ORIGINAL ARTICLE

Prevalence of Mild Cognitive Impairment in Clinical Dimensions of Chronic Obstructive Pulmonary Disease (COPD)

Worawat Chumpangern, MD[1], Wipa Reechaipichitkul, MD[1], Panita Limpawattana, MD[2], Apichart So-Ngern, MD[3], Itthiphat Arunsurat, MD[1], Pailin Ratanawatkul, MD[1], Manchumad Manjavong, MD[2]

[1] Division of Pulmonary and Critical Care Medicine, Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand

[2] Division of Geriatrics, Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand

[3] Division of Sleep Medicine, Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen, Thailand

Background: Impairment of cognitive function is reported to be a significant comorbidity of Chronic Obstructive Pulmonary Disease, which can have a negative effect on clinical outcomes.

Objective: To investigate the prevalence of mild cognitive impairment (MCI) among Thai COPD patients and related factors.

Materials and Methods: The cross-sectional study enrolled severe COPD patients in outpatient units (COPD registry) between September 2022 and December 2023. To assess cognitive function, the Thai version of the Rowland Universal Dementia Assessment Scale (RUDAS-Thai) was performed. Descriptive statistics were used to analyze characteristic data. Univariate and multivariate analyses were used to evaluate the variables associated with cognitive impairment among participants.

Results: A total of 40 participants were recruited for the present study, with 92.5% identifying as male. The median age was 72 years (IQR 65 to 78). The median score on the COPD Assessment Test (CAT) was 9.95 (IQR 3.75 to 15). Additionally, 50% of the participants had a history of severe acute exacerbations in recent years. The prevalence of mild cognitive impairment (MCI) was 57%, with a median RUDAS-Thai score of 25 (IQR 24 to 27.25). There was a significant correlation between a history of severe acute exacerbations and MCI (OR 7.42, 95% CI 1.91 to 34.69). However, no correlation was found between symptom scores and lung function in patients with MCI.

Conclusion: MCI was commonly observed among COPD patients, and severe acute exacerbations were associated with MCI. The screening of MCI in patients with COPD should be recommended as part of the treatment plan.

Keywords: COPD; Mild cognitive impairment; Rowland Universal Dementia Assessment Scale (RUDAS)

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Chronic obstructive pulmonary disease (COPD) is characterized by chronic inflammation of the airways and destruction of the pulmonary parenchyma due to exposure to toxic substrates. Inflammation in COPD is not only confined to the respiratory system but also encompasses the multisystem. Therefore, the evaluation of COPD should be comprehensive and include all affected systems, particularly the cardiovascular system. Disease assessment using common tools, such as airflow obstruction, may not adequately reflect the multisystem involvement caused by the disease[1].

Cognitive impairment is one of the essential aspects of COPD management and a negative predictor of survival and adverse outcomes[2,3]. There has been evidence from many studies that patients with COPD may have altered cerebral perfusion due to hypoxemia, which is an abnormally low oxygen level in the blood, and these changes could result in cognitive impairment[3,4]. The prevalence of cognitive impairment in COPD patients ranges from 5 to 50%, depending on cognitive assessment tests and the severity of COPD[4-6].

Many previous studies have utilized the Mini-Mental State Examination (MMSE) to evaluate the cognitive status of these patients[4,5]. However, the MMSE has limitations

Correspondence to:

Manjavong M.

Division of Geriatrics, Department of Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand.

Phone: +66-43-363664, **Fax:** +66-43-203767, +66-43-348399

Email: manchu@kku.ac.th

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when it comes to detecting mild cognitive impairment (MCI). Even after adjusting for education level, the MMSE still exhibits ceiling and floor effects[7-9]. Many studies have shown that the Montreal Cognitive Assessment (MoCA) provides better accuracy than the MMSE in identifying MCI[10,11]. Nevertheless, the MoCA requires more time to administer compared to other cognitive tests. The Rowland Universal Dementia Assessment Scale (RUDAS) is a less time-consuming tool that shows comparable sensitivity and specificity to MoCA in detecting MCI[12]. Additionally, a previous study indicated that COPD patients with MCI are mainly non-amnestic, characterized by dominant attention and executive dysfunction[6]. MMSE may not be suitable for detecting executive impairment[13,14], while RUDAS can assess this cognitive domain[15].

The prevalence of cognitive impairment in the Asian population and its effect on COPD-related outcomes remain unknown. Cognitive impairment is reported in the entire range of airway obstruction severity, but the relationship is still uncertain. Thus, in the present study, the authors examined the prevalence of MCI and associated factors among Thai patients with COPD.

Materials and Methods

Subjects

A cross-sectional study was conducted at Srinagarind Hospital, Faculty of Medicine, Khon Kaen, Khon Kaen, Thailand, from September 2022 to December 2023. Data were retrieved from the COPD registry, which included patients who attended the chest clinic of the Srinagarind Hospital. The COPD registry has been approved by Khon Kaen University Ethics Committee for Human Research (Approval number No. HE641485). COPD case was defined as a patient with relevant symptoms and spirometric confirmation by GOLD criteria (post-bronchodilator FEV1/FVC less than 0.7) or with emphysema identified by a chest CT scan.

Data collection

A baseline characteristic is defined as age, gender, weight, height, body mass index, smoking status, number of packs smoked (pack-year), co-morbidities, and history of exacerbations within the past year. Symptom scores were collected from self-reports, including the Modified Medical Research Council (mMRC) and COPD Assessment Test (CAT). Spirometry was performed in accordance with the Standardization of Spirometry ATS/ERS 2019[16].

Operational definitions

Mild cognitive impairment (MCI)

To define MCI in the present study, a Thai version of the Rowland Universal Dementia Assessment Scale (RUDAS-Thai) was performed on each participant. The RUDAS-Thai is a 6-item questionnaire with a total score of 30. The items cover different cognitive abilities, such as memory, language, visuospatial, judgment, praxis, and visuoconstruction. The optimal cut-off scores for detecting MCI in Thai elderly are ≤25 and ≤26 in those with ≤6 years and >6 years of education, respectively. These cut-off scores provided the AUC of 0.76 with sensitivity and specificity of 76.2 and 75%, respectively[17].

Statistical analysis

The participants were categorized into subgroups according to cognitive status, and descriptive statistics were provided for age, gender, education, body mass index (BMI), smoking habits, and comorbidities. For COPD-related characteristics, we demonstrated the Modified Medical Research Council (mMRC) dyspnea scale, the COPD Assessment Test (CAT) score, history of acute exacerbation, and spirometry results. The participants' cognitive status was assessed using a Thai version of the Rowland Universal Dementia Rating Scale (RUDAS-Thai), and the results were adjusted by educational level. Baseline differences between groups were evaluated using the Wilcoxon rank-sum test for continuous variables and Pearson's Chi-squared tests for categorical factors, with a significance threshold α=0.05. To assess the association between MCI and participant's characteristics, a simple logistic regression model with a history of acute exacerbation as the sole independent variable was fit for cognitive status dichotomous response (MCI/non-MCI), as well as multiple logistic regression models with other participant characteristics included as additive covariates. The results were shown as crude and adjusted odds ratio with a 95% confidence interval. Based on a study by Villeuve et al.[6], the prevalence of mild cognitive impairment in COPD patients was 36%. The estimated population size is 40, with alpha at 0.05.

Results

A total of 40 participants were recruited for this study; 92.5% were male, and the median age of all participants was 72 (IQR 65 to 78). Out of a total of 40 participants, 20 individuals (50%) reported experiencing severe exacerbation in the past year. The median CAT score was 9.5 (IQR 3.75 to 15), and the median mMRC dyspnea scale was 2 (IQR 1 to 3). The mean RUDAS score was 25.3 (SD 3.05). For MCI status evaluated by RUDAS score, 23 individuals (57.5%) were defined as having MCI. Baseline characteristics based on MCI status are shown in Table 1.

Association between history of exacerbation and MCI

The association between a history of acute exacerbation

and MCI was evaluated. According to univariate analysis, participants who experienced any acute exacerbation associated with MCI with crude odds ratio (OR) 1.93 (95% CI 1.23 to 3.56). Moreover, the history of severe acute exacerbation showed a higher association with crude OR 7.42 (95% CI 1.91 to 34.9). The results of multivariate analysis are shown in Table 2. History of severe acute exacerbation showed significant association with MCI with adjusted OR 6.7 (95% CI 1.36 to 42.46) after adjusting with age, gender, comorbidities, and CAT score.

Discussion

Our study findings indicate that 57.5% of stable COPD patients have mild cognitive dysfunction. A history of severe acute exacerbations within the past year was a significant predictor of this impairment. In contrast, factors such as

Table 1. Baseline characteristics of participants

Characteristic	Non-MCI (n=17)	MCI (n=23)	p-value
Age (year, IQR)	68 (63 to 74)	73 (67 to 81)	0.09
Male (n, %)	16 (94%)	21 (91%)	>0.90
Mean BMI (kg/m^2, SD)	21.3 (4.3)	21.1 (3.2)	>0.90
Smoking status (n, %)			0.90
Never smoking	5 (29.5%)	5 (21.7%)	
Former smoker	1 (5.8%)	2 (8.7)	
Active smoker	11 (64.7%)	16 (69.6%)	
Pack-years (n, IQR)	14 (0 to 20)	20(13 to 26)	0.30
Presence of co-morbidities (n, %)	16 (94%)	18 (78%)	0.20
mMRC ≥2 (n, %)	9 (53%)	12 (52%)	>0.90
CAT (score, IQR)	14 (2 to 15)	8 (5 to 15)	>0.90
CAT ≥10 (n, %)	10 (59%)	10 (43%)	0.30
History of any acute exacerbation (n, %)	12 (70.5%)	19 (82%)	0.01
History of severe acute exacerbation (n, %)	4 (24%)	16 (70%)	0.01
Mean pre-bronchodilator-FEV1 (L, SD)	1.27 (0.59)	1.44 (0.49)	0.20
%predicted pre-bronchodilator-FEV1 (L, IQR)	51 (30 to 67)	64 (43 to 71)	0.20
Mean post-bronchodilator FEV1/FVC	52 (18)	58 (13)	0.40
Education level higher than primary school (n, %)	8 (47%)	10 (43%)	0.80
Mean RUDAS (score, SD)	28 (1)	23 (2)	<0.001

MCI=mild cognitive impairment; IQR=interquartile range; SD=standard deviation; BMI=body mass index; mMRC=the Modified Medical Research Council dyspnea scale; CAT=the COPD Assessment Test score; FEV=forced expiratory volume; FVC=forced vital capacity; RUDAS=the Rowland Universal Dementia Rating Scale

Table 2. Univariate and multivariate regression analysis of COPD patients stratified by presence of MCI

	Univariate			Multivariate		
	Odd ratio	95% CI	p-value	Odd ratio	95% CI	p-value
Age	1.04	0.97 to 1. 17	0.21	1.00	0.93 to 1.08	0.84
Female	1.52	0.13 to 34.51	0.74	0.61	0.03 to 17.17	0.73
BMI	0.98	0.82 to 1.17	0.86			
Presence of co-morbidities	4.44	0.63 to 89.9	0.19	2.43	0.22 to 58.94	0.49
mMRC ≥2	0.97	0.27 to 3.43	0.96			
CAT	0.99	0.9 to 1.09	0.89			
CAT ≥10	0.54	0.15 to 1.9	0.34	0.58	0.12 to 2.57	0.47
History of any acute exacerbation	1.93	1.23 to 3.56	0.02			
History of severe acute exacerbation	7.42	1.91 to 34.69	0.006	6.70	1.36 to 42.46	0.02
Pre-bronchodilator FEV1	1.92	0.52 to 8.39	0.35			
Post-bronchodilator FEV1/FVC	1.024	0.979 to 1.08	0.30			

BMI=body mass index; mMRC=the Modified Medical Research Council dyspnea scale; CAT=the COPD Assessment Test score; FEV=forced expiratory volume; FVC=forced vital capacity

body mass index, lung function, and symptom scores did not show any correlation with mild cognitive impairment.

Acute exacerbations have been identified as a significant risk factor for cognitive impairment in COPD patients. Our results were similar to a prior prospective study[18] that compared cognitive function between three groups: COPD patients with recent acute exacerbations, stable COPD patients, and control populations. A cognitive assessment was performed at three points: baseline, before discharge, and 3 months post-discharge. It was found that 57% of COPD patients with acute exacerbations exhibited impaired cognitive function, a significantly higher proportion than the other two. The 3-month follow-up revealed no significant improvement in any of the cognitive domains. Cognitive impairment was associated with longer hospital stays and poorer quality of life[18].

Additionally, the results were similar to another study in which cognitive function was evaluated among COPD patients who required mechanical ventilation following an acute exacerbation. In the follow-up period, there was a more significant proportion of cognitive impairment and a worse perceived health profile. Recovery from impairment was uncertain as well[19]. As part of our study, we included stable COPD patients who had experienced severe acute exacerbations in the past year and found a significant correlation between cognitive impairment and severe acute exacerbations. After hospitalization, a patient in a stable condition is unlikely to recover from cognitive impairment. Therefore, patients with severe acute exacerbations of COPD should be assessed on their cognitive function both after hospitalization and at a stable stage. Hypoxic-induced neuronal damage and altered neurotransmitter regulation may be the possible mechanisms by which acute exacerbation is associated with cognitive impairment[20]. Furthermore, it has been demonstrated that cognitive dysfunction in COPD patients is correlated with inflammation mediators such as c-reactive protein, interleukin (IL)-6, IL-1β, tumor necrosis factor-α, and a1-antichymotrypsin[21].

Our study found no significant association between lung function and cognitive impairment, which is consistent with previous studies. A study by Antonelli-Incalzi et al. found that the level of airway obstruction, as classified by the GOLD criteria, is associated with a decline in health status but not cognitive function[22]. Another study revealed that non-hypoxemic COPD patients had poorer cognitive function than subjects of the same age, education level, and intelligence quotient. Nonetheless, cognitive function did not differ among COPD patients with higher or lower FEV1[23]. It has been shown that lung function is related to quality of life and mortality; however, cognitive impairment may occur despite mild obstruction, so a cognitive impairment screening should be performed regardless of obstruction.

A limitation of our study was that we could not demonstrate a relationship between cognitive dysfunction and quality of life, self-management ability, or self-management ability.

Conclusion

MCI was commonly observed among COPD patients, and severe acute exacerbations were associated with MCI. The screening of MCI in patients with COPD should be recommended as part of the treatment plan.

What is already known on this topic?

Cognitive impairment relates to poor clinical outcomes among patients with COPD. The prevalence of cognitive impairment in the Asian population and its effect on COPD-related outcomes remain unknown.

What this study adds?

The present study observed that mild cognitive impairment (MCI) was frequently found among patients with COPD. Furthermore, it was noted that severe acute exacerbations of COPD were linked to the presence of MCI.

Conflicts of interest

The authors declare no conflict of interest.

References

1. Celli BR, Wedzicha JA. Update on Clinical Aspects of Chronic Obstructive Pulmonary Disease. N Engl J Med. 2019;381:1257-66.
2. Chang SS, Chen S, McAvay GJ, Tinetti ME. Effect of coexisting chronic obstructive pulmonary disease and cognitive impairment on health outcomes in older adults. J Am Geriatr Soc. 2012;60:1839-46.
3. Torres-Sanchez I, Rodriguez-Alzueta E, Cabrera-Martos I, Lopez-Torres I, Moreno-Ramirez MP, Valenza MC. Cognitive impairment in COPD: a systematic review. J Bras Pneumol. 2015;41:182-90.
4. Thakur N, Blanc PD, Julian LJ, Yelin EH, Katz PP, Sidney S, et al. COPD and cognitive impairment: the role of hypoxemia and oxygen therapy. Int J Chron Obstruct Pulmon Dis. 2010;5:263-9.
5. Samareh Fekri M, Hashemi-Bajgani SM, Naghibzadeh-Tahami A, Arabnejad F. Cognitive Impairment among Patients with Chronic Obstructive Pulmonary Disease Compared to Normal Individuals. Tanaffos. 2017;16:34-9.
6. Villeneuve S, Pepin V, Rahayel S, Bertrand JA, de Lorimier M, Rizk A, et al. Mild cognitive impairment in moderate to severe COPD: a preliminary study. Chest. 2012;142:1516-23.
7. Franco-Marina F, García-González JJ, Wagner-Echeagaray F, Gallo J, Ugalde O, Sánchez-García S,

et al. The Mini-mental State Examination revisited: ceiling and floor effects after score adjustment for educational level in an aging Mexican population. International Psychogeriatrics. 2010;22:72-81.
8. Hoops S, Nazem S, Siderowf AD, Duda JE, Xie SX, Stern MB, et al. Validity of the MoCA and MMSE in the detection of MCI and dementia in Parkinson disease. Neurology. 2009;73:1738-45.
9. Jia X, Wang Z, Huang F, Su C, Du W, Jiang H, et al. A comparison of the Mini-Mental State Examination (MMSE) with the Montreal Cognitive Assessment (MoCA) for mild cognitive impairment screening in Chinese middle-aged and older population: a cross-sectional study. BMC Psychiatry. 2021;21:485.
10. Sokołowska N, Sokołowski R, Mazur E, Podhorecka M, Polak-Szabela A, Kędziora-Kornatowska K. Is the Montreal Cognitive Assessment (MoCA) test better suited than the Mini-Mental State Examination (MMSE) in mild cognitive impairment (MCI) detection among people aged over 60? Meta-analysis. Psychiatria Polska. 2016;50:1039-52.
11. Pinto TCC, Machado L, Bulgacov TM, Rodrigues-Junior AL, Costa MLG, Ximenes RCC, et al. Is the Montreal Cognitive Assessment (MoCA) screening superior to the Mini-Mental State Examination (MMSE) in the detection of mild cognitive impairment (MCI) and Alzheimer's Disease (AD) in the elderly? Int Psychogeriatr. 2019;31:491-504.
12. Manjavong M, Limpawattana P, Sawanyawisuth K. Can RUDAS Be an Alternate Test for Detecting Mild Cognitive Impairment in Older Adults, Thailand? Geriatrics (Basel). 2021;6.
13. Korver S, van de Schraaf SAJ, Geurtsen GJ, Hollak CEM, van Schaik IN, Langeveld M. The Mini Mental State Examination does not accurately screen for objective cognitive impairment in Fabry Disease. JIMD Rep. 2019;48:53-9.
14. Galioto R, Garcia S, Spitznagel MB, Strain G, Devlin M, Crosby RD, et al. The Mini-Mental State Exam (MMSE) is not sensitive to cognitive impairment in bariatric surgery candidates. Surg Obes Relat Dis. 2014;10:553-7.
15. Iype T, Ajitha BK, Antony P, Ajeeth NB, Job S, Shaji KS. Usefulness of the Rowland Universal Dementia Assessment scale in South India. J Neurol Neurosurg Psychiatry. 2006;77:513-4.
16. Graham BL, Steenbruggen I, Miller MR, Barjaktarevic IZ, Cooper BG, Hall GL, et al. Standardization of Spirometry 2019 Update. An Official American Thoracic Society and European Respiratory Society Technical Statement. Am J Respir Crit Care Med. 2019;200:e70-e88.
17. Manjavong M, Limpawattana P, Sawanyawisuth K. Performance of the Rowland Universal Dementia Assessment Scale in Screening Mild Cognitive Impairment at an Outpatient Setting. Dement Geriatr Cogn Dis Extra. 2021;11:181-8.
18. Dodd JW, Charlton RA, van den Broek MD, Jones PW. Cognitive dysfunction in patients hospitalized with acute exacerbation of COPD. Chest. 2013;144:119-27.
19. Ambrosino N, Bruletti G, Scala V, Porta R, Vitacca M. Cognitive and perceived health status in patient with chronic obstructive pulmonary disease surviving acute on chronic respiratory failure: a controlled study. Intensive Care Med. 2002;28:170-7.
20. Borson S, Scanlan J, Friedman S, Zuhr E, Fields J, Aylward E, et al. Modeling the impact of COPD on the brain. Int J Chron Obstruct Pulmon Dis. 2008;3:429-34.
21. Dodd JW, Getov SV, Jones PW. Cognitive function in COPD. Eur Respir J. 2010;35:913-22.
22. Antonelli-Incalzi R, Imperiale C, Bellia V, Catalano F, Scichilone N, Pistelli R, et al. Do GOLD stages of COPD severity really correspond to differences in health status? Eur Respir J. 2003;22:444-9.
23. Liesker JJ, Postma DS, Beukema RJ, ten Hacken NH, van der Molen T, Riemersma RA, et al. Cognitive performance in patients with COPD. Respir Med. 2004;98:351-6.