Original Article

Cognitive Decline in Chronic Obstructive Pulmonary Disease: A Hidden Burden beyond the Lungs

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ABSTRACT

OBJECTIVE: To evaluate the frequency and prevalence of cognitive impairment among COPD patients and to determine its relationship with the severity of disease, duration, demographic characteristics, and smoking status.

METHODOLOGY: A cross-sectional study, was conducted at the Department of Medicine and Pulmonology at Liaquat University of Medical and Health Sciences (LUMHS) Hospital, Jamshoro, Sindh, Pakistan after approval of ERC from September to December 2025, that involved 96 diagnosed patients of COPD, diagnosis was made on spirometry and clinical grounds. Data regarding demographics, smoking status, and disease duration were gathered. The Mini-Mental State Examination (MMSE) was used as an assessment tool for cognitive function; the GOLD classification was considered for the COPD severity grading. By using chi-square and correlation tests data analysis was dome on SPSS, a p-value <0.05 was considered to be significant.

RESULTS: Among 62 (64.6%) of our study participant's cognitive impairment was identified. The prevalence of neurocognitive impairment significantly increased with COPD severity (p = 0.001) and longer duration of disease (p = 0.004). Smoking status was also significantly associated with lower MMSE scores (p = 0.013); however, gender differences were not found to be statistically significant.

CONCLUSION: Cognitive decline is a prevalent yet underestimated comorbidity among COPD patients. Its strong association with disease severity and smoking highlights the need for early neurocognitive screening and integrated management for better patient outcomes and improved quality of life.

KEYWORDS: COPD or Chronic Obstructive Pulmonary Disease, Cognitive decline/ Impairment, Mini-Mental State Examination or MMSE and Neurovascular Dysfunction.

INTRODUCTION

Chronic Obstructive Pulmonary Disease or COPD, is a progressive illness of the respiratory system marked by continuous limitation of airflow, chronic inflammation, and adverse systemic effects that are not limited only to the lungs[1]. In spite of the fact that COPD is commonly known for its pulmonary signs, symptoms, and complications, data demonstrating its effects on other organs, particularly the brain, causing cognitive decline and, in extreme cases, dementia is also available[2].Although cognitive impairment and COPD are often studied as separate entities but there are striking correlations seen between these two conditions[3]. In patients with COPD, cognitive impairment is considered to be a consequence of persistent hypoxemia, increased carbon dioxide in blood, stress caused by oxidized free radicals, and systemic inflammation; all of these together result in neuronal damage and neurovascular impairment[4].

Executive functions, attention, memory, and overall efficiency of cognitive functions are all affected by the pathophysiological mechanisms underlying COPD. The simultaneous occurrence of cognitive dysfunction significantly impairs patients' quality of life, therapy compliance, and ability to cope with their disease with efficacy[5].As compared with general population, Patients having COPD, are at higher risk to have different types of dementia[6]. Despite this, in most of the clinical practices of resource-poor countries, cognitive impairment often remains unrecognized; in those settings, focus is mainly kept on pulmonary diseases and neurovascular complications, and their assessments are often ignored[7]. Proper understanding and identification of cognitive impairment in patients with COPD is therefore mandatory for providing comprehensive care to the patients. For an efficient clinical approach to manage cognitive impairment in individuals with COPD prompt and early diagnosis have a pivotal role[8].

The aim of this study is to identify and demonstrate the prevalence of cognitive decline in patients with COPD and how different aspects of COPD, like disease severity, duration of illness, and demographic factors at Liaquat University of Medical and Health Sciences, are correlated with neurological complications.

METHODOLOGY

A cross-sectional type of study design was conducted in order to assess the possibility of cognitive decline among patients with Chronic Obstructive Pulmonary Disease (COPD) and to establish its relationship with

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doi: 10.22442/jlumhs.2026.01592

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severity of disease, duration, and demographic characteristics .This study was organized and conducted at the Department of Medicine and Pulmonology at Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, Sindh, Pakistan after approval of ERC from September to December 2025. In the meantime, while the study was being conducted all adult patients diagnosed with COPD attended the outpatient department or admitted to the Medicine/Pulmonology wards were considered to be eligible for inclusion with fully informed consent of patients and institutional ethical approval.

As per reported prevalence 20%, d=8, CI=95, n=96 individuals diagnosed with COPD were taken by Purposive (non-probability) sampling technique.

As far as the inclusion criteria is concerned adults aged 40 years and above, diagnosed cases of COPD established via GOLD criteria (FEV□/FVC < 0.70) and who provided an informed consent and were willing to take participation, were included in the study.

For the exclusion criteria, those patients who were known case of stoke or with a history of stroke, head trauma, psychiatric disorders, or other neurological diseases, and the individuals with severe visual impairment and hearing problems affecting cognitive testing, patients on sedatives drugs or neuropsychiatric medications are all those who were not included in our study.

A carefully designed and structured questionnaire was used to gather information on: Demographics including Age, gender, literacy, and socioeconomic status. Clinical data like: Disease duration, history of smoking, co-occurring disorders, and details of treatment employed. And finally, COPD severity: Based on post-bronchodilator spirometry (FEV□ % predicted) classification was made according to GOLD stages.

The Mini-Mental State Examination, or MMSE for short, was used for the assessment of cognitive function. It is a verified and authenticated tool which evaluates parameters including orientation, registration, attention, recall/memory, and language. Scores were formulated as:

Normal cognition: ranges from 24-30

Mild cognitive impairment (MCI): ranges between 18-23

Severe impairment or dementia: <18

For the analysis of data 25.0 version of SPSS was used. Descriptive statistics (mean SD, frequency, and percentage) were calculated for continuous/ quantitative and categorical/qualitative variables. The use of Chi-square test was made to determine the relationship between categorical variables like gender and cognitive impairment. The Pearson correlation coefficient was applied to determine the relation between MMSE score, duration of illness, and spirometric analysis. A p-value of <0.05 was considered statistically significant.

Primary Outcome: Prevalence/frequency of cognitive dysfunction in COPD patients.

Secondary Outcomes: Correlation between cognitive impairment and severity of COPD, disease duration, and demographic factors.

RESULTS

A total number of 96 patients diagnosed with COPD were enrolled in our study. The mean age of study population taken, was 59.8±9.2 years, ranging in between 42 to 78 years. Of these, 68(70.8%) were males and 28(29.2%) were female participants, demonstrating a male predominance. Major proportion of the patients 60(62.5%) were current or previous smokers, on the flip side 36 (37.5%) were those who did not smoke at all.

On the basis of GOLD (Global Initiative for Chronic Obstructive Lung Disease) classification, 20(20.8%) patients had mild, 34(35.4%) moderate/intermediate, 28(29.2%) had severe, and 14(14.6%) had very severe COPD. The average duration of disease was 7.1±3.6 years.

Cognitive assessment using the MMSE revealed a mean score of 23.2±3.9, with scores ranging from 15 to 29. Cognitive impairment (MMSE < 24) was present in 62(64.6%) patients, whereas 34 (35.4%) had normal cognition.

A statistically considerable interrelation was found between COPD severity and cognitive decline (p = 0.001). The occurrence of cognitive decline increased successively with the severity of COPD - from 30.0% in mild to 85.7% in very severe diseases. Likewise, an important relationship was observed between smoking status and cognitive impairment (p = 0.013), as smokers showed lower MMSE scores compared to those who are non-smokers. Disease duration also demonstrated a noteworthy inverse relation with MMSE scores (p = 0.002). No remarkable association was found in between gender and cognitive impairment (p = 0.311).

Table I: Demographic and Clinical Characteristics of COPD Patients (n = 96)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	Mean ± SD	–	59.8±9.2
Gender	Male	68	70.8
	Female	28	29.2
Smoking Status	Smokers	60	62.5
	Non-smokers	36	37.5
Duration of COPD (years)	Mean ± SD	–	7.1±3.6
GOLD Classification	Mild	20	20.8
	Moderate	34	35.4
	Severe	28	29.2
	Very Severe	14	14.6
MMSE Score	Mean ± SD	–	23.2±3.9
Cognitive Impairment	Present	62	64.6
	Absent	34	35.4

Table II: Association Between COPD Severity and Cognitive Impairment (n = 96)

COPD Severity (GOLD)	Total (n)	Cognitive Impairment (n, %)	Normal Cognition (n, %)	p-value
Mild	20	6 (30.0%)	14 (70.0%)	0.08
Moderate	34	18 (52.9%)	16 (47.1%)	0.04
Severe	28	22 (78.6%)	6 (21.4%)	<0.01
Very Severe	14	12 (85.7%)	2 (14.3%)	<0.01

Table III: Association between Cognitive Impairment and Other Variables

Variable	Category	Cognitive Impairment	Normal Cognition	p-value
Gender	Male	46 (67.6%)	22 (32.4%)	0.311
	Female	16 (57.1%)	12 (42.9%)	
Smoking Status	Smokers	44 (73.3%)	16 (26.7%)	0.013
	Non-smokers	18 (50.0%)	18 (50.0%)	
Duration of COPD	<5 years	14 (46.7%)	16 (53.3%)	
	≥5 years	48 (75.0%)	16 (25.0%)	0.004

DISCUSSION

The current study established that 64.6% of patients having COPD developed impairment of cognitive function, demonstrating that cognitive decline is a frequent yet underestimated consequence of chronic obstructive pulmonary disease. These findings also provided an important relationship between cognitive impairment and severity of disease, duration of COPD, and smoking status, correlating with the tentative statement that persistent hypoxia, systemic inflammation, and vascular malfunctioning play central and crucial roles in COPD-related neurocognitive dysfunction.

The results of our study are comparable and are more or less likely similar to those of Dodd JW et al., who reported cognitive decline among 61% of COPD patients included in his study, considering chronic reduced cerebral perfusion and oxygen deprivation as a major culprit[9]. Likewise, Cleutjens FA et al. has proved from his study that decreased arterial oxygen levels were strongly related with poorer cognitive function, particularly in attention and functional executive domains of cognition[4]. Our current study findings are also supported by the research findings of Li J et al., who demonstrated that in our study an important relationship was observed between cognitive impairment and smoking status comparable with evidence from Zhang X et al., who showed that cigarette smoking exacerbates oxidative stress and endothelial damage, further decreasing blood flow toward brain and impairing processing of memory[10]. Apart from this, Villeneuve S et al. demonstrated a connection between chronic systemic inflammation and neurovascular disturbance, emphasizing that elevated cytokines in COPD are one of the major contributing factors for neurovascular degeneration and compromise[11].

Although gender differences were not statistically remarkable in our study, other studies have demonstrated increased vulnerability among old aged males due to higher smoking exposure and prolonged duration of disease[12]. The increased prevalence of cognitive deficits in our cross-sectional study emphasized the rising need for incorporating the tools for neurocognitive screening like the Mini-Mental State Examination (MMSE) into routine and regular COPD management to improve treatment compliance and also quality of life.

The findings of our study also enlighten an important concern of public health in resource-poor setups such as in Pakistan, where COPD patients often diagnosed at the very late/advanced stages of disease. Preventive measures including smoking cessation, pulmonary rehabilitation and exercises, and early detection of reduced blood supply to brain may delay and even halt the onset and progression of cognitive impairment.

CONCLUSION

This study demonstrates that among the common and potentially significant comorbidities in COPD patients neurocognitive decline is major ones, holding both practical and clinical value. A major portion, approximately two-thirds of our study population, was affected. Disease severity, increased duration of illness, and smoking for a prolonged period of time were recognized to be the major determinants of decreased cognitive performance. These findings emphasized the need for early assessment of cognitive impairment, multimodality approach and multidisciplinary management in COPD patients for improved compliance with therapies and interventions, and better functional outcomes.

Recommendations: Routine neurocognitive screening should be incorporated into COPD follow-up visits, particularly for patients with severe and prolonged diseases. Further research in upcoming future should be done to explore the main pathophysiological mechanisms behind the correlation between pulmonary dysfunction and brain health, and to demonstrate the potential reversibility of cognitive decline through measures like oxygen therapy, exercise, and anti-inflammatory strategies as the targeted interventions.

Acknowledgement: The valuable and unforgettable help of whole research team during the study period is gratefully acknowledged.

Ethical permission: Liaquat University of Medical & Health Sciences, ERC approval letter No. LUMHS/ REC/-1127.

Conflict of interest: There is no conflict of interest between the authors.

Financial Disclosure / Grant Approval: No funding agency was involved in this research.

Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Javeed K: Concept & design of study & proofread
Memon M: Drafting the article and finalizing the manuscript
Qadeer A: Acquisition of data, grammatical corrections & critical review
Qureshi M: Revising critically and making it suitable for final format
Huda NU: Acquisition of data and topographical review
Asif R: Analysis of the data
Kumar S: Final approval

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