

Viewpoint

Diagnostic Procedures for Parkinson's Disease Dementia: Recommendations from the Movement Disorder Society Task Force

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Abstract: A preceding article described the clinical features of Parkinson's disease dementia (PD-D) and proposed clinical diagnostic criteria for "probable" and "possible" PD-D. The main focus of this article is to operationalize the diagnosis of PD-D and to propose practical guidelines based on a two level process depending upon the clinical scenario and the expertise of the evaluator involved in the assessment. Level I is aimed primarily at the clinician with no particular expertise in neuropsychological methods, but who requires a simple, pragmatic set of tests that are not excessively time-consuming. Level I can be used alone or in concert with Level II, which is more suitable when there is the need to specify the pattern and the severity on the dementia of PD-D for clinical monitoring,

research studies or pharmacological trials. Level II tests can also be proposed when the diagnosis of PD-D remains uncertain or equivocal at the end of a Level I evaluation. Given the lack of evidence-based standards for some tests when applied in this clinical context, we have tried to make practical and unambiguous recommendations, based upon the available literature and the collective experience of the Task Force. We accept, however, that further validation of certain tests and modifications in the recommended cut off values will be required through future studies. © 2007 Movement Disorder Society

Key words: Parkinson's disease; PD dementia; diagnostic criteria; executive functions; task force.

As potential therapeutic approaches for Parkinson's disease dementia (PD-D) become available, there is a need to establish diagnostic procedures PD-D that can be used internationally. To address this challenge, the Movement Disorder Society Task Force on Dementia in Parkinson's Disease developed recommendation for two series of tests; first a practical set (Level I) that can be used by any clinicians and requiring no particular expertise in neuropsychological methods, and a second set (Level II) that allows greater descriptive documentation, more suitable to a research setting or to a longitudinal follow-up. The algorithm for the diagnostic procedure and the ordering of the tests that are proposed in this article "map" with the clinical features and criteria described in the preceding article.¹

LEVEL I TESTING

Here, we recommend a simple and short algorithm based on current tools that can be used in an office or at the bedside. This level is best considered as a screening tool for the diagnosis of PD-D.

Recommended Algorithm for PD-D Diagnosis

The diagnosis relies on the presence of the following five criteria:

1. Parkinson's Disease.

The patient should fulfill the set of diagnostic criteria for PD proposed by the Queen Square Brain Bank (except for the criterion regarding a lack of dementia which should not be fulfilled).²

2. PD Developed Prior the Onset of Dementia.

This information is gathered by the clinician from the patient/caregiver history or from ancillary records.

3. PD Associated With a Decreased Global Cognitive Efficiency.

Test proposed: MiniMental Status Examination (MMSE). The MMSE is a formalized mental status examination useful for identifying cognitively impaired patients³ and for characterizing PD-D.⁴ It is proposed because it is a simple and universally applied scale that can be easily and rapidly performed by a clinician in the office or at the bedside.

Cutoff proposed: score <26. A score of 25 or below is proposed because the MMSE is relatively insensitive to executive dysfunction. This cut off score was used in a recent pharmacological trial in PD-D.⁵ The MMSE is influenced by the effects of age and level of education. The recommended cut off is appropriate in patients below the age of 80 and in those with at least 10 years of formal education. In older or more poorly educated patients, reference to published norms may therefore be helpful in judging impairment in individual patients.^{6,7}

4. Cognitive Deficiency Severe Enough to Impair Daily Life.

One cornerstone of the diagnosis of dementia is the evidence of an impact on daily living activities that cannot be attributed to motor or autonomic symptoms in case of PD-D. The examiner should ask questions about daily functioning such as the patient's ability to manage finances, use pieces of equipment, and cope in social situations. Appendix lists another simple assessment of the ability to organize independently the daily distribution of antiparkinsonian medication that may be suitable to determine an impact of cognitive changes on daily life, although this requires validation. This item can be an index of mental organization and functioning in a daily living situation. It has broad application as virtually all

parkinsonian patients take a number of medications several times a day.

Both the presence of significant cognitive changes and the subsequent impact on everyday life activities have come to define the threshold for dementia,⁸ and represent an important step in the diagnostic process of the dementia of PD.

5. Impairment in More Than One Cognitive Domain.

The proposed diagnostic criteria require a profile of cognitive deficits, typical of those described for PD-D, in two or more of four domains.

a) Attention. Tests proposed (the clinician may choose one of the following):

- *Serial 7's of the MMSE.*³ The patient is asked to repeatedly subtract 7 starting at 100. As the test is aimed at assessing attention, the instructions should not be repeated.

Cutoff proposed: At least two incorrect responses.

- *Months reversed.*⁹ Selective attention and mental control can be assessed with a mental tracking task that asks the patient to give the months of year backward, starting from December.

Cutoff proposed: Omission of two or more months, incorrect sequencing of the months, or failure to complete the test within 90 seconds.

b) Executive Function. Tests proposed (the clinician may choose one of the following):

- *Lexical Fluency.*¹⁰ This neuropsychological test is an effective way to assess how well subjects activate frontal-related strategies to retrieve specific types of information. It involves short-term memory and keeping track of what words have already been said. The subject's task is to evoke in a limited time (usually 60 seconds) the maximum number of words pertaining to a phonological category (e.g., words beginning by a given letter). Together with verbal memory, the phonological or lexical fluency performance has been shown to be very sensitive in detecting cognitively impaired PD patients.^{11,12} It is highly unlikely that any demented patient would have normal verbal fluency. Reference 13 details the precise instructions for the task.

*Variable of interest*¹³: Number of words beginning with the letter S in 1 minute.

Cutoff proposed: A score ≤ 9 words is considered as an impairment, reflecting a significant executive dysfunction.

- *Clock Drawing Test*¹⁴: This test evaluates executive

more than visuo-perceptual dysfunction. The person is asked to draw a clock with the hands showing "10 past 2."

Cutoff proposed: Inability to insert the correct clock face numbers and/or the clock hands pointing to the correct time.

c) Visuo-Constructive Ability. Test proposed:

- *Drawing of the MMSE pentagons.*³ The patients are asked to copy the two intersecting pentagons.

Cutoff proposed: The copy should include two pentagons that overlap.

d) Memory Impairment. Test proposed:

- *3-Word Recall of the MMSE.*³ Patients with PD-D have impaired recall performance in episodic memory, especially in the free recall condition.¹⁵ We propose utilizing this subtest of the MMSE to evaluate the memory performance of patients in a free recall condition.

Cutoff proposed: At least one missing word. Missing one word in the free recall of the MMSE is considered sufficient to suggest the existence of a memory/retrieval problem.

It is worth emphasizing here that memory impairment is not a prerequisite for the diagnosis of PD-D and that a preservation of language function (that can be evaluated during the general neurological examination and patient interview) is usual in PD-D.

Supportive Features

Although behavioral symptoms are not required, the presence of at least one of the following behavioral symptoms (apathy, depressed or anxious mood, hallucinations, delusions, excessive daytime sleepiness) supports the diagnosis of probable PD-D. These symptoms can be assessed with the *4-item Neuropsychiatric Inventory*,¹⁶ which covers hallucinations, depression, delusions, and apathy.

Cutoff proposed: score ≥ 3 for each item.

Involuntary and excessive daytime sleepiness can be assessed by specific questions.

Features Making the Diagnosis of Probable PD-D Uncertain

We do not propose to be proscriptive regarding ancillary investigations that should be undertaken when establishing if the patient has dementia associated with PD or some other cause for their cognitive decline. If, however, in the course of history taking from both patient and care-giver, and/or on clinical examination comorbidities come to light that may be relevant, we strongly recom-

TABLE 1. Algorithm for diagnosing PD-D at Level I

1	A diagnosis of Parkinson’s disease based on the Queen’s Square Brain Bank criteria for PD ²
2	PD developed prior to the onset of dementia
3	MMSE ³ below 26
4	Cognitive deficits severe enough to impact daily living (Caregiver interview or Pill Questionnaire)
5	Impairment in at least two of the following tests: Months reversed ⁹ or Seven backward ³ Lexical fluency ¹⁰ or Clock drawing ¹⁴ MMSE Pentagons ³ 3-Word recall ³

The presence of one of the following behavioral symptoms: apathy or depressed mood or delusions¹⁶ or excessive daytime sleepiness may support the diagnosis of probable PD-D.

The presence of major depression or delirium or any other abnormality which may by itself cause significant cognitive impairment makes the diagnosis uncertain.

mend that appropriate tests be performed (e.g., B12, TSH and CT or MRI brain scan in subjects with several vascular risk factors).

If the time interval between the development of motor and cognitive symptoms is not known, it will be unclear whether the patient has DLB or PD-D. Care-giver interview and/or review of the medical records are therefore essential to establish the correct temporal sequence as accurately as possible. In practice, if dementia develops in the context of established PD, a diagnosis of PD-D is warranted; if the symptoms of dementia develop prior to or within the same year of concurrence of motor features, a diagnosis of DLB would be justified.¹⁷

In PD, delirium and iatrogenic effects of anticholinergics, dopaminergic drugs, benzodiazepines or other agents need to be excluded. Similarly, treatable causes of dementia or confusion, such as infection, dehydration, vitamin deficiency, or endocrinologic disturbances, need to be ruled out for diagnostic clarity. Generally speaking, an absence of depression is required for the diagnosis of dementia. In PD, depression is frequent and should **not** be *a priori* an exclusionary criterion for the diagnosis of dementia. However, as it may aggravate cognitive changes, it should be documented and we suggest that, in case of major depression, antidepressant treatment should be tried before determining the existence of a dementia.

*Test proposed: Geriatric Depression Scale*¹⁸—The short version of the GDS (GDS-15) was recently shown to be a good screening instrument for depression in PD because it is brief and can be self-administered, with test characteristics comparable to the Hamilton Dementia Rating Scale.¹⁹ It can be combined with NPI in patients with more severe dementia.¹⁶

Cutoff proposed: A cutoff > 4 has acceptable discriminant validity for the depression in PD. In case of major depression, the diagnosis of PD-D should not be made and should be reconsidered after antidepressant treatment.

Table 1 summarizes the algorithm and the proposed instruments for establishing the diagnosis of PD-D at Level I. These tests are widely available and require no specific expertise in neuropsychology. For the diagnosis of possible PD-D, see Ref 1. Table 2 proposes a simple diagnostic rating sheet that can be useful for checking the presence of the diagnostic features of PD-D.

LEVEL II TESTING

Once the diagnosis of PD-D is established, it may be important to specify its pattern and severity, either for clinical monitoring, research studies or pharmacological trials. Level II tests provide a more detailed series of assessments that will allow characterization of the components of PD-D and the monitoring of elements that may be responsive to interventions. As the patient has already been diagnosed as having dementia, these investigations are qualitative and have no diagnostic cutoff scores. The same Level II assessments may also be utilized when the diagnosis of PD-D remains uncertain or equivocal at the end of Level I process, for example where the cognitive deficits are patchy and relatively mild or when depression is present. In these cases, additional neuropsychological investigation is needed to complement the simple assessments described above for Level I, and help bring the clinician closer to a firm diagnosis. The Level II evaluation assesses four domains: global cognitive efficiency; subcortico-frontal

TABLE 2. Diagnostic rating sheet for probable PD-D, recommended by the Movement Disorder Task Force

	YES	NO
1. Parkinson’s disease	<input type="checkbox"/>	<input type="checkbox"/>
2. Parkinson’s disease developed before dementia	<input type="checkbox"/>	<input type="checkbox"/>
3. MMSE <26	<input type="checkbox"/>	<input type="checkbox"/>
4. Dementia has Impact on ADLs	<input type="checkbox"/>	<input type="checkbox"/>
5. Impaired cognition (For Yes, at least of 2 of 4 tests below are abnormal)	<input type="checkbox"/>	<input type="checkbox"/>
Mark which Tests are abnormal		
<input type="checkbox"/> Months reversed or Sevens backwards		
<input type="checkbox"/> Lexical fluency or clock drawing		
<input type="checkbox"/> MMSE pentagons		
<input type="checkbox"/> 3-word recall		
6. Absence of Major Depression	<input type="checkbox"/>	<input type="checkbox"/>
7. Absence of delirium	<input type="checkbox"/>	<input type="checkbox"/>
8. Absence of other abnormalities that obscure diagnosis	<input type="checkbox"/>	<input type="checkbox"/>
Probable PD-D (items 1–8 must all be YES)	<input type="checkbox"/>	<input type="checkbox"/>

TABLE 3. Summary of Tests at Level II testing for PD-D

Global efficiency	Mattis DRS ²⁰
Executive functions	
Working memory	Digit span ²⁵ Spatial span (CANTAB) ²⁹ Digit ordering test ³²
Conceptualization	Similarities (WAIS-III) ³⁴ Wisconsin CST ³⁶
Set activation	Verbal fluency (C, F, L) ^{10,21}
Set shifting	TMT ⁴⁰
Set maintenance	Stroop test ^{21,42} Odd man out test ⁴³
Behavioral control	Prehension behavior ⁴⁴
Memory	RAVLT ^{53,55} Free and cued recall test ^{15,54}
Instrumental functions	
Language	Boston naming test ⁵⁷
Visuo-constructive	Copy of the clock ^{14,59}
Visuo-spatial	Benton line orientation test ⁶⁰ Cube analysis (VOSP) ⁶¹
Visuo-perceptive	Benton face recognition test ⁶³ Fragmented letters (VOSP) ^{61,64}
Neuropsychiatric functions	
Apathy	Apathy scale ⁴⁷
Depression	MADRS ⁶⁶ Hamilton ^{19,66} Beck depression inventory ⁶⁷ GDS-15 ⁶⁸
Visual hallucination	PPQ ⁶⁹
Psychosis	NPI ⁵⁰

features; of PD-D; instrumental (cortically mediated) functions; and neuropsychiatric features (see Table 3).

Assessment of Global Efficiency

Because the MMSE is relatively insensitive to the changes that characterize the subcortico-frontal cognitive impairments of PD-D, a more comprehensive assessment of global efficiency in PD can be obtained with the Mattis Dementia Rating Scale (DRS).²⁰ It is recommended because: (i) it is a global scale sensitive to the dysexecutive syndrome that has been reported as a key feature of PD-D;²¹ (ii) it provides a score that is helpful to characterize the severity of the dementia; and (iii) it can be used in longitudinal assessments.²²

*Test proposed: MATTIS Dementia Rating Scale.*²⁰ This widely used scale examines five areas, most of which are particularly sensitive to the changes that characterize subcortical-frontal dementias (attention; initiation and perseveration; conceptualization; memory)

Variable of interest: the global score (normal ≥ 136). We would recommend the use of age- and education-based normal values.²³

Assessment of Subcortico-Frontal Features of PD-D

Subcortico-frontal involvement in PD-D is considered to be the cause of many of the clinical features, espe-

cially executive dysfunction (impaired working memory, attention, conceptualization and shifting aptitude), as well as behavioral changes (apathy) and a memory retrieval deficit.²¹

1. Assessment of Executive Functions. (see Table 3)

In a restrictive sense, executive functions refer to the processes that are needed for the realization of complex cognitive tasks requiring the selection of information to be processed, to find a rule, to shift mental set, to solve a multiple steps problem, to resist cognitive interferences, to share attentional resources, and to actively retrieve information. Most of these processes are strongly correlated with *working memory*. In a broader definition, executive functions constitute the processes that are needed in novel or demanding situations that require the elaboration of goal-directed behaviors: (i) anticipation of the goal; (ii) selection, maintenance, and monitoring of appropriate information within the working memory buffer; (iii) elaboration and execution of the plan; (iv) control and monitoring of the response; and (v) validation of its pertinence as a function of internal and external contingencies.²⁴

a) Short Term and Working Memories.

- *The Digit Span Test*²⁵—This test is a common measure of short-term memory that comprises two different tests: the digit span forward and the digit span backward. The subject's task is to repeat number sequences exactly as it is given (digit forward) or in an exactly reversed order (digit backward). The requirement of the reversed digit span is to store data items briefly while mentally manipulating them is an effortful activity that calls upon the working memory. The normal range score for digit forward is 6 ± 1 ^{26,27} and slightly more than one less for digits reversed. The performance in the Digit Span Test is decreased in parkinsonian patients with cognitive deficit.²⁸

Variable of interest: number of digits recalled in the right order.

- *The Spatial Span from the CANTAB*²⁹—This is a visuospatial short-term memory test based upon the Corsi Block Tapping Task.³⁰ Subjects are shown a series of boxes in a spatial array that change color one by one. They must reproduce the sequence by touching the boxes in the same order. Sequence length increases from two to nine boxes; the task terminates if subjects make three errors at any one level.

Variable of interest: The final level at which the subject correctly reproduces a sequence (i.e., the spatial span), and numbers of errors.

- *The Digit Ordering Test*^{31,32}—In this test, subjects are

asked to read a random selection of digits and required to reorder the items maintained in working memory and, finally, to repeat them in ascending fashion. This task is very sensitive to working memory deficits particularly in patients with PD.³³

Variable of interest: Number of digits correctly recalled in ascending fashion.

b) Conceptualization Ability.

- *The Similarities of the WAIS-R*³⁴—Participants are presented with 14 word pairs ranging in difficulty from easy (orange-banana) to more difficult (fly-tree) and are asked to explain how the words in each pair are similar to one another. The test assesses the participant's ability to understand and synthesize relationships in order to arrive at a common theme. Abstract responses are given 2 points, concrete or partially abstract answers are given 1 point, and incorrect responses are given no points.

Variable of interest: Number of abstract responses given.

- *The Wisconsin Card Sorting Test (WCST)*^{35,36}—This test requires subjects to sort cards according to one criterion (color, form or number) that they must deduce from feedback of the examiner indicating if the response is correct or not. After 10 consecutive correct responses, the examiner shifts the rule without warning, requiring that subjects deduce the new criterion guided only by reinforcement for correct responses. From responses on the WCST, it is possible to determine several indices of performance: the number of categories or concepts achieved (a measure of the subject's concept or set formation ability); the number of perseverative errors (a measure of the patient's ability to "get out" of the previous category and to shift from one sorting principle to another); and the number of nonperseverative errors (a measure of attentional deficits). The performance is impaired in parkinsonian patients with cognitive dysfunction.³⁷⁻³⁹

Variable of interest: Number of categories achieved; number of perseverative and non perseverative errors.

c) Set Activation, Set Shifting and Set Maintenance.

- *Verbal fluency*¹⁰—This test provides an excellent means of determining how well subjects activate pathways to retrieve specific information. Comparison between the number of retrieved words pertaining to a phonological (e.g., words beginning by C, F or L) or to a semantic (e.g., animal names) category or to the number of correct words produced in naming task (see below) can be used to evaluate the severity of executive dysfunction. The performance is decreased in

parkinsonian patients with cognitive changes.³⁸

Variable of interest: Number of words provided in a given time.

- *Trail Making Test-TMT*⁴⁰—This is a test of complex visual scanning with a motor component that mainly assesses shifting aptitude. The test is divided in two parts: part A and part B. TMT-A requires the participant to join a series of randomly positioned numbers in consecutive order (i.e., 1-2-3). On part B (TMT-B), participants are required to join a series of randomly positioned numbers and letters alternately in their respective sequence (i.e., 1-A-2-B-3-C). The motor component of the response can be controlled by subtracting TMT B - TMT A. The Trail Making Test is sensitive to Parkinson's disease cognitive changes.⁴¹
- Variable of interest:* number of TMT-B errors; TMT B time -TMT A time in seconds.

- *Stroop Test*⁴²—This test measures the ability to shift a perceptual set to conform to changing demands. It includes a key demand on selective attention of a given response characteristic (i.e., color naming) to the exclusion of a more dominant one (i.e., word reading). This is called the interference condition. Subjects are presented with a succession of names of colors printed in a color other than the one spelled by the letters and are asked to say the color of the word as quickly as possible. The difficulty lies in the competition between the color of the ink and the meaning of the word, because the subject must inhibit the strong tendency to read the word.

Variable of interest: Number of ink colors that are named in a given time in the interference task.

- *The Odd Man Out Test*⁴³—This is a sorting task in which subjects are required to indicate which element of a set of three letters or forms is different from the two others, using two rules of classification alternately on successive trials (difference in form or in size).

Variable of interest: The number of correct responses which is decreased in parkinsonian patients with cognitive changes.

d) Behavioral Control.

- *Prehension behavior*⁴⁴—This test assesses the ability to control for the spontaneous activation of pattern of behavior in response to environmental stimulation. This ability is decreased in PD patients with cognitive changes.⁵⁷ To test for this behavior, the examiner first places his hands within the proximity of the patient's hands and then touches both of the patient's palms, to see if he/she will spontaneously take them.

Variable of interest: Subject's ability to control for the

prehension of examiner's hands. A scoring of this behavior has been proposed in the Frontal Assessment Battery (FAB).⁴⁵

2. Assessment of Apathy.

Apathy is a common feature in subcortico-frontal dysfunction that is related to the subcortico-frontal networks⁴⁶ and can be evaluated with:

- *The Apathy Scale*⁴⁷—This scale, adapted from Marin's apathy scale,⁴⁸ includes 14 items that are scored by the patient and/or the patient's relative or caregiver. Each item has four possible answers, scored from 0 to 3. This scale is currently used in PD.⁴⁹
Variable of interest: The Apathy Scale score (that ranges from 0 to 42 points with score above 14 generally considered indicative of a significant apathy).
- *The Neuropsychiatric Inventory (NPI)*^{50,51}—The NPI consists of a structured caregiver interview that rapidly assesses a wide range of behavioral symptoms encountered in demented patients and which provides a method for characterizing the frequency (rated 1 to 4, being 4 the most frequent) and the severity (rated 1 to 3, being 3 the most severe) of these behavioral changes. This scale has been used in patients with PD-D.⁵²
Variable of interest: The apathy score. Scores above 3 indicate significant apathy.

3. Assessment of Long-Term Memory Process and Retrieval Ability.

The dissociation between the mediotemporal component (predominantly impaired in Alzheimer's disease) and the subcortico-frontal component (predominantly impaired in PD-D) is of central importance in understanding the patterns of memory deficit found in different dementia syndromes. When impaired, the medial temporal/hippocampal component is responsible for encoding deficits, loss of information after delay, low effect of cueing on recall or high number of extra-list intrusions and false positives in recognition. The subcortico-frontal component mediates the more strategic aspects of explicit memory, involved in encoding and retrieval. Accordingly, impaired recall in PD-D can result from both an attentional disorder at registration and an inability to activate appropriate retrieval networks. This strategic demand is high in memory tests in which: (i) the material to be learned is not semantically organized; and (ii) recall has to be activated by internally generated retrieval strategies that guide the memory search, as in the Rey Auditory Verbal Learning Test.⁵³ Interestingly, replacing these defective internally generated strategies by explicit

ones may enhance the performance of patients with dys-executive syndrome by facilitating the registration and the retrieval of information. This is the case with the Free and Cued Recall Test⁵⁴: by controlling both encoding and retrieval with the same semantic cues, the test can normalize the recall performance of patients with frontal lobe dysfunction. Comparing the free and cued recall performance allows for isolation of retrieval deficits that have been reported as a feature specific to the memory impairment in PD-D.²¹

Tests proposed:

- *Rey Auditory Verbal Learning Test*.⁵³ This comprises five presentations with recall of a 15-word list (list A) and one presentation of a second 15-word list (list B) with a sixth recall trial. Retention can be examined by a delayed recall (after a 30 minute delay) and by a recognition trial in which the subject is presented with the list of 50 words containing all the items from both the A and B lists. This test provides information about immediate memory span, learning curve, learning strategies and tendencies for retroactive and proactive interference. The performance is decreased in patients with PD.⁵⁵
Variable of interest: Successive recalls of list A, recall of list B, delayed recall and recognition scores.
- *Free and Cued Recall Test*.⁵⁴ In this task, an effective encoding of the verbal items is controlled by asking the subject to point and to read aloud each of the to-be-remembered items, in response to its semantic category. All 16 items have to be retrieved before starting memory assessment across three consecutive series of free and cued recall. For any item not retrieved spontaneously at free recall, the semantic cue is provided to facilitate retrieval. The comparison between free and cued recall evaluates the subcortico-frontal component.
Variable of interest: Free Recall score (decreased) and Total Recall Score (significantly increased) % of reactivity to cueing.¹⁵

Assessment of Instrumental Functions

Although PD-D has been reported to be mainly a "dysexecutive" dementia,²¹ instrumental functions may also be impaired, reflecting possible cortical involvement.⁵⁶ Functions and tests to elicit these features are:

1. Language.

- *Boston Naming test*^{57,58}—This test consists of naming drawings of items with different levels of familiarity. The Boston Naming Test is effective for identifying

naming deficits and word-finding problems.

Variable of interest: Number of correct answers.

2. Complex Visual Functions.

Complex visual functions are impaired in PD-D and impairment is evident even in PD.

These functions can be assessed with:

- *Visuo-constructional tasks such as the Clock Drawing Test (copy).*¹⁴ Besides executive disorders, visuo-constructional impairments indicative of a parietal dysfunction can be identified with the copy of a clock.^{59,60}
Variable of interest: copy of the drawing (with model). See scoring system currently used.¹⁴
- *Visuospatial tasks such as the Benton Line Orientation Test* which has been used in several studies and found to be sensitive to PD-D,⁶⁰ or the Cube Analysis of the Visual Object and Space Perception Battery (VOSP)⁶¹ also found to be sensitive to DLB.⁶²
Variable of interest: Number of correct responses.
- *Visuo-perceptual tasks such as the Benton Face Recognition Test⁶³ or the Fragmented Letters of the VOSP.⁶¹*
Variable of interest: Number of correct identifications.

Assessment of Neuropsychiatric Functions

Neuropsychiatric symptoms are very common in PD-D, and have important clinical implications such as caregiver distress. The most characteristic features are apathy and visual hallucinations. In more severely demented PD patients, the neuropsychiatric symptoms are dominated by apathy, depression, psychosis, and agitation.⁶⁴ Although dopaminergic drugs can influence these symptoms, a wide range of studies has shown that host-factors are more important. Depression is among the most common symptoms, but is less characteristic for PD-D because it is common in most other dementias as well. Recent effort has been made to propose diagnostic criteria for psychosis associated with PD that highlights the specificity of its clinical features.⁶⁵

Several instruments can be proposed for assessing neuropsychiatric features. The Task Force recommends:

- *For Depression:* Depression can be rated using clinical interview (Montgomery and Asberg Depression Rating Scale and Hamilton Depression Rating Scale) or with a self-rating questionnaire (Beck Depression Inventory, Geriatric Depression Scale); all have been validated for PD patients.^{66–68} However, the assessment of depression in PD-D may be less straightforward, because specific instruments have not been validated in this population.
- *For Visual hallucinations:* Scale focusing on visual

hallucinations exist, such as the Parkinson Psychosis Questionnaire—PPQ.⁶⁹

- *For Psychosis:* Instruments assessing psychosis or other psychiatric symptoms have not been validated for use in PD populations. Scales that measure a broad range of neuropsychiatric symptoms are recommended, since these may demonstrate the characteristic neuropsychiatric profile of patients with PD-D. The most widely used scale is the *NPI*, which is highly structured and covers both frequency and severity and also evaluates caregiver distress.⁵⁰ It should be noted that some patients may not communicate their hallucinations to caregivers and that the PPQ⁶⁹ is more specific to PD although it has not been validated in PD-D.

DISCUSSION

The PD-D Task Force has proposed diagnostic criteria for the diagnosis of PD-D and, in this article, has suggested procedures that may be used to establish this diagnosis (Level I) and characterize the disorder (Level II). Fundamental to the diagnosis of PD-D is the fact that there is an impact upon daily living resulting from cognitive deficits, over and above those imposed by motor and autonomic problems. In proposing two levels of assessment, we have attempted to separate the fundamental and minimal set of tests required for the diagnosis (Level I) in order to permit clinicians in active practice to arrive at the diagnosis in a straight-forward manner. No particular expertise in neuropsychological assessment and no special tools are required. The tests within the battery proposed (Table 1) are well known and can be rapidly completed. In many cases, this battery, coupled with a careful accompanying account from the caregiver, will be adequate to confirm the diagnosis of PD-D, according to the criteria proposed. The tests will also highlight domains of particular concern to the patient and their family and may be useful in prioritizing treatment decisions. Level II testing is more detailed and requires greater expertise in neuropsychological methods, and the availability of the relevant instruments (Table 3). Level II testing may be suitable for research studies or pharmaceutical trials where there is a need to document the efficacy of drugs under investigation. It may also be required when diagnostic doubt exists, and the Level I assessment produces equivocal results. In this case, when the practitioner is unable to arrive at the diagnosis of PD-D because of these concerns, a referral for neuropsychological evaluation will be needed and the consultation can specifically include a request to follow the Level II battery. Given the number of neuropsychological tests currently available we hope the carefully selected

range given here will facilitate more direct comparison between different studies in future. The dementia syndrome associated with PD is not simply a disorder of cognition. Neuropsychiatric disturbances may be prominent and a source of major distress to the patient and their family. The operationalization of these behavioral and neuropsychiatric features is not straightforward, given their diversity and the current lack of validated tools in several key areas (for example visual hallucinations).⁷⁰ We have suggested widely used instruments to detect these features, which have also been employed in several studies of PD-D, but acknowledge that this is no substitute for further work in this area to develop disease-specific instruments that are sensitive to change. A validation of all these tests

and instruments for PD-D is recommended by the Task Force.

There will be two major strategies for the validation of the proposed criteria and their operationalization. First, the criteria may be applied retrospectively to existing cohorts that have detailed investigations including neuropsychological assessments. Second, prospective cohorts should be acquired that are followed to post mortem. This prospective approach should include nondemented individuals with PD. At their initial study visit, subjects should be evaluated with the newly proposed criteria and, in subsequent visits, the stability of the diagnosis under these proposed criteria should be determined.

APPENDIX: THE PILL QUESTIONNAIRE

A Simple Test to Assess Decline in Cognitive Function and Its Impact on Daily Live in Parkinson's Disease

If the patient was previously able to manage his/her treatment in the past, this test may be an index of mental organization and functioning in a daily living situation, although it requires formal validation in prospective studies. It will be widely applicable because virtually all parkinsonian patients take a number of medications several times a day. As some patients may be treated for other additional medical problems, the investigation will only focus on antiparkinsonian therapy. The assessment can involve the patient and the caregiver: (e.g., "Is the patient still able to take the prescribed pills reliably?"). Although we consider this a sensitive test for cognitive impairment, some patients do not manage their treatments because of motor handicap. Consequently, we propose that this item should be assessed by asking the patient to describe verbally his/her treatment and its time schedule.

Cutoff: Even if the patient does not manage his treatment himself, we can conclude that he/she has lost at least a part of his/her autonomy if he/she can no longer describe the treatment. The criterion of impairment is met if the patient is no longer able to explain his daily PD medication, or if errors are made that is considered clinically significant as judged by the clinician.

We propose three items for quotation:

- The patient is able to spontaneously and clearly describe the drugs, doses (mg or color of tablet), and timing of treatment = *there is no impact*.
- The patient needs some help from the examiner (What time do you take to your medication which drug and which doses? . . .) but he/she is successful without clinically pertinent errors. In this case, the determination of impact on daily living requires consultation with a caregiver:
 - If the caregiver certifies that the patient can (or could) safely and reliably take the pills without supervision in daily life = *no impact*.
 - If the caregiver certifies that the patient can (or could) no longer safely and reliably take the pills without supervision in daily life = *there is an impact on daily living*.
- The patient is not able to describe, even with the help of the examiner, the time and nature (drugs and doses) of his/her treatment = *impact on daily living*.

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