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ORIGINAL ARTICLE

The Amnesia Light and Brief Assessment (ALBA) and Door PICture Naming and Immediate Recall (PICNIR) Brief Tests for Identifying Mild Cognitive Impairment in Patients With Parkinson's Disease

Kateřina Stolaríková,[1,2] Aleš Bartoš,[3,4]✉ Kateřina Menšíková,[1,2] Helena Kisvetrová,[5] Jana Zapletalová,[6] Sandra Kurčová,[1,2] Raymond Rosales,[7] Petr Kaňovský[1,2]

[1]Department of Neurology and Clinical Neuroscience Center, Faculty of Medicine and Dentistry, Palacky University, Olomouc, Czech Republic
[2]University Hospital Olomouc, Olomouc, Czech Republic
[3]Department of Neurology, Third Faculty of Medicine, Charles University, Prague, Czech Republic
[4]Department of Neurology, University Hospital Kralovske Vinohrady, Prague, Czech Republic
[5]Faculty of Health Sciences, Palacky University, Olomouc, Czech Republic
[6]Department of Medical Biophysics, Faculty of Medicine and Dentistry, Palacky University, Olomouc, Czech Republic
[7]Research Center for Health Sciences-FMS, University of Santo Tomas and Hospital, Manila, Philippines

ABSTRACT

Objective This study aimed to identify mild cognitive impairment (MCI) in patients with Parkinson's disease (PD) using two brief tests, the Amnesia Light and Brief Assessment (ALBA) and the door version of the PICture Naming and Immediate Recall (door PICNIR), in 6–8 minutes.

Methods The ALBA, the door PICNIR, and the Addenbrooke's Cognitive Examination III (ACE-III) were administered to 124 participants, equally divided into patients with PD and sociodemographically matched normal controls (NC). The PD group was divided into those with normal cognitive function (PD-CN) and those with MCI (PD-MCI) using neuropsychological tests.

Results Cognitive impairment in the PD group was mild, with significantly lower ACE-III scores than in the NC group (91 vs. 96 points). Despite these subtle deficits, gesture recall in the ALBA group was significantly lower even in the PD-CN group than in the NC group. Patients with PD-MCI had other significant deficits according to the ALBA and door PICNIR tests. In the PD group, the gesture recall in the ALBA and correctly recalled pictures in the door PICNIR correlated with the results of the verbal fluency and trail-making tests, followed by the memory tests and all the ACE-III scores except the visuospatial score. In contrast, correctly recalled sentence words in the ALBA correlated with the memory and language scores in the ACE-III test and memory test scores.

Conclusion Subtle cognitive changes in patients with PD can be detected through gesture recall tests, even in those with normal cognition. The ALBA and PICNIR tests are effective in identifying MCI in patients with PD and provide a brief and valid assessment of cognitive function.

Keywords Parkinson's disease; Mild cognitive impairment; Dementia; Amnesia Light and Brief Assessment (ALBA); PICture Naming and Immediate Recall (PICNIR); Addenbrooke's Cognitive Examination III (ACE-III).

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✉ **Corresponding author:** Aleš Bartoš, MD, PhD
Department of Neurology, Third Faculty of Medicine, Charles University, University Hospital Kralovske Vinohrady, Prague, Czech Republic / **Tel:** +420 267 162 928 / **E-mail:** ales.bartos@fnkv.cz

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INTRODUCTION

Early detection of mild cognitive impairment (MCI) in patients with Parkinson's disease (PD) is gaining importance in the context of the newly developed concept of biological classification of the disease.[1,2] Global cognitive deficit was also recently incorporated as a prodromal marker of PD in the updated version of the Movement Disorder Society (MDS) research criteria for prodromal PD.[3] Subtle cognitive deficits in patients with PD are not easy to detect using brief cognitive tests.[4]

Cognitive impairment and dementia are common in patients with advanced PD.[5] Cognitive dysfunction may already be present in the early stages of PD,[6] when it may not be clinically apparent but is detectable by specific cognitive tests.[7] The severity of early cognitive impairment can vary from subjective cognitive decline to MCI, which can progress slowly over the course of the disease to dementia syndrome in patients with PD.[8,9]

The earliest cognitive deficit in patients with PD is dysexecutive syndrome. Impairment of other cognitive domains, including recognition memory, attention processes, and visuospatial abilities, occurs later in the progression of the disease.[10,11] Memory disorders in PD most often include episodic and working memory impairment with reduced working memory span, both for verbal and visuospatial material.[12] Working memory significantly affects the cognitive and social functioning of patients with PD, as it enables the storage of information and its further use.[8] Episodic memory deficits are almost as common as executive dysfunction in PD, and patients with episodic memory deficits are at a higher risk of developing dementia than patients with only executive dysfunction.[9]

Various brief cognitive tests are used to assess cognitive functions in patients with PD.[7,13,14] These tests usually reliably differentiate moderate dementia from normal cognition but provide limited discrimination between normal cognitive function, MCI, and mild dementia.[4] However, early detection enables diagnosis, management, and a treatment plan tailored to the patient.[4]

Cognitive tests vary in terms of administration, scoring, sensitivity, specificity, and time required for administration.[15] When tests at different workplaces are chosen, the speed and ease of test administration play major roles. In addition, all tests require test-taking skills, special forms or aids, and some are copyrighted or charge a user fee.[15] An optimal test suitable for universal use across disciplines should be free of charge, very short (less than five minutes), and not influenced by the age and education of the person tested but should be able to detect MCI. The MDS Task Force recommends a short screening for impairment assessed with global cognitive scales or impairment in specific cognitive tasks to diagnose PD-MCI.[5]

Two very brief tests certified by the Ministry of Health in the Czech Republic have been developed by one author of this article.[16,17] The Amnesia Light and Brief Assessment (ALBA) was validated for mild cognitive deficits.[16] The hedgehog PICture Naming and Immediate Recall (PICNIR) was validated for very MCI.[17] Both are very brief, lasting up to four minutes each (6–8 minutes total), and mild cognitive deficits can be detected, especially in short-term episodic or long-term semantic memory, aphasia, and dysgraphia.[16,17]

In the Czech Republic, the ALBA and PICNIR tests are used by physicians, speech therapists, social workers, and pharmacists to detect cognitive impairment in patients and clients.[18]

Both tests were converted to the ALBAV test for the electronic self-evaluation of memory. A quick and easy electronic memory self-evaluation might be useful at home and at a doctor's outpatient clinic for prescreening in research, clinical trials, and other purposes.[19]

The aim of this study was to determine the usefulness of a newly developed original brief cognitive assessment using the ALBA and the door PICNIR tests to detect incipient cognitive dysfunction in patients with PD.

MATERIALS AND METHODS

Ethics statement

All procedures performed in the study were in accordance with the ethical standards of the institutional research committee and with the 1975 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all the patients included in the study. All subjects included in this study were informed about the purpose and design of the study and they all gave their informed consent. The study was approved by the Ethics Committee of University Hospital Olomouc (standard SM-L031, approval numbers 139/10 and 76/15).

Study participants

The study included patients with PD who were regularly monitored at the tertiary movement disorders center of University Hospital Olomouc and normal cognitive (NC) elderly individuals as a control group. All patients with PD underwent a thorough neurological examination to establish a clinical diagnosis as follows: 1.5-T magnetic resonance imaging (MRI) of the brain, dopamine transporter DaTScan (^{123}I-ioflupane) imaging, neurophysiological examination, including electroencephalography, an examination of multimodal evoked potentials and electromyography, a head-up tilt table test and urodynamic testing to confirm or rule out significant autonomic dysfunction, blood serum and cerebrospinal fluid examination, a speech

therapy examination to assess the presence or absence of any impairment of higher nerve functions, and a detailed neuropsychological examination. Clinical diagnosis of PD was established on the basis of currently valid clinical diagnostic criteria.[20] Neuropsychological examination of all patients with PD was performed during the on-state to rule out modification of cognitive performance by somatic complaints. The exclusion criteria were a type of parkinsonism other than degeneration, the presence of dementia, and other brain diseases that could affect cognitive performance (e.g., stroke, trauma, tumor, and encephalopathy). All patients with a vascular origin of neurological symptoms, including cognitive deterioration, were excluded on the basis of imaging studies such as T2-weighted, fluid-attenuated inversion recovery, and diffusion-weighted MRI, ultrasonography, and transcranial Doppler examinations, as well as a Hachinski ischemic score of less than 3 points.

The NC group consisted of individuals without cognitive deficits who were spouses of patients, volunteers from previous and ongoing normative studies, members of senior clubs and universities of the third age, and from other sources. The inclusion criteria were age ≥50 years, Czech as native language, and living independently in the community. The exclusion criteria were psychiatric and neurological brain disorders (e.g., stroke, trauma, tumor, alcohol abuse, or use of psychoactive drugs).

Neuropsychological measures

All patients with PD underwent examination using a standard one-hour battery of neuropsychological tests and questionnaires, which were administered and scored by a trained psychologist (KS). The neuropsychological battery included the Czech version of the Addenbrooke's Cognitive Examination III (ACE-III),[21] Wechsler Memory Scale-III Abbreviated (WMS-IIIa), The Trail Making Test (TMT), Verbal Fluency Test (VFT), and the Clock Drawing Test (CDT); these tests assessed immediate and delayed recall, verbal and visual memory, semantic memory, executive function, language, visuospatial functions, psychomotor speed, and attention.[22] Participants with PD were classified into two subgroups on the basis of standardized neuropsychological assessments. The first subgroup included patients with MCI (PD-MCI), whereas the second subgroup included patients who exhibited preserved cognitive function (PD-CN). The diagnosis of MCI was established through a comprehensive neuropsychological evaluation; MDS PD-MCI level I criteria were used to determine MCI.[23] Cognitive deficits were identified in at least one cognitive domain, with test performance approximately 1.0 to 1.5 standard deviations (SD) below age- and education-adjusted normative values. Functional status, including activities of daily living, was assessed through structured interviews. This classification enabled the differentiation between subtle cognitive decline and intact cognitive functioning, facilitating subsequent comparative analyses between the subgroups.

Both groups were then examined with the brief ALBA and PICNIR tests; their performance is described below. The individuals in the NC group were subjected to ALBA, PICNIR, and ACE-III tests.

The Amnesia Light and Brief Assessment

The ALBA test consists of brief tests to measure speech and short-term episodic memory. The examination procedure is shown in Figure 1. The ALBA test includes two tests and four tasks. It involves the learning and recall of a single but rather complicated sentence interrupted with a gesture test, called TEGEST (TEst of GESTures). The gesture test serves as a standalone test and simultaneously as a distraction for the sentence recall test.

In the first part, the participant has the task of repeating and memorizing a six-word sentence that they will hear only once. Its wording in English translation is: "Indian summer brings the first morning frost." In the second part, the participants are asked to perform a series of six gestures following the examiner's instructions during the middle TEGEST. The gestures are based on the three principles of the paradigm shown in Figure 1. First, all gestures are related to all five human senses. Second, a second gesture associated with sight is added to increase the number of items and make it more difficult. Third, the order of the gestures approximates a clockwise progression. This mnemonic arrangement helps the administrator remember the gesture sequence and makes administration easier. However, the person being tested is unlikely to uncover this underlying cue. The participant subsequently demonstrates how to eat with a spoon (taste), stroke their face (touch), make a telephone call (hearing), put on glasses (sight), smell a flower (smell), and look through binoculars (sight). The participants are not told beforehand that they should try to remember the gestures. After performing the set of gestures, they are asked to, immediately and without distraction, recall, demonstrate, and verbally describe the gestures. ALBA testing is concluded with a sentence recall.[16]

Scores of individual parts range from 0 (the worst) to 6 points (the best) for each of the four tasks: 1) the number of correctly repeated words of the sentence (Word 1 [W1] score: 0–6 points), 2) the number of correctly recalled words of the sentence after the distraction using the TEGEST (W2 score: 0–6), 3) the number of correctly performed gestures of the TEGEST (Gesture 1 [G1] score: 0–6), and 4) the number of correctly recalled gestures of the TEGEST (G2 score: 0–6). The sum, called the memory ALBA score (MAS), is derived from correctly recalled words in the sentence and correctly recalled gestures (W2 + G2) and

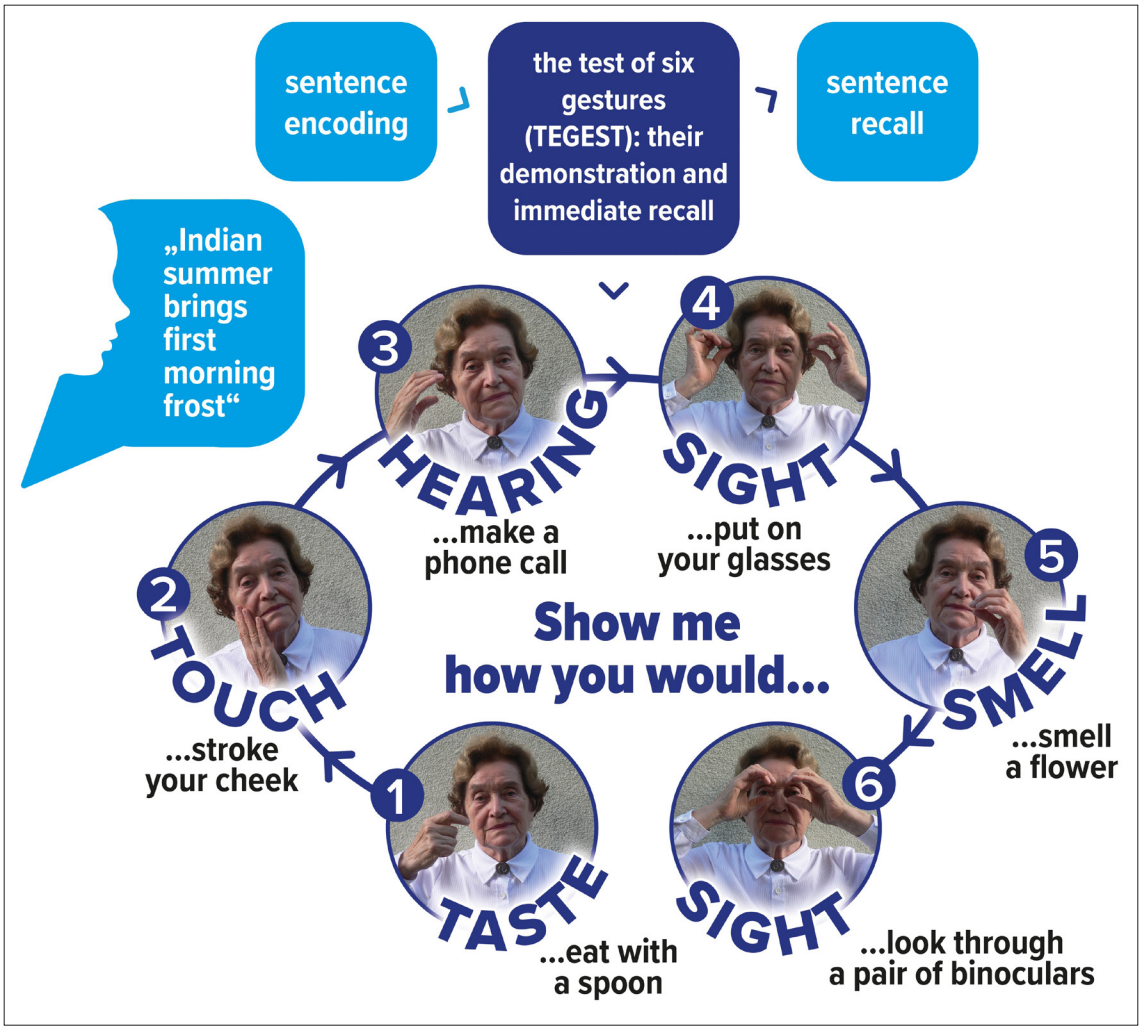


Figure 1. Procedure for administering the Amnesia Light and Brief Assessment (ALBA) test and the demonstration of the 6 gestures symbolic of the 5 human senses. The ALBA consists of a one-time memorization of a six-word sentence "Indian summer brings the first morning frost," a gradual demonstration of six gestures and their closest matching in a different order (TEGEST), and finally matching as many correct words of the original sentence as possible. The woman depicted is for illustrative purposes only and is not a patient. A healthy volunteer provided written informed consent for publication.

thus ranges from 0 to 12 points (maximum recall of 6 words + 6 gestures), with higher scores indicating better cognitive performance. The development, validation, and further details of the ALBA test were described in our previous original paper.[16]

The door version of the PICNIR test

The PICNIR test can be used for the early detection of disorders of written naming, long-term semantic memory, and short-term episodic memory. The development, validation, and further details of the PICNIR test were presented in our previous original paper.[17] Here, we used its door version (door PICNIR), which follows the same principles but includes different drawings—specifically, a selection of the best and most challenging pictures. This version is therefore capable of detecting even mild cognitive deficits.[24]

The door PICNIR test consists of two parts. The first task is to write down the names of 20 black-and-white pictures to evaluate long-term semantic memory and language. The second task involves immediate recall and writing the names of as many previously named pictures as possible in one minute. The performance on the door PICNIR test is evaluated by determining the number of picture naming errors (NE, Part 1) and the number of correctly recalled pictures (PICR, Part 2). Although each part of the test can theoretically be quantified between 0 and 20 points; in reality, the scores of most patients and normal individuals range from 0–10 (NE) and 0–15 (PICR). Lower NE scores and higher PICR scores indicate better cognitive performance.

On the basis of this inverse relationship, the only value derived from the PICNIR test was calculated as the number of correctly recalled picture names (Part 2) minus the number of

picture naming errors (Part 1). This value was called the Recnam score on the basis of two abbreviations: "Rec" derived from "recalled" and "nam" derived from "naming." We introduced and defined a new variable named "memory efficiency (items/min)" as the number of items to be memorized divided by the total administration time (in minutes), analogous to previously used administration efficiency metrics in cognitive screening assessments (e.g., domains per minute).[15]

Summary ALPIR score of the ALBA and the PICNIR

To summarize both the ALBA and the PICNIR tests, we introduced the ALPIR score, which is a composite measure that combines the outcomes of both tests to represent overall cognitive performance as a single value. The acronym is formed by merging the initial letters of both test names—"AL" from ALBA and "PIR" from PICNIR—resulting in ALPIR. It is calculated as the sum of the MAS score of the ALBA test plus the Recnam score of the PICNIR test. Higher ALPIR scores indicate better cognitive performance.

An English-translated version of the ALBA and PICNIR test sheets, including instructions and scoring principles, is freely available for download from our website (https://www.abadeco.cz/learn-and-download-tests) and is also provided as Supplementary Materials 1 and 2 to international readers of this article. Educational videos with English subtitles demonstrate the proper administration and scoring with a patient and are available on Aleš Bartoš YouTube channel (ALBA: https://youtu.be/LyCuWc0-Gro; PICNIR: https://youtu.be/cbJGtPG-nVA). Aleš Bartoš holds the copyright and makes these tests available for free for noncommercial use in clinical practice, education, and research; for other uses, the corresponding author should be contacted for permission.

The Addenbrooke's Cognitive Examination III

The ACE-III is a brief cognitive test validated in several languages for screening and differential diagnosis of dementia.[25] The Czech version was validated by several coauthors of the current study.[21] The ACE-III includes five subscales to assess five different cognitive domains, providing particular subscores, attention/orientation, verbal fluency, memory, language, and visuospatial skills, which correlate with standardized neuropsychological tests.[26] As such, it can be useful for general neuropsychological assessments.[27] When the diagnostic capacity of five cognitive screening tests for diagnosing MCI was compared, ACE-III showed better diagnostic properties than the other tests.[16,28] The ACE-III has good sensitivity and specificity in the assessment of cognitive deficits.[26] A maximum score of 100 can be obtained, with higher scores indicating better cognitive performance. ACE-III was validated in several studies, including ours, for the diagnosis of dementia, MCI, cognitive impairment associated with PD or atypical parkinsonism, and vascular cognitive impairment.[21,26] It is also a useful battery for assessing cognitive domains and differentiating individuals with PD-MCI and PD dementia (PDD).[13]

Statistical analysis

The results of the sociodemographic and test scores between the PD patient group and the NC group were compared using the Mann−Whitney test. Brief tests ALBA and PICNIR were compared with standard neuropsychological tests, and their discriminant and convergent validity were determined. The discriminant validity of the ALBA and PICNIR tests was assessed by comparing their individual parts and the ACE III test and its subtests between the PD-MCI, PD-CN, and NC groups with the use of the nonparametric analysis of covariance (ANCOVA) method and the following covariates: age, sex, education, and disease duration.

Effect sizes for pairwise between-group comparisons were additionally quantified using Hedges' g, which was calculated as the standardized mean difference with pooled standard deviation and a correction for small sample sizes. The thresholds for interpreting Hedges' g were 0.20 (small), 0.50 (medium), 0.80 (large), and 1.20 (very large). For group effects estimated by the ANCOVA model, effect sizes were expressed as partial eta-squared (η_p^2), indicating the proportion of variance explained by group membership after accounting for covariates, with values of 0.01, 0.06, and 0.14 were used as thresholds for small, medium, and large effects, respectively.

The convergent validity of the ALBA and PICNIR tests was assessed by correlations of their scores with neuropsychological test scores in a group of patients with PD. Spearman correlation was used to verify the convergent validity of the ALBA and PICNIR tests and their relationships with other neuropsychological tests. Bonferroni correction for multiple comparisons was applied. Receiver operating characteristic (ROC) curve analysis was used to estimate appropriate cutoff values for significant variables to differentiate the PD-MCI group from the PD-CN group.

Statistical analysis was carried out using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp.). The normality of the distributions was tested using the Shapiro−Wilk test. A level of $p<0.05$ was considered to indicate statistical significance.

RESULTS

Characteristics of study participants

The study included 62 patients with PD and 62 sociodemo-

graphically matched healthy control participants. The two groups did not differ significantly in terms of age, education, or sex distribution. The median age was 66 years (range: 44–82) in the patient group and 65 years (57–80) in the control group, with mean ages of 65±8 and 67±5 years, respectively. The median number of years of schooling was 13 (12–17) in patients and 16 (13–18) in controls, with corresponding means of 15±3 and 16±4 years, respectively. The proportion of female participants was comparable in both groups (61% in patients and 65% in controls).

As expected, the patient group had significantly lower cognitive performance on the ACE-III, with a median score of 91 (mean 89±8), compared with a median score of 96 (mean 96±2) in the NC group (p<0.0001). The mean Mini-Mental State Examination (MMSE) scores estimated from the ACE-III results were 28 for patients and 29 for controls. The overall ACE-III scores were within the Czech normative range (above 90 points, corresponding to the mean−1 SD), with only a minimal deficit observed in the PD group—only a 5-point difference in median ACE-III scores between the groups. Similarly, the estimated MMSE scores of both groups were within the Czech normative range[24,27,29] and differed by just one point between the groups.

In the PD group, 22 patients with PD-MCI (mean age at disease onset 57±9 years, mean disease duration 8±6 years) and 40 patients with PD-CN (mean age at disease onset 57±9 years, mean disease duration 8±5 years) were included. No significant differences in sociodemographic variables were observed for the PD subgroups—patients with PD-CN and those with PD-MCI—at the time of examination.

Discriminant validity of the ALBA and door PICNIR tests

The results of testing the discriminant validity of the ALBA and door PICNIR tests are shown in Table 1. Gesture recall in the ALBA was the only measure among the ALBA and PICNIR tests that showed statistical significance between the NC and PD-CN groups, although the cognitive functions in both groups were normal according to the results of the neuropsychological battery. All individual parts of the ALBA and the door PICNIR, except the initial demonstration of six gestures in the ALBA, were significantly impaired in the PD-MCI group despite subtle cognitive deficits in the ACE-III of this group (Table 1). This applied to comparisons of the PD-MCI group with both the NC

Table 1. Results of individual parts of the ALBA test, the door PICNIR test, and the ACE-III between the normal control group and the PD patients with normal cognitive functions and with mild cognitive impairment

	NC (n=62)	PD-CN (n=40)	PD-MCI (n=22)	p		
				NC vs. PD-CN	NC vs. PD-MCI	PD-CN vs. PD-MCI
ALBA components*						
Sentence encoding (W1)	6 (5–6) 6±0	6 (3–6) 6±1	6 (1–6) 5±1	n.s.	0.043 (0.07/0.98)	n.s.
Sentence recall (W2)	5 (0–6) 5±2	5 (0–6) 5±1	3 (0–6) 3±2	n.s.	0.002 (0.13/0.97)	0.0003 (0.23/1.39)
TEGEST gesture demonstration (G1)	6 (6–6) 6±0	6 (6–6) 6±0	6 (6–6) 6±0	n.s.	n.s.	n.s.
TEGEST gesture recall (G2)	5 (3–6) 5±1	4 (3–6) 4±1	3 (1–6) 3±1	0.0005 (0.13/0.97)	<0.0001 (0.29/0.94)	0.001 (0.19/0.97)
Memory ALBA score	10 (4–12) 9±2	9 (3–12) 9±2	6 (2–10) 6±2	n.s.	<0.0001 (0.26/1.46)	<0.0001 (0.32/1.46)
Door PICNIR components						
Picture naming error score, NE (0–20 points)	0 (0–5) 1±1	0 (0–5) 1±2	2 (0–8) 3±2	n.s.	0.004 (-0.12/-1.21)	0.0004 (0.22/-0.97)
Picture recall score, PICR (0–20 points)	8 (0–13) 8±2	8 (3–11) 8±2	6 (0–8) 5±2	n.s.	<0.0001 (0.31/1.46)	<0.0001 (0.33/1.46)
Total ACE-III score	96±2	90±7	82±6	n.a.	n.a.	n.a.

Results are presented as median (min–max) and mean±SD. p-values are derived from nonparametric ANCOVA adjusted for age, sex, education, and disease duration (Bonferroni correction). Values in parentheses indicate effect sizes in the following order: partial eta-squared (η_p^2) / Hedges' g. Positive values indicate better performance in the first group; negative ones indicate worse performance.
*ALBA components: Sentence encoding—number of correctly repeated words of the sentence (0–6 words); Sentence recall—number of correctly recalled words of the sentence after distraction using the TEGEST (0–6 words); TEGEST gesture demonstration—initial demonstration of six gestures according to instructions (0–6 gestures); TEGEST gesture recall—number of correctly recalled gestures (0–6 gestures).
ALBA, Amnesia Light and Brief Assessment test; TEGEST, test of gestures; door PICNIR, door version of the PICture Naming and Immediate Recall; ACE-III, Addenbrooke's Cognitive Examination III; p-value (partial eta squared – effect size), corrected p-value of nonparametric ANCOVA with covariates: age, sex, education and disease duration (Bonferroni method), and effect size; p, the probability of a group result difference; n.s., not significant; g, Hedges' g (standardized mean difference with small-sample correction); n.a., not applicable; NC, normal control; PD-CN, Parkinson's disease patients with normal cognitive functions; PD-MCI, Parkinson's disease patients with mild cognitive impairment.

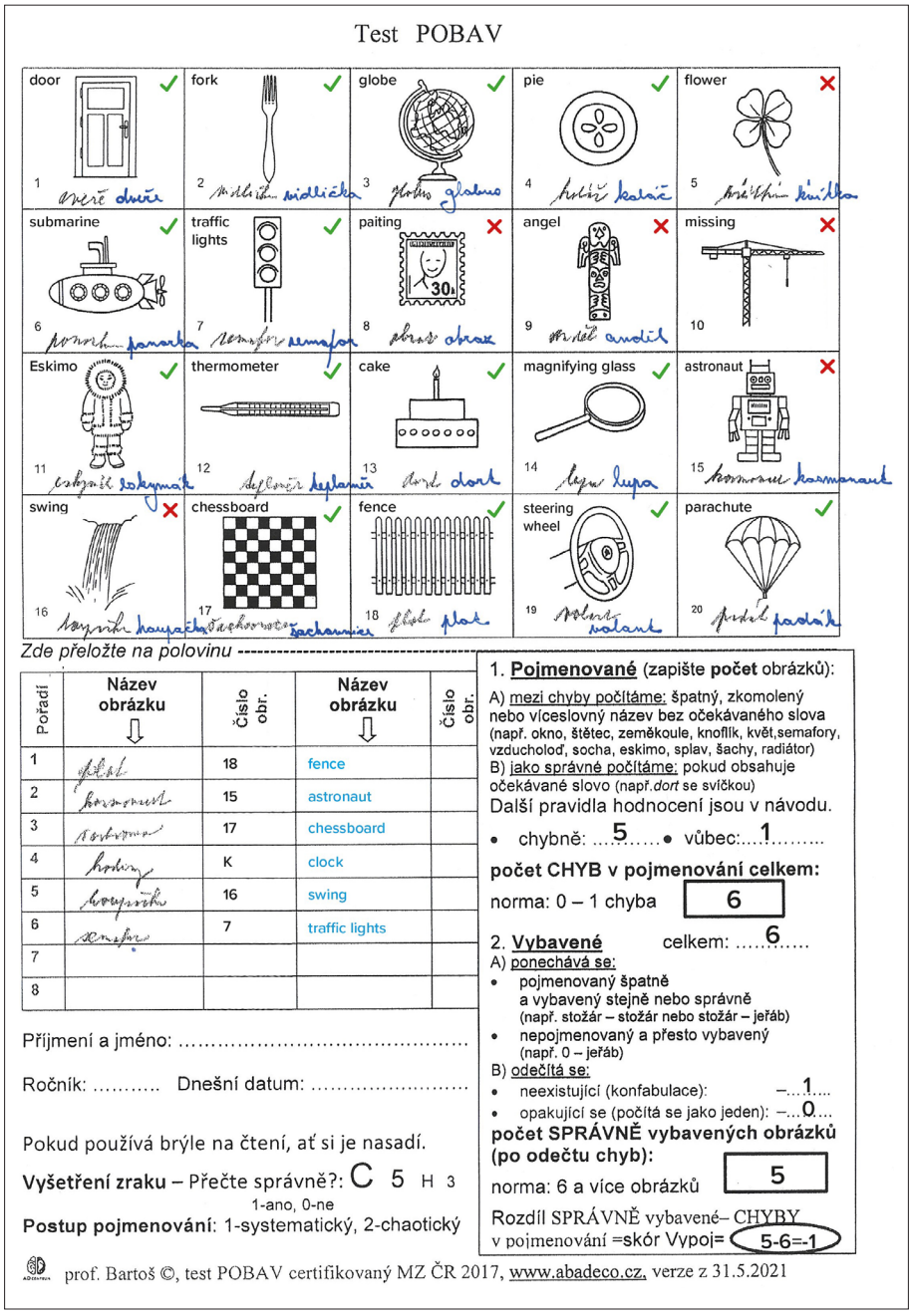


Figure 2. A filled-in test form of the door PICture Naming and Immediate Recall (PICNIR) including brief administration and evaluation instructions at the right bottom. An English version of the blank PICNIR test form, including instructions and scoring principles, is provided as Supplementary Material 2. The door PICNIR test consists of two parts. The persons are to name each of the 20 pictures in one word and remember these picture names. Then they are asked to recall and write as many picture names as they can during one minute. Note five naming errors marked with a cross x and one unnamed picture No 10 (crane) in the naming part and five correctly recalled picture names plus one confabulation (clock) in the recall phase.

group and the PD-CN group. The most significant differences were for the memory ALBA score and picture recall PICNIR score (Table 1). This finding indicates that the observed group differences were not only statistically significant but also clinically meaningful, with effect sizes ranging from medium to large and very large effects for key pairwise comparisons. Figure 2 shows a completed PICNIR test form handwritten by one of our patients with PD, illustrating micrographia, naming errors, and recalled picture names. Two more original examples in Czech without translation demonstrate dysgraphia and micrographia with overlapping and densely packed letters (Supplementary Material 3).

Table 2. Correlations of ALBA or PICNIR scores with scores of the ACE-III and neuropsychological tests in patients with Parkinson's disease

Test*	Correlation coefficient *r* (*p*)						
	ALBA				PICNIR		ALPIR (ALBA+PICNIR)
	Sentence encoding	Sentence recall	TEGEST gesture recall	Memory score	Picture naming error score	Picture recall score	
ACE-III total score	n.s.	0.457 (0.017)	0.531 (0.001)	0.611† (<0.0001)	n.s	0.651† (<0.0001)	0.748† (<0.0001)
Attention score	n.s.	n.s.	n.s	n.s.	n.s.	n.s	n.s.
Memory score	n.s.	0.474 (0.009)	n.s.	0.553† (0.0003)	n.s.	0.530 (0.001)	0.646† (<0.0001)
Verbal fluency score	n.s.	n.s.	0.594† (<0.0001)	n.s.	n.s.	0.430 (0.045)	0.437 (0.035)
Language score	n.s.	n.s	n.s	n.s.	-0.427 (0.049)	0.459 (0.016)	0.553† (0.0003)
Visuospatial abilities score	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Score of Lexical Fluency Test	n.s.	n.s.	n.s	n.s	n.s.	n.s.	n.s.
Score of Category Fluency Test	n.s.	n.s.	0.475 (0.009)	n.s.	n.s.	0.529 (0.001)	0.448 (0.024)
Trail Making Test part A	n.s.	n.s.	-0.467‡ (0.012)	n.s.	n.s.	-0.527‡ (0.001)	-0.512‡ (0.002)
Trail Making Test part B	n.s.	n.s.	-0.467‡ (0.012)	n.s.	n.s.	-0.527‡ (0.001)	-0.512‡ (0.002)
Score of WMS-IIIa	n.s.	n.s.	0.485 (0.009)	0.600† (<0.0001)	n.s.	0.551 (0.001)	0.674† (<0.0001)
Logical Memory subscore	n.s.	n.s.	n.s.	0.558† (0.0004)	n.s.	n.s.	0.595† (0.0001)
Visual Memory subscore	n.s.	n.s.	0.647 (0.017)	n.s.	n.s.	0.523 (0.002)	0.520 (0.002)

*ACE-III total score (0–100 points): overall cognitive performance across attention, memory, verbal fluency, language, visuospatial abilities; Attention score (0–18 points): attention and working memory; Memory score (0–26 points): verbal learning and memory (immediate and delayed recall, recognition); Verbal fluency score (0–14 points): executive control and lexical retrieval; Language score (0–26 points): receptive and expressive language functions; Visuospatial abilities score (0–16 points): visuospatial processing and constructional abilities. Score of Lexical Fluency Test (starting with letter *p*) (word count): phonemic fluency and executive functioning; Score of Category Fluency Test (animals) (word count): semantic fluency and semantic memory. Trail Making Test part A (duration in seconds): processing speed and visual attention; Trail Making Test part B (duration in seconds): executive function, cognitive flexibility, and set-shifting. Score of WMS-IIIa (2–38 weighted score): composite memory performance across verbal and visual modalities (immediate and delayed recall); WMS-IIIa: Logical Memory subscore (2–38 weighted score), verbal episodic memory (immediate and delayed story recall); †highest correlations; ‡negative correlations.
ALBA, Amnesia Light and Brief Assessment test; TEGEST, test of gestures; PICNIR, PICture Naming and Immediate Recall; ALPIR (ALBA and PICNIR), the composite score as the memory ALBA score minus the number of picture naming errors plus the number of correctly recalled picture names; ACE-III, Addenbrooke's Cognitive Examination III; WMS-IIIa, Wechsler Memory Scale-III Abbreviated; *p*, corrected *p*-value for multiple testing (Bonferroni method); n.s., not significant.

Correlational validity of the ALBA and door PICNIR tests

The correlations of the ALBA and PICNIR scores with the ACE-III and neuropsychological test scores in patients with PD are displayed in Table 2.

In the ALBA test, sentence recall demonstrated the expected correlations with memory and language measures but did not correlate with other cognitive domains. Gesture recall might resemble sentence recall. However, gesture recall differed in two aspects. First, it correlated with the majority of measures. Second, compared with sentence recall, it correlated not only with memory measures but also with verbal fluency tests and TMT parts A and B. The memory ALBA score was most strongly correlated with the total ACE-III score and memory subscore.

PICNIR naming was associated only with the language score. On the other hand, PICNIR recall was significantly correlated with the majority of cognitive measures, particularly the total ACE-III score and the memory, language, verbal fluency, TMT, and visual WMS-IIIa scores.

Notably, ALPIR, summarizing the results of both tests, exhibited the highest correlation values across the entire table. No significant correlations were found between the ALBA or PICNIR scores and the visuospatial subscores of the ACE-III (Table 2).

ROC curve analyses were performed to compare participants with PD-CN and PD-MCI. As summarized in Table 3, both the ALBA and the PICNIR demonstrated good diagnostic performance, with reported area under the curve (AUC) values indicating their ability to discriminate between PD-CN and PD-MCI. Optimal cutoff scores are provided alongside the corresponding sensitivity and specificity values. Table 3 also provides a more

Table 3. Diagnostic accuracy and time efficiency of the ALBA and the PICNIR compared with selected brief (<5 min) and widely used (10–30 min) cognitive tests for identifying mild cognitive impairment in PD-MCI and other cognitive disorders

Test	Very brief tests <5 minutes for identifying PD-MCI					
	Cutoff value	Sensitivity (%)	Specificity (%)	Sensitivity+ specificity	AUC	Ref
ALBA (12 items/2.3 min=5)						
Memory score	8	73	65	138	0.82	Current study
Gesture recall	4	86	28	114	0.71	Current study
Sentence recall	4	68	73	141	0.77	Current study
Door PICNIR (20 items/3.5 min=6)						
Picture naming error score	1	68	73	141	0.75	Current study
Picture recall score	6	77	73	150	0.84	Current study
ALPIR (ALBA+door PICNIR)	13	86	85	171	0.91	Current study
Other very brief tests						
CDT (0–10 points) (no items to remember)	≤7	75	43	118	0.59	Scarpina 2020[50]
MemTrax composite score	<75	70	69	139	0.72	Liu 2024[47]
Test	**ALBA and PICNIR for identifying cognitive disorders**					
	Cutoff value	Sensitivity (%)	Specificity (%)	Sensitivity+ specificity	AUC	Ref (patient characteristics)
ALBA (12 items/2.3 min=5)						
Memory score	≤8	90	77	167	0.90	Bartos 2025[16] (50% MCI and 50% mild dementia)
Memory score–the very first study	≤7	90	74	164	0.92	Bartos 2019[43] (mild cognitive deficits defined as MMSE >20 points)
Hedgehog PICNIR–picture recall (items/3.5 min=6)	≤8	86	50	136	0.76	Bartos 2024[17] (very MCI)
Czech MoCA for comparison	Not reported	81	50	131	0.74	Bartos 2024[17] (very MCI)
Test	**Cognitive tests lasting 10–30 minutes for identifying PD-MCI**					
	Cutoff value	Sensitivity (%)	Specificity (%)	Sensitivity+ specificity	AUC	Ref
MMSE (3 items/10 min=0.3)						
North American MMSE	≤28	67	67	134	0.68	Marras 2013[48]
Italian MMSE	<29.5	96	62	158	0.84	Federico 2015[41]
MoCA (5 items/13 min=0.4)						
Brazilian MoCA	≤24	84	27	111	0.50	Sobreira 2015[42]
Mexican MoCA	≤24	42	76	118	0.59	Hernández-Medrano 2025[44]
North American MoCA	≤25	67	62	129	0.71	Marras 2013[48]
Irish MoCA	<23	66	79	145	0.72	O'Caoimh 2024[49] (82% idiopathic PD, 8% vascular-type parkinsonism, 10% Lewy body disease).
Italian MoCA	<24.5	82	67	149	0.80	Federico 2015[41]
ACE (7 items/20 min=0.4)						
Brazilian ACE-Revised	≤89	84	20	104	0.53	Sobreira 2015[42]
Brazilian ACE-III	≤85	59	60	119	0.64	Sousa 2023[13]
Australian ACE-Revised	≤93	61	64	125	0.66	Komadina 2011[46]
Italian ACE-Revised	<86	82	67	149	0.81	Federico 2015[41]
MDRS-2 (not applicable/25 min)						
MDRS-2	≤139	68	79	147	0.81	Koevoets 2018[45]

Each test is accompanied by the number of items to remember, average test duration (min), and memory efficiency (items/min), which was calculated as the number of items to be memorized divided by administration time, i.e., number of items per minute. The ALBA and the PICNIR showed memory efficiency of approximately 5–6 items per minute, whereas the MMSE, the MoCA, and the ACE-R achieved only 0.3–0.4 items per minute.
ACE-III, Addenbrooke's Cognitive Examination III; ACE-R, Addenbrooke's Cognitive Examination–revised; ALBA, Amnesia Light and Brief Assessment; ALPIR, ALBA+door PICNIR; AUC, area under the receiver operating characteristic curve; CDT, Clock Drawing Test; MDRS-2, Mattis Dementia Rating Scale-2; MMSE, Mini-Mental State Examination; MoCA, Montreal Cognitive Assessment; PD-MCI, Parkinson's disease with mild cognitive impairment; PICNIR, PICture Naming and Immediate Recall.

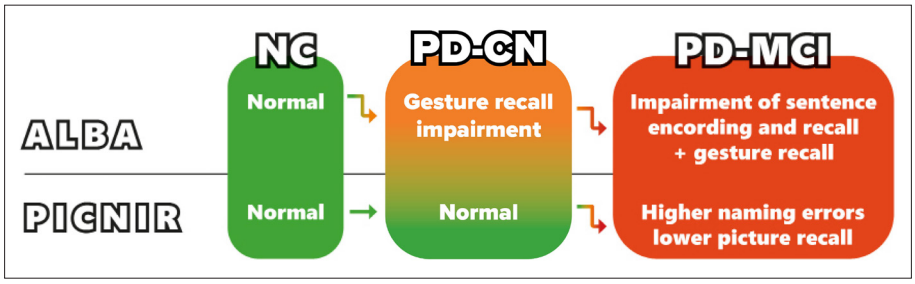


Figure 3. Performance patterns in the Amnesia Light and Brief Assessment (ALBA) and PICture Naming and Immediate Recall (PICNIR) tests across cognitive stages in Parkinson's disease. While cognitively normal controls (NC) show normal performance on both tasks, patients with Parkinson's disease with normal cognitive functions (PD-CN) display isolated gesture recall deficits in the ALBA. In contrast, patients with mild cognitive impairment (PD-MCI) exhibit broader impairments, including sentence encoding and recall deficits in the ALBA, and increased naming errors with reduced picture recall in the PICNIR.

direct comparison of the ALBA and the PICNIR with widely used brief cognitive screening tools, including their diagnostic performance, optimal cutoff scores, and corresponding sensitivity and specificity values.

Despite their very brief administration time (<5 minutes), the ALBA and door PICNIR tests demonstrated high memory efficiency (approximately 5−6 items per minute) and good diagnostic performance for identifying PD-MCI. Both tests showed comparable or higher sensitivity, specificity, and AUC values than other brief cognitive tests, such as the CDT or MemTrax. Importantly, the combined ALBA + PICNIR score (ALPIR) yielded the highest overall diagnostic accuracy (sensitivity 86%, specificity 85%, AUC 0.91), highlighting the benefit of integrating both tests for rapid and effective detection of MCI in PD.

DISCUSSION

Two innovative and very brief tests, ALBA and the PICNIR, identify subtle cognitive deficits that are present not only in patients with PD-MCI but also in those with PD-CN. This finding was significantly different between the normal control, PD-CN, and PD-MCI groups. Surprisingly, the patients with PD with normal cognitive functions (the PD-CN group) recalled significantly fewer gestures than the NC group did (Figure 3). This isolated change may indicate very early and first cognitive impairment at the pre-MCI stage, specifically in patients with PD. Further deficits appeared in the other tasks of the ALBA (W2 score) and the PICNIR (both parts NE, PICR) at the MCI stage in patients with PD (Figure 3). These findings are favorable for three reasons. First, the cognitive impairment of PD patients was mild. Overall, cognitive functions were relatively preserved at a high level of 91 points on average in the ACE-III in the group of PD-CN and PD-MCI patients, which was only five points below the average score of the normal controls. In other studies, a score of 91 points on the ACE-III was considered normal.[30] Second, memory impairment is not a prominent feature of PD; however, it was detected using our very brief cognitive tests. Third, the duration of the ALBA or the PICNIR test is very short, between two and four minutes,[16,17] thus they can be easily used and implemented in everyday clinical practice. In addition, the PICNIR test provides an evaluation of handwriting, which is typically impaired in patients with PD (Supplementary Materials 2 and 3). Micrographia in the PICNIR was noted during the handwriting task, which was consistent with the motor symptoms of PD. Abnormally small, cramped handwriting, often with progressively smaller letters, is typically seen in individuals with PD and related disorders. Its presence can support the clinical diagnosis of parkinsonism.

In this study, we demonstrated that the correlation patterns between ALBA, PICNIR, and standard neuropsychological measures reflect the characteristic cognitive profile of PD rather than nonspecific cognitive decline. Our findings show that these instruments are sensitive to the interaction between episodic memory and executive control processes, which are typically affected in PD due to frontostriatal dysfunction.

Specifically, we found that sentence repetition within ALBA correlated only weakly with executive and attentional measures, which is consistent with relatively preserved immediate verbal encoding in many patients with PD. In contrast, delayed sentence recall showed stronger associations with established episodic memory measures, supporting its sensitivity to retrieval-based memory impairment, which is a well-documented feature of cognitive dysfunction in PD.

Importantly, our results further indicate that the recall of the gesture sequence is associated with executive function measures, highlighting the role of sequencing, monitoring, and controlled retrieval processes. These findings align with the known executive deficits in PD and suggest that gesture recall captures a memory−executive interaction rather than a pure memory storage deficit. Notably, gesture recall showed little or no correlation with visuospatial measures, indicating that its executive

demands are not driven by visuoconstructive or spatial processing, which may be variably affected in PD but are not central to its core cognitive phenotype.

For the door PICNIR test, our findings revealed a complementary pattern. Picture naming errors correlated primarily with language-related measures, whereas picture recall was more strongly associated with episodic memory indices. This dissociation reflects the frequent coexistence of lexical retrieval difficulties and retrieval-based memory deficits in PD, even in the absence of marked semantic degradation.

Finally, we found that the composite ALPIR score showed the most consistent correlations with memory and executive measures but remained largely independent of visuospatial domains. Taken together, these results provide empirical support for the construct validity of ALBA, PICNIR, and ALPIR as cognitively grounded instruments that align with the characteristic memory–executive profile of PD.

Why does the gesture test provide distinct and the best results in PD patients? The ALBA test is composed of two different types of recall using words and gestures to evaluate memory. In addition, each task differs in instructions as to whether individuals are informed before the performance to remember and recall items (sentence words) or not (gestures). Gesture demonstration and recall are nonverbal motor tasks involving the basal ganglia and their connections. Thus, it makes sense that lower gesture recall is associated with impairments in the extrapyramidal system. Moreover, gesture recall has an executive component that is typically altered in patients with PD. The performance on the gesture recall task may be influenced by multiple factors beyond memory. Motor sequencing, praxis, and attention/executive control can affect task performance. In PD, motor dysfunction, such as bradykinesia, rigidity, or tremor, may further confound the results. Moreover, frontostriatal dysfunction impairs executive functions and working memory, which are critical for planning and reproducing multistep gestures. Thus, impaired performance on the gesture test likely reflects an interaction of cognitive and motor limitations rather than a purely memory deficit.

This was demonstrated by the highest correlations between the gesture recall scores and the scores of the verbal fluency tests and the trail-making tests. The lower associations were with the memory test and all domain scores of the ACE-III except the visuospatial score. By contrast, sentence word recall correlated with scores of memory tests and memory and language domains of the ACE-III, i.e., it had different levels of cognitive loading.

It is well known that nonamnestic single-domain MCI is the most common subtype of PD, with predominant deficits in visuospatial, executive, and attention domains rather than memory. Memory deficits are generally not considered initial cognitive impairment in patients with PD and are not considered in the examination, although impairments in some memory domains have been described as part of PD-MCI.[13,31] This may explain why these new short tests were able to detect these deficits in patients with PD. Moreover, even patients in the PD group with normal cognitive function on comprehensive neuropsychological examination showed subtle cognitive deficits when tested with these tests. This may have stemmed from the difficulty of the tests (the 20 items included in the PICNIR test represent three times the capacity of short-term memory, which is 7 items) and from the principle of the examination, owing to which these short instruments are able to capture subtle cognitive changes.

In recent years, there has been increasing emphasis on the identification of MCI in PD, which is considered a major risk factor for the development of dementia during the course of the disease, especially in more advanced stages. Up to one-third of people with PD-MCI develop dementia over the course of 7 years.[5] Conversion rates from PD-MCI to PDD have been reported by one study more precisely, ranging from 39% to 50% at a 5-year follow-up.[32] Dementia in PD is an important factor for reducing the quality of life of patients and increasing the burden on caregivers, the risk of nursing home placement, and thus the cost of health care.[5]

The detection of MCI in patients with PD, as defined in the diagnostic criteria of MDS, requires a comprehensive neuropsychological assessment with at least two tests for each of the five cognitive domains (attention and working memory, executive, language, memory, and visuospatial).[23,33] Such an examination is time-consuming, requires an experienced neuropsychologist, and is therefore difficult to use for routine screening of patients with MCI. The ALBA and PICNIR tests could thus represent useful tools for this purpose. Examinations could be performed at various levels of health care, including by general practitioners or outpatient neurologists. Patients with this quick and easily detected MCI are then sent for a more detailed neuropsychological examination, which determines the severity and type of cognitive impairment.

In addition to the advantages over standard neuropsychological batteries, the new tests also have certain advantages over widely used brief screening tools for assessing cognitive impairment. Several brief cognitive instruments are used to detect PD-MCI. Their psychometric characteristics are summarized in Table 3. While most tools assess multiple cognitive domains, the ALBA and the PICNIR primarily target memory. This function is traditionally considered relatively preserved in PD. Moreover, they were applied in patients with PD at an early stage of MCI. However, both tests demonstrated good discriminative

performance.

Their diagnostic accuracy was comparable to, or exceeded, that of widely used screening tools, including the Montreal Cognitive Assessment (MoCA) recommended in the MDS guidelines. The ALBA and the PICNIR achieved the highest overall diagnostic accuracy among the compared instruments presented in Table 3.

A key advantage of ALBA and PICNIR lies in their very short administration times combined with relatively high memory loads. Consequently, brevity does not necessarily imply reduced diagnostic sensitivity. In fact, they can identify MCI in patients with PD with accuracy comparable to substantially longer assessments, such as the MoCA or the ACE, which require considerably more administration time.

Despite their brevity, both tests include more items to remember than commonly used instruments do. The number corresponds to or exceeds short-term memory capacity (7±2 items). The ALBA includes 12 items (two sets of six), yielding a score range of 0−12 points. The PICNIR imposes an even higher demand on memory, with 20 pictorial items. This memory load is higher than that of other brief screening tools, which typically include fewer than seven items (three in the MMSE, five in the MoCA, and seven in the ACE). These features likely explain why the ALBA and the PICNIR are capable of identifying MCI in patients with PD with a diagnostic accuracy comparable to that of substantially longer instruments. In addition, the special feature of the gesture test of the ALBA may help identify even the pre-MCI stage in patients with PD.

To further characterize this relationship between cognitive demand and testing duration, we introduced the concept of memory efficiency, defined as the number of memoranda items per minute. ALBA and PICNIR showed values clearly above one item per minute, whereas commonly used tools remained below this threshold. Considering memory efficiency may help reduce the reliance on time-consuming, costly, or burdensome neuropsychological assessments.

Time constraints, motor impairments, and patient fatigue can restrict the use of longer cognitive tests in clinical settings. In contrast, the ALBA and the PICNIR tests combine brevity with diagnostic accuracy, making them suitable for early screening of cognitive impairment in patients with PD.

PD shares several clinical and pathological features with dementia with Lewy bodies (DLB), including early cognitive impairment,[34,35] for which several tests have been proposed.[36] Thus, pronounced deficits in the ALBA and PICNIR tests in patients with parkinsonian syndrome may suggest that DLB is more likely to be an underlying cause than PD is. Similarly, they may contribute to the early differentiation of the underlying disease in cases of coexistence of parkinsonism with MCI or mild Alzheimer's disease, which may not be rare according to the results of a recent study.[37]

Early detection of MCI in PD may enable the identification of patients with an increased risk of developing dementia who may benefit from early intervention, either pharmacological[38] or nonpharmacological, e.g., cognitive training or physical exercise.[5] Early detection of MCI may also facilitate research aimed at determining the pathogenesis of the disease at earlier stages of the disease,[33] understanding the relationships between PD and DLB, which are still debated,[39] as well as testing potential disease-modifying therapies capable of slowing the progression of cognitive impairment in PD.[40]

A limitation of the study may be the relatively small sample size of individuals and the PD-MCI subgroup. However, comparable sample sizes for the PD-MCI subgroup have been reported previously; for example, n=22[41] and n=32.[42] Although the sample size of the PD-MCI group was relatively modest, the observed between-group differences were associated with large effect sizes, supporting the clinical relevance of the findings. Post hoc power analysis for the correlation analyses indicated sufficient power for the observed significant correlations (r=0.427−0.748, power 0.944−1.000). We are aware that the ALBA and PICNIR tests were developed and validated in the Czech population; therefore, some of the included tasks might be language dependent. Cross-cultural validation might be needed before their use can be generalized to other populations.

The ALBA and PICNIR tests may be useful tools for routine screening of patients with MCI. Compared with standard neuropsychological testing, which is time-consuming and requires an experienced neuropsychologist, these tests are very brief, and the examination takes a total of 6−8 minutes. They have a significantly shorter administration time and greater accuracy in distinguishing patients with PD-MCI or even PD-CN from NC individuals. The ALBA and the PICNIR tests are time-saving tools that can be used in large-scale screening. We verified that compared with traditional scales such as the ACE and the MoCA, they can detect MCI in patients with PD very quickly. Tests can be performed at various levels of health care, including by general practitioners or outpatient neurologists. Patients for whom impairment is quickly and easily detected could subsequently be referred for a more detailed neuropsychological examination to determine the severity and type of cognitive impairment. In the context of the current effort to diagnose neurodegenerative diseases as early as possible, this procedure could contribute to early detection and more accurate prediction of the type of disease.

In conclusion, this study addressed a critical clinical need in PD. Early detection of PD-MCI is essential for patient management and prognosis, yet comprehensive neuropsychological

testing is often not feasible in routine practice. We validated brief and easily accessible screening tools capable of detecting MCI in patients with PD. Very brief tests such as the ALBA and PICNIR demonstrated high memory efficiency and diagnostic performance, matching or exceeding that of longer 10–30 minute cognitive tests. Most notably, the combined ALPIR score provided the highest diagnostic accuracy, highlighting the advantage of integrating complementary brief assessments. These time-efficient and sensitive tools offer a practical solution for routine cognitive screening and may help ensure early identification and monitoring of cognitive decline in patients with PD.

Supplementary Materials

The Data Supplement is available with this article at https://doi.org/10.14802/jmd.25271.

Conflicts of Interest

Aleš Bartoš developed the ALBA and the PICNIR tests. The other authors declare that they have no conflicts of interest.

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Author Contributions

Conceptualization: Kateřina Stolaříková, Aleš Bartoš. Data curation: Kateřina Stolaříková, Kateřina Menšíková, Sandra Kurčová, Helena Kisvetrová. Formal analysis: Kateřina Stolaříková, Aleš Bartoš. Funding acquisition: Aleš Bartoš. Investigation: Kateřina Stolaříková, Sandra Kurčová, Helena Kisvetrová. Methodology: Kateřina Stolaříková, Aleš Bartoš. Project administration: Aleš Bartoš. Resources: Kateřina Stolaříková, Sandra Kurčová, Helena Kisvetrová. Supervision: Aleš Bartoš, Petr Kaňovský. Validation: Petr Kaňovský, Aleš Bartoš. Visualization: Kateřina Stolaříková, Kateřina Menšíková. Writing—original draft: Kateřina Stolaříková, Aleš Bartoš, Kateřina Menšíková. Writing—review & editing: all authors.

ORCID iDs

Kateřina Stolaříková https://orcid.org/0009-0000-1749-6637
Aleš Bartoš https://orcid.org/0000-0002-8020-8252
Kateřina Menšíková https://orcid.org/0000-0003-4834-3160
Helena Kisvetrová https://orcid.org/0000-0003-0174-5779
Jana Zapletalová https://orcid.org/0000-0002-9694-2486
Sandra Kurčová https://orcid.org/0000-0002-2901-1497
Raymond Rosales https://orcid.org/0000-0001-6387-1389
Petr Kaňovský https://orcid.org/0000-0002-9009-3241

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