d	375.68 (308.46)	524.89 (368.89)	550.39 (552.68)	753.99 (438.45)	0.18

MDA (Non-Memory) vs. SDA, PD-MCI, p = 0.07.
MDA (Non-Memory) vs. MDA PD-MCI, p=0.03.

Table 2. *Subtypes of PD-MCI with UPDRS factor scores.*

Characteristics	Single Domain Amnesia (N=20)	Multi Domain Amnesia (N=40)	single Domain Amnesia (Non-Memory) (N=30)	Multi Domain Amnesia (Non-Memory) (N=42)	Probability value
postural control and locomotion	5.98 (2.89)	6.92 (3.56)	5.99 (3.34)	8.86 (4.23)	0.09
Rest tremor	1.45 (1.88)	1.82 (2.26)	1.45 (2.25)	1.23 (2.45)	0.85
Rigidity	5.19 (2.48)	4.98 (2.48)	5.38 (2.59)	6.12 (1.79)	0.62
left-side slowness of movement	3.98 (2.46)	4.81 (2.05)	4.31 (1.95)	5.58 (1.88)	0.23
Right side slowness of movement	3.56 (1.89)	4.29 (2.05)	4.21 (2.15)	4.89 (1.52)	0.45
Action tremor	1.17 (1.25)	1.15 (1.19)	1.29 (1.19)	0.74 (1.15)	0.62

MDA (Non-Memory) vs. SDA (Non-Memory), p= 0.09.

Table 3. *Neurocognitive assessment of PD-MCI subgroups.*

Characteristics	Single Domain Amnesia (N=20)	Multi Domain Amnesia (N=40)	Single Domain Amnesia (Non-Memory) (N=30)	Multi Domain Amnesia (Non-Memory) (N=42)	Probability value
MMSE	27.92 (1.54) *	26.65 (1.56)	27.56 (1.53) ^	25.09 (3.48)	<0.0001
Cognitive complaints, n (%)	16 (80)	†40 (100)	25 (83.3)	5 (11.9)	0.04
HDRS	5.26 (3.26)	7.66 (4.38)	7.42 (4.19)	7.35 (3.78)	0.28
UPDRS Cognitive Dysfunction score (Midpoint and span).	0, 0–3	0.5, 0–4	0.5, 0–3	0.5, 0–1	0.86
Z-scores for cognitive abilities					
Cognitive Control	−0.78 (0.62)	−1.25 (0.59)	−0.85 (0.75)	−1.57 (0.55)	<0.0001
Cognitive ability	−1.65 (0.38)	−1.85 (0.45)	−0.62 (0.62)	−0.88 (0.56)	<0.0001
Language	0.95 (1.62)	0.45 (1.23)	0.57 (1.35)	−1.45 (2.45)	0.04
spatial-visual	−0.82 (0.76)	−2.56 (3.26)	−1.95 (1.68)	−2.79 (0.99)	<0.0001

**SDA vs. MDA, p=0.03; vs. MDA p<0.0001.*
^SDA (Non-Memory) vs. MDA, p=0.04; MDA p<0.0001.
†MDA vs. SDA, p=0.04; vs. SDA (Non-Memory), p =0.04 vs. MDA, p=0.04.

multiple-domain PD-MCI subgroups to evaluate the extent of cognitive decline. Our findings revealed that multiple-domain PD-MCI participants exhibited lower MMSE scores compared to single-domain PD-MCI subjects (t [132] = 5.11,p < 0.001) and reported cognitive issues more frequently (t [132] = 2.17,p = 0.03).Regarding motor function, the Hoehn and Yahr rating, UPDRS components representing axial/gait function, and left-sided bradykinesia all indicated poorer motor function in multiple-domain PD-MCI participants (t [132] = 1.96,p = 0.05), as did left-sided disorders(t [121] = 2.09,p = 0.04).

PD - MCI Subtype Predictors:

Multinomial logistic regression models were utilized to analyze the contributing factors to PD-MCI subgroups. The predictors included the vascular risk factor score, age, duration of PD, LEDD, HDRS, and motor severity, while the PD-MCI category served as the dependent variable. The model was significantly improved ($\chi2$ = 11.46,df = 4,p = 0.001) with the addition of the Hoehn and Yahr ratings, which revealed a notable distinction between SDA PD-MCI and MDA (Non-Memory) PD-MCI (Wald = 8.89, p = 0.003).

Significant variations were discovered among SDA and MDA (Non-Memory) PD-MCI (Wald = 5.92, p = 0.02), with walking ability being the only UPDRS motor component influencing these distinctions ($\chi2$ = 8.33,df = 4,p = 0.007). Interestingly, UPDRS total motor scores, depression, LEDD, age, duration of the PD, and vascular variables did not predict the PD-MCI classification.

$$\log\left(\frac{p}{1-p}\right)=\beta0+\beta1x1+\beta2x2+\ldots+\beta kxk$$

p is the probability of the event occurring,

$\beta0$ is the intercept,

$\beta1$, $\beta2$,……, βk are the coefficients for the independent variables $x1$, $x2$,……xk.

The odds ratio for a one-unit change in an independent variable x_i is given by:

odds Ratio = e $^{\beta i}$

e *is the base of the natural logarithm.*

βi *is the coefficient for the corresponding independent variable* x_i

Strength.

Cognitive function in PD correlates with typical neurotransmitter impairments, but the strength of this connection can vary, depending on the severity and progression of the condition. It's important to note that the monoaminergic and cholinergic nervous systems influence executive functioning, while the monoaminergic system plays a role in memory and learning. Neuropathological analyses revealed vascular abnormalities, Lewy body lesions, and AD in eight patients with mixed subtypes of PD-related cognitive impairment. Future biomarker studies and post-mortem investigations should target both non-memory-related and memory-related subgroups of cognitive challenges in PD to gain a comprehensive understanding of the neurological underpinnings of these diverse profiles and to identify individuals experiencing concurrent AD and PD-related problems.

Limitation.

When evaluating our results, several limitations should be noted. Firstly, the research was conducted in an educational setting with a highly educated sample, potentially limiting the generalizability of the findings to a broader demographic. Secondly, the judgments made during the neuropsychological assessment, including test selection, the number of tests administered, categorization of cognitive areas, and the establishment of cut-off scores for PD-MCI, were based on established neuropsychological frameworks and clinical expertise.

This approach might result in an overestimation or underestimation of PD-MCI and its variations. Clear recommendations for addressing these challenges have yet to be determined as the field of PD-MCI continues to evolve. Furthermore, the released MDS PD-MCI criteria require validation. Third, we employed broad neuropsychological constructs and prior research to classify neuropsychological tests into cognitive areas. In our methodology, the term executive system covered both executive and attentional functions. Some tests might assess multiple areas, certain aspects could overlap with other tests, and specific tests could be sensitive to impairments across several domains. Fourth, it should be noted that our PD-MCI cohort had a substantial sample size (n=132), with the MDA (Non-Memory) type being the smallest subset.

It's important to recognize the potential impact of unbalanced group sizes on the results. Any conclusions drawn regarding the smaller group may require confirmation in larger samples, despite statistical safeguards. The UPDRS section and Hoehn and Yahr level, at the least served as the foundation of our neurological evaluation. Future research incorporating dual-task paradigms or other motor investigations could offer thorough comprehension of the neurological correlates of attentional and executive dysfunction.

Conclusions.

A comprehensive analysis of the various clinical profiles found in PD with Mild Cognitive Impairment (PD-MCI) groups was presented in Clinical Variations and Co-morbid Trends in PD-MCI Groups. These findings emphasized the connection between more severe axial/gait impairment and PD-MCI with deficits across MDA (Non-Memory). It was crucial that future longitudinal investigations encompassed extensive, precisely characterized PD-MCI cohorts to achieve a comprehensive understanding of the progression and prognosis of various PD-MCI subtypes. Additionally, such studies should have assessed the impact of an elevated load of cognitive impairments affecting multiple domains and the specific nature of cognitive deficits, whether they were related to memory loss or non-memory-related deficits, on the risk of developing dementia.

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