CHEST

Original Research

COPD

Mild Cognitive Impairment in Moderate to Severe COPD

A Preliminary Study

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Background: **Cognitive impairment is a frequent feature of COPD. However, the proportion of patients with COPD with mild cognitive impairment (MCI) is still unknown, and no screening test has been validated to date for detecting MCI in this population. The goal of this study was to determine the frequency and subtypes of MCI in patients with COPD and to assess the validity of two cognitive screening tests, the Mini-Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA), in detecting MCI in patients with COPD.**

Methods: **Forty-five patients with moderate to severe COPD and 50 healthy control subjects underwent a comprehensive neuropsychologic assessment using standard MCI criteria. Receiver operating characteristic curves were obtained to assess the validity of the MMSE and the MoCA to detect MCI in patients with COPD.**

Results: **MCI was found in 36% of patients with COPD compared with 12% of healthy subjects. Patients with COPD with MCI had mainly the nonamnestic MCI single domain subtype with predominant attention and executive dysfunctions. The optimal MoCA screening cutoff was 26 (≤25 indicates impairment, with 81% sensitivity, 72% specificity, and 76% correctly diagnosed). No MMSE cutoff had acceptable validity.**

Conclusions: **In this preliminary study, a substantial proportion of patients with COPD were found to have MCI, a known risk factor for dementia. Longitudinal follow-up on these patients is needed to determine the risk of developing more severe cognitive and functional impairments. Moreover, the MoCA is superior to the MMSE in detecting MCI in patients with COPD.**

CHEST 2012; 142(6):1516–1523

Abbreviations: AD = Alzheimer disease; AUC = area under the curve; CFQ = Cognitive Failures Questionnaire; DLCO = diffusion capacity of the lung for carbon monoxide; DSM-IV-TR = *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*; MCI = mild cognitive impairment; MMSE = Mini-Mental State Examination; MoCA = Montreal Cognitive Assessment; NPV = negative predictive value; PPV = positive predictive value; ROC = receiver operating characteristic; Sa_{O_2} = oxygen saturation

COPD is a progressive disease characterized by partially irreversible chronic airflow limitation.[1] Typical onset is in middle adulthood (≥ 55 years), and > 14% of individuals older than 65 years are affected.[2] Cognitive impairment is one of the most frequent extrapulmonary manifestations in COPD,[3] and it has been associated with higher mortality and disability.[4,5] Assessing cognitive impairment in patients with COPD should, therefore, provide relevant information on disease prognosis. Previous studies of cognitive performance in patients with COPD vs healthy subjects found mostly poor performance on cognitive tests of attention, memory, and executive functions.[3] However, the proportion of patients with COPD with clinically relevant cognitive impairments, based on standard criteria that can be readily applied in clinical and research settings, remains unknown.

Mild cognitive impairment (MCI) refers to significant cognitive decline without major functional impacts on activities of daily living.[6,7] Individuals with MCI are of particular interest, because they are at higher risk for dementia,[7] including Alzheimer disease (AD)

and vascular dementia.[8] Longitudinal studies have shown that almost one-half of the individuals who meet MCI criteria develop dementia within 3 years.[7,9] Accordingly, knowing the proportion of patients with COPD with MCI would provide essential information about the frequency of clinically relevant cognitive decline in patients with COPD, as well as objective long-term follow-up criteria and guidelines for selecting patients liable to benefit from therapeutic interventions.[7]

A comprehensive neuropsychologic assessment is the most effective way to detect MCI. However, it is time consuming, requires specialized training, and is often unavailable to patients with COPD in clinical practice. Thus, efficient tools that can detect MCI in patients with COPD are needed. The Mini-Mental State Examination (MMSE)[10] is the most commonly used test for screening cognitive impairments.[11] However, its sensitivity to MCI has been questioned,[11] particularly in individuals with executive dysfunctions. The Montreal Cognitive Assessment (MoCA) test is another 5- to 10-min cognitive screening tool designed to assist clinicians in detecting cognitive impairment.[12] The MoCA has been found to be superior to the MMSE in detecting MCI in various clinical populations.[12-14] However, the validity of these tests to detect MCI in patients with COPD has not been established. The aim of the present study was to determine the frequency and main subtype of MCI in patients with moderate to severe COPD and to assess the validity of the MMSE and the MoCA in detecting MCI in patients with COPD.

Manuscript received December 7, 2011; revision accepted May 10, 2012.

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Funding/Support: This study was supported by grants from the Fonds de recherche du Québec-Santé (Drs Pepin and Gagnon), the Canadian Lung Association/Canadian Respiratory Health Professionals (Dr Pepin), the Faculté des sciences humaines de l'Université du Québec à Montréal (Dr Gagnon), and the Réseau provincial de recherche en adaptation-réadaptation (scholarship to Mr Rahayel).

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DOI: 10.1378/chest.11-3035

Materials and Methods

Patient Selection

Patients with COPD were prospectively enrolled and referred by a pneumologist from the outpatient COPD clinic at the Hôpital du Sacré-Coeur de Montréal. The inclusion criteria were: (1) clinically stable moderate to severe COPD according to the GOLD (Global Initiative for Chronic Obstructive Lung Disease) classification,[15] (2) postbronchodilation $FEV_1 < 80\%$ of the predicted normal value and FEV_1 to FVC ratio < 0.7, (3) age ≥ 40 years, and (4) smoking history of ≥ 10 American pack-years (20 cigarettes per pack).

Exclusion criteria for patients with COPD and control subjects were as follows: (1) exacerbation of respiratory symptoms in the past 4 weeks (change in dyspnea and/or volume/color of sputum, need for antibiotic treatment, or need for hospitalization); (2) oxygen therapy; (3) presence of asthma, unstable coronary heart disease, uncontrolled diabetes or hypertension, left-sided congestive heart failure, neoplasia, severe claudication, encephalitis, or epilepsy; (4) history of head injury or brain tumor; (5) major psychiatric condition according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR)[16]; (6) dementia according to the DSM-IV-TR criteria and the neuropsychologic assessment (ie, at least two cognitive domains impaired, including verbal learning and memory). Cognitive deficits should be severe enough to exert a significant impact on activities of daily living (ie, medication management, meal preparation, finances, transportation, shopping, and housekeeping), as assessed by a structured interview based on an in-house questionnaire; (7) age > 90 years; (8) language other than French or English; and (9) illiteracy.

Spirometry, lung volume assessment, and diffusion capacity of the lung for carbon monoxide (Dlco) assessment were performed according to recommended procedures.[17] Results were compared with predicted normal values from the European Community for Coal and Steel and the European Respiratory Society.[18] Oxygen saturation (Sa_{O_2}) was measured at rest.

Fifty healthy older adults were recruited from the general population through newspapers and by word of mouth. Most of the control subjects had participated in a previous study on cognition in Parkinson disease.[19] Ethical approval was obtained from the hospital's ethics committee (institutional review board committee name and project approval number: Hôpital du Sacré-Coeur de Montréal, 2008-01-107), and all participants gave their written informed consent according to the Helsinki Declaration.

Comorbidities

Vascular comorbidities (hypertension, hypotension, dyslipidemia, diabetes mellitus, carotid stenosis, history of coronary artery disease, transient cerebral ischemia, and cardiac arrhythmia) were computed in patients with COPD to create a vascular burden score.[20] Comorbidities were assessed based on clinical records and information provided by participants or proxies during the medical interview. This index was not systematically assessed in all our control subjects. Therefore, we used a control group of 77 participants living in the same community as our sample and with equivalent age (70.04 ± 9.55 years), sex (19 men), and education (14.01 ± 3.41 years) for comparison with patients with COPD.[20] The Epworth Sleepiness Scale was administered to assess excessive daytime sleepiness.[21]

Neuropsychologic Tests and MCI Criteria

Patients with COPD and control subjects underwent comprehensive neuropsychologic testing by a neuropsychologist

according to standard procedures.[22] Table 1[23-36] presents the cognitive domains, tests, variables, and normative data used. Patients with COPD began with the MoCA.[12] All participants then performed the MMSE[10] and the other neuropsychologic tests in the same 2-h session. Questions on orientation (date, month, year, day of the week, place, and city) were asked only once, on the MoCA, and these orientation scores were added to the scores on the MMSE. Following standard procedure,[12] one point was added to the MoCA score for patients with ≤ 12 years of education.

All of the following criteria should be met for an MCI diagnosis[6,37,38]: (1) a subjective complaint of cognitive change by the patient or informant on a structured interview or the Cognitive Failures Questionnaire (CFQ)[39] (based on a total score > 24, or, on at least one item, the response 3: quite often or 4: very often); (2) objective evidence of cognitive decline defined as at least two scores in a same cognitive domain ≥ 1.5 SD below the standardized mean, adjusted for age and education (Table 1); (3) preserved activities of daily living (see exclusion criterion number 6 in the "Patient Selection" section); and (4) cognitive deficits not better explained by other medical or psychiatric disorders or medication use. MCIs were classified into four subtypes: amnestic MCI single domain (isolated learning and memory deficit), nonamnestic MCI single domain (either attention and executive functions or visuospatial impairment), amnestic MCI multiple domain (learning and memory deficit plus impairment in another cognitive domain), and nonamnestic MCI multiple domain (attention and executive dysfunction plus visuospatial impairment).[6]

Statistical Analysis

Student *t* tests were performed to assess group differences in continuous data. Categorical variables were compared using Pearson χ^2 tests. A receiver operating characteristic (ROC) curve with area under the curve (AUC) (95% CI) was used to assess the sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV), and percentage of patients with correct diagnosis using total scores on the MoCA and the MMSE to detect MCI in patients with COPD. Three cutoffs were proposed for each screening test: (1) the optimal screening value, or the lowest value with > 80% sensitivity and NPV; (2) the optimal diagnostic value, or the highest value with > 80% specificity and PPV; and (3) the maximum accuracy value, calculated by the Youden Index (y = sensitivity + specificity − 1].[13] Statistical significance was set at $P < .05$.

Results

Of the 53 patients with COPD invited to participate in the study, eight were excluded (five refused, one for concomitant schizophrenia, one for alcoholism, and one for native language other than French or English), for a final sample of 45 patients with COPD (Table 2 for sociodemographic and clinical characteristics). No significant differences were found between patients with COPD and control subjects for age, sex, educational level, or excessive daytime sleepiness (Epworth Sleepiness Scale score). Patients with COPD had more vascular comorbidities and more cognitive complaints (average CFQ score and proportion of patients with a total score > 24) than control subjects.

Table 1—*Neuropsychologic Testing*

Cognitive Domains and Neuropsychologic Tests	Variables and Normative Data	Criteria for Defining Impairment
Attention and executive functions		2 of 5 variables abnormal
Digit Span (forward and backward)[23]	Scaled score[23]	
TMT, part B[24]	Time, s[25]	
SCWT		
D-KEFS[26, a]	Part 4—part 2 (time, s) or part 4 (No. of errors)[26, a]	
Modified version[27, b]	Part 3—part 1 (time, s) or part 3—part 1 (No. of errors)[19, b]	
Semantic verbal fluency	Number of words (1 min)[26,28]	
Animals and boys' names[26, a]		
Animals, fruits/vegetables[b]		
Letter verbal fluency (P, F, and L)[26,29]	Number of words (1 min)[26,30]	
Verbal learning and memory		2 of 5 variables abnormal
RAVLT (15 words)[31]	Sum of trials 1 to 5, List B, immediate recall, delayed recall (20 min), recognition[32]	
Visuospatial abilities		2 of 3 variables abnormal
Copy of the Rey-O figure[33]	Score/36 (40-68 y old,[34] ≥ 69 y old[35])	
Block Design[23]	Scaled score[23]	
Bells Test[36]	No. of omissions[36]	
Processing speed[c]		2 of 3 variables abnormal
TMT, part A[24]	Time, s[25]	
Coding[23]	Scaled score[23]	
SCWT		
D-KEFS[26, a]	Part 1 (time, s)[26, a]	
Modified version[27, b]	Part 1 (time, s)[19, b]	

D-KEFS = Delis-Kaplan Executive Function System; RAVLT = Rey Auditory-Verbal Learning Test; SCWT = Stroop Color Word Test; TMT = Trail Making Test.

[a]Included in the assessment of patients with COPD.

[b]Included in the assessment of control subjects.

[c]Not included as a mild cognitive impairment subtype.

Table 2—*Demographic and Clinical Characteristics*

Characteristics	Patients With COPD			Control Subjects	*P* Value	
	Total (N = 45)	MCI (n = 16)	NoMCI (n = 29)	Total (N = 50)	All COPD vs Control Subjects	COPD-MCI vs NoMCI
Demographic						
Age, y	68.42 ± 8.72	71.25 ± 7.52	66.86 ± 9.07	67.44 ± 8.77	.59	.11
Sex, male (female)	16 (29)	5 (11)	11 (18)	20 (30)	.58	.65
Education, y	12.27 ± 4.05	10.06 ± 3.21	13.48 ± 4.00	13.14 ± 2.92	.23	.005[a]
Cognitive complaint						
CFQ total score	31.75 ± 11.25	33.08 ± 11.00	31.08 ± 11.55	23.84 ± 11.67	.006	.62
CFQ score > 24, %	72	83	67	33	.004	.29
Daytime sleepiness						
Epworth total score	6.97 ± 3.50	8.42 ± 3.09	6.28 ± 3.53	6.29 ± 4.19	.45	.62
Medications						
Antidepressants use, No.	10	3	7	…	…	.68
Antianxiety use, No.	10	4	6	…	…	.95
Vascular comorbidities						
Vascular burden index	1.29 ± 1.12	1.56 ± 1.26	1.14 ± 1.56	0.90 ± 1.01[b]	.05[a]	.23
COPD clinical status				…	…	
Disease severity, moderate/severe	25/20	10/6	15/14	…	…	.49
FEV_1, L	1.34 ± 0.42	1.38 ± 0.38	1.32 ± 0.45	…	…	.69
FEV_1 % predicted	54.51 ± 14.45	58.44 ± 12.03	52.34 ± 15.39	…	…	.18
FVC, L	2.78 ± 0.71	2.80 ± 0.70	2.77 ± 0.72	…	…	.89
FVC, % predicted	91.96 ± 17.92	97.88 ± 21.45	88.69 ± 15.06	…	…	.10
FEV_1/FVC	0.48 ± 0.10	0.50 ± 0.09	0.48 ± 0.10	…	…	.53
DLCO, mL/mm Hg/min	22.18 ± 2.88	20.76 ± 2.33	22.82 ± 2.91	…	…	.06
DLCO, % predicted	51.74 ± 12.36	47.90 ± 11.42	53.57 ± 12.64	…	…	.24
SaO_2	95.49 ± 1.52	95.27 ± 1.56	95.63 ± 1.50	…	…	.48

Data are shown as mean ± SD unless otherwise noted.

CFQ = Cognitive Failures Questionnaire; DLCO = diffusion capacity of lung for carbon monoxide; MCI = patients with COPD with mild cognitive impairment; NoMCI = patients with COPD without mild cognitive impairment; SaO_2 = oxygen saturation.

[a]Also significant between COPD with MCI and control subjects.

[b]From an equivalent control group (see "Materials and Methods" section).[20]

MCI Frequency

MCI was found in 36% (16 of 45) of patients with COPD compared with 12% (six of 50) of control subjects ($\chi^2[1] = 7.39$, $P = .007$) (Fig 1). The main MCI subtype in COPD was nonamnestic MCI single domain, with predominant attention and executive dysfunctions. Patients with COPD with MCI had a lower education level than patients with COPD without MCI and control subjects (Table 2). Slowed processing speed was found in three patients with COPD (two with MCI) and one control subject (without MCI). No difference was found between patients with COPD with and without MCI in age, sex, disease severity, pulmonary capacity (a tendency was found for DLCO [mL/mm Hg/min]), antidepressant or antianxiety medication intake, vascular comorbidities, or excessive daytime sleepiness.

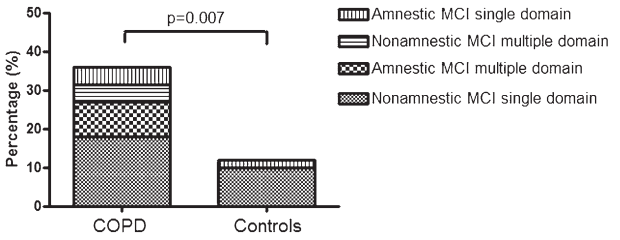

FIGURE 1. Percentage of MCI in patients with COPD and control subjects. Eight of the patients with COPD with MCI had nonamnestic MCI single domain (seven with attention and executive dysfunctions and one with visuospatial impairment), four had amnestic MCI multiple domain (three with memory and attention and executive dysfunctions and one with all domains impaired), two had nonamnestic MCI multiple domain, and two had amnestic MCI single domain. In the control group, five subjects had nonamnestic MCI single domain (all associated with impaired attention and executive functions) and one had amnestic MCI single domain. MCI = mild cognitive impairment.

Screening Tests for MCI in COPD

Montreal Cognitive Assessment: The mean MoCA score ± SD was 25.64 ± 2.89 (range 20-30). The ROC curve analysis for MoCA showed an AUC of 0.82 (95% CI, 0.68-0.96). The optimal screening value was 26 (≤ 25 indicates impairment, 81% sensitivity, 72% specificity, 76% correctly diagnosed), the maximum accuracy value was 25 (≤ 24 indicates impairment, 75% sensitivity, 79% specificity, 78% correctly diagnosed), and the optimal diagnostic value was

23 (≤ 22 indicates impairment, 44% sensitivity, 93% specificity, 76% correctly diagnosed) (Table 3).

Mini-Mental State Examination: The mean MMSE score ± SD was 28.31 ± 1.58 (range 22-30). The MMSE had an AUC of 0.63 (95% CI, 0.45-0.81). The optimal screening value was 30 (≤ 29 indicates impairment, 88% sensitivity, 28% specificity, 49% correctly diagnosed), whereas both the maximum accuracy and optimal diagnostic value was 27 (≤ 26 indicates impairment, 31% sensitivity, 97% specificity, 73% correctly diagnosed) (Table 3).

Discussion

The main finding of this study was that patients with moderate to severe COPD are at high risk for MCI, with an estimated 36% frequency. This is significantly higher than the proportion of MCI found in healthy control subjects matched for age, sex, education, and severity of excessive daytime sleepiness. Moreover, we found convincing evidence that the MoCA is a more reliable screening test than the MMSE in detecting MCI in patients with COPD.

MCI in COPD

MCI is a syndrome defined as the presence of significant cognitive decline that does not notably interfere with social or occupational functioning.[6,7] The high frequency of MCI found in our COPD population is in line with previous studies that reported poor cognitive performance in patients with COPD.[3] However, only a few studies have assessed the proportion of patients with COPD with cognitive impairment, and to our knowledge, none of them used standard MCI criteria that can be readily applied in clinical and research settings. Cognitive impairment in COPD has been associated with higher mortality and disability.[4,5] Therefore, detection and assessment of MCI in COPD is needed to provide patients with appropriate follow-up and management. All types of dementia, including AD, vascular dementia, mixed dementias, dementia with Lewy bodies, Parkinson disease dementia, and frontotemporal dementia, may have a prodromal phase.[40] Considering that MCI is a risk factor for dementia,[6-9,40] it is important to identify individuals with MCI in elderly clinical populations, such as patients with COPD. In fact, approximately one-half of MCI patients will progress to dementia within 3 to 5 years.[7,9] However, increasing evidence indicates that not all patients with MCI will eventually develop dementia; some remain stable over time, whereas others return to normal.[7,41] It remains unknown whether patients with COPD with MCI are in a prodromal phase of dementia or whether they are among the patients with MCI who remain stable over time or return to normal. Recent evidence indicates that cognitive impairment worsens with time in patients with severe COPD,[42] suggesting that patients with COPD with MCI may be at higher risk for dementia such as AD, vascular dementia, or mixed dementias. Future studies using neuroimaging or biomarkers are needed to explore this issue.

Table 3—*Validity of the Montreal Cognitive Assessment and the Mini-Mental State Examination in Detecting Mild Cognitive Impairment in COPD*

Screening Tests and Psychometric Properties								
MoCA								
Cutoff	30/29	29/28	28/27	27/26	26/25[a]	25/24[b]	24/23	23/22[c]
Sensitivity	94	94	94	88	81	75	56	44
Specificity	14	34	41	55	72	79	90	93
PPV	38	44	47	52	62	67	75	78
NPV	80	91	92	89	88	85	79	75
% Correctly diagnosed	42	56	60	67	76	78	78	76
AUC (95% CI), 0.82 (0.68-0.96)								
MMSE								
Cutoff	30/29[a]	29/28	28/27	27/26[b,c]	26/25	25/24	24/23	23/22
Sensitivity	88	50	38	31	6	6	6	6
Specificity	28	55	86	97	100	100	100	100
PPV	40	38	60	83	100	100	100	100
NPV	80	67	71	72	66	66	66	66
% Correctly diagnosed	49	53	69	73	67	67	67	67
AUC (95% CI), 0.63 (0.45-0.81)								

AUC = area under the curve; MMSE = Mini-Mental State Examination; MoCA = Montreal Cognitive Assessment; NPV = negative predictive value; PPV = positive predictive value.

[a]Optimal screening value (lowest value with sensitivity and NPV at about 80%).

[b]Maximum accuracy value according to the Youden Index.

[c]Optimal diagnostic value (highest value with specificity and PPV at about 80%).

We found that the main MCI subtype in COPD was nonamnestic MCI single domain, with predominant attention and executive dysfunctions. The second most commonly impaired cognitive domain was verbal learning and memory. Attention, memory, and executive functions are often reported as the most commonly impaired cognitive domains in patients with COPD.[3] Neuroimaging studies have reported reduced cerebral blood flow in the frontal and subcortical areas in COPD, which may explain the attention/executive dysfunctions reported.[3,43,44]

The underlying mechanisms of cognitive impairments in COPD remain controversial and poorly understood.[3] Hypoxemia, hypercapnia, or vascular comorbidities have been proposed as a possible cause of brain alterations in patients with COPD.[3] In our study, patients with COPD had more vascular comorbidities than controls, as reported in other studies.[3,45] However, the respiratory measures and vascular comorbidities were similar between patients with COPD with MCI and patients with COPD without MCI. This suggests that these factors alone are unlikely to account for MCI in patients with COPD. Similar conclusions have previously been proposed.[3] However, our results must be replicated in a larger sample and subjected to other types of statistical analysis.

Education is the only significant difference between patients with COPD with MCI and both patients with COPD without MCI and control subjects. Our results are in line with other studies showing that low education is a well-recognized risk factor for MCI.[46,47] In our study, we tried to minimize the effect of these variables using normative data adjusted for age and education. Moreover, control subjects and patients with COPD were well matched for age and education. Therefore, these factors cannot account for the higher frequency of MCI found in COPD than in controls. Some may argue that this reflects a difference in premorbid status and not in cognitive decline, and we cannot exclude this possibility. However, none of our patients with COPD was illiterate and all had completed at least primary school, which suggests that all patients with COPD had adequate premorbid abilities. On the other hand, education and premorbid status are two major determinants of cognitive reserve,[48,49] which refers to individual differences in how people process tasks, such that some people cope better than others with brain damage.[48] Interestingly, both the COPD with MCI and COPD without MCI groups had similar subjective complaints of cognitive change. This may suggest that some patients with COPD, with less education and consequently less cognitive reserve, were unable to compensate possible brain damage while performing cognitive tasks and were therefore at higher risk to meet MCI criteria. Because education, premorbid status, cognitive reserve, and MCI are strongly interrelated, we were unable to determine the specific role played by education or premorbid status in the frequency of MCI in COPD. A longitudinal follow-up will allow a better understanding of MCI progression in patients with COPD.

Cognitive Screening Tests in COPD

Several screening tests have been developed to help clinicians detect cognitive impairments in elderly populations.[11] To our knowledge, none has been validated for detecting MCI in patients with COPD. Our study assessed the validity of the MMSE and the MoCA in detecting MCI in patients with COPD based on optimal screening, diagnostic, and maximum accuracy values.

For the MoCA, a cutoff of 25 ($\leq$24 indicates impairment) was identified as the maximum accuracy value, with good sensitivity (75%) and specificity (79%) and 78% correct classification. However, for screening purposes, a normality cutoff of 26 ($\leq$25 indicates impairment) should be used, increasing sensitivity to 81% but reducing specificity to 72%, with 88% negative predictivity and 76% correct classification. Accordingly, a neuropsychologic assessment should be performed in patients with COPD without cognitive complaints who score $<$ 26 on the MoCA to better characterize their cognitive profile and to exclude the presence of MCI. On the other hand, if the MoCA is used as a diagnostic tool for MCI in patients with COPD, a normality cutoff of 23 ($\leq$22 indicates impairment) is suggested, increasing specificity to 93% at the cost of lower sensitivity (44%) and correct classification (76%). However, a substantial proportion of patients with COPD with MCI would remain undetected, and a comprehensive neuropsychologic investigation would be required to confirm the presence of MCI in patients with cognitive complaints who score $>$ 22 on the MoCA.

For the MMSE, no acceptable cutoff for detecting MCI in COPD was identified based on the optimal screening value. The suggested optimal screening cutoff of 30 ($\leq$29 indicates impairment) shows very good sensitivity at 88% but very poor specificity at 28% and only 49% correct classification. The optimal maximum accuracy and diagnostic cutoff was 27 ($\leq$26 indicates impairment), which allowed excellent specificity (97%) but poor sensitivity (31%), with 73% correct classification. Although the MMSE is the most commonly used screening test to detect cognitive impairment in the elderly, its validity for detecting MCI and more severe cognitive deficits in patients with COPD has been questioned.[11,50] The MMSE is insensitive to attention and executive dysfunctions,

the main cognitive deficits reported in COPD. Previous studies have also suggested that the MoCA is superior to the MMSE in detecting MCI in clinical populations with predominant impaired attention and executive functions.[13,14] Hence, compared with the MMSE, the current study shows that the MoCA is an appropriate and validated brief screening test for detecting MCI in patients with COPD.

Some limitations of this study should be noted. Although our neuropsychologic battery was relatively extensive, working memory was not tested using more complex cognitive tasks than the Digit Span. Moreover, we did not include patients with mild or very severe COPD. Patients with very severe COPD may have significant cognitive impairment, whereas patients with mild COPD may present attention and executive dysfunctions that could interfere with treatment compliance. This is a preliminary study, and our results need to be replicated in a larger sample that includes patients with a wider severity range of COPD. The selection process for control subjects (ie, through newspapers and by word of mouth) might have created a selection bias. However, the frequency of MCI observed in our healthy control group (12%) is representative of what it is usually reported in population-based studies (3%-19%).[7]

In conclusion, this preliminary study found that a substantial proportion of patients with moderate to severe COPD have MCI, a risk factor for dementia. Longitudinal follow-up is therefore needed on these patients to determine the risk of developing more severe cognitive and functional impairments. Furthermore, the MoCA (available free at http://www.mocatest.org/) is valid for detecting MCI in patients with COPD.

Acknowledgments

Author contributions: Drs Villeneuve, Pepin, and Gagnon are guarantors of the article.
Dr Villeneuve: contributed to data acquisition, analysis, and interpretation; wrote the first draft of the manuscript; and revised it following critical reviews by the coauthors.
Dr Pepin: contributed to study design, data acquisition and interpretation, study coordination, and fundraising and critically reviewed the manuscript.
Mr Rahayel: contributed to data acquisition and analysis and critically reviewed the manuscript.
Ms Bertrand: contributed to data acquisition and interpretation and graphic design and critically reviewed the manuscript.
Ms de Lorimier: contributed to data acquisition and critically reviewed the manuscript.
Ms Rizk: contributed to data acquisition and critically reviewed the manuscript.
Ms Desjardins: contributed to data acquisition and critically reviewed the manuscript.
Dr Parenteau: contributed to referring patients with COPD, participated in the data acquisition, and critically reviewed the manuscript.
Dr Beaucage: contributed to referring patients with COPD, participated in the data acquisition, and critically reviewed the manuscript.
Dr Joncas: contributed to study design and critically reviewed the manuscript.
Dr Monchi: contributed to data acquisition and critically reviewed the manuscript.
Dr Gagnon: contributed to study design, data acquisition and interpretation, study coordination and supervision, and fundraising, and critically reviewed the manuscript.
Financial/nonfinancial disclosures: The authors have reported to CHEST the following conflicts of interest Dr Pepin has received honoraria from GlaxoSmithKline for serving on the ADC113877 Steering Committee. Dr Beaucage was a speaker for industry-sponsored conferences for GlaxoSmithKline; AstraZeneca; Merck & Co, Inc; and Boehringer Inghelheim GmbH. Drs Villeneuve, Parenteau, Joncas, Monchi, and Gagnon; Mr Rahayel; and Mss Bertrand, de Lorimier, Rizk, and Desjardins have reported that no potential conflicts of interest exist with any companies/organizations whose products or services may be discussed in this article.
Role of sponsors: The sponsors had no role in the design of the study, the collection and analysis of the data, or in the preparation of the manuscript.
Other contributions: We thank the Respirology Unit at Hôpital du Sacré-Coeur de Montréal for their contributions. More specifically, we thank all the respirologists who participated in the study as well as Lucie Jolicoeur, RT, and Bernadette Tardivel, BSc nursing, for their invaluable help. We thank Jean Paquet, PhD, for his help with the statistical analysis and interpretation.

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