

Prevalence of Cognitive Impairment in Persons with Chronic Obstructive Pulmonary Disease of Ahmedabad City: An Observational Study

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Abstract: Background: Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases. Other than typical pulmonary pathology of COPD, there are several effects occurring outside the lungs that has been described as systemic effects of COPD or extrapulmonary effects of COPD like weight loss, decrease in muscle mass, strength and endurance, osteoporosis, cognitive impairment, increased cardiovascular risk, etc. Cognition is an act or process of knowing, including awareness, reasoning, judgement, intuition and memory. Aim: The aim of the study is to find the prevalence of cognitive impairments in persons with chronic obstructive pulmonary disease. Methodology: One hundred eighty-eight (n=188) subjects participated in the study. Data was collected by the means of English and Hindi translation of MoCA questionnaire. Result: The overall prevalence of cognitive impairment in COPD was 73.93%. Conclusion: It could be concluded from the study that the cognitive impairment is present in patients suffering with chronic obstructive pulmonary disease.

Keywords: Cognitive impairment, Montreal Cognitive Assessment Questionnaire, Chronic Obstructive Pulmonary Disease.

1. Introduction

Chronic obstructive pulmonary disease (COPD) is currently the 4th leading cause of death in the world but is projected to be the 3rd leading cause of death by 2020 [1]. As on 2016, 3 out of 5 causes of mortality constitute non-communicable diseases whereas COPD is the second biggest cause of death in India today [2].

Chronic obstructive pulmonary disease (COPD) is a common, preventable and treatable disease that is characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases [1]. The symptoms of COPD include dyspnea, cough, sputum production, wheezing, chest tightness and/or history of exposure to risk factors of the disease.

Risk factors causing COPD include smoking, exposure to occupational dust, vapors & fumes, indoor/outdoor air pollution. There are also various host factors like genetic factors like airway hyperresponsiveness, Alpha-1 antitrypsin deficiency (AATD), and lung growth. Also, low socioeconomic status and infection are risk factors for COPD [3]. Extrapulmonary features of COPD include weight loss, decrease in muscle mass, strength and endurance, heart failure, osteoporosis, anxiety, depression, cognitive impairment, increased cardiovascular risk, etc [6]. Brain can be vulnerable to systemic effects of COPD as several features of the disease may increase the risk for impaired cognitive function & also contribute to cognitive decline across the progress of the disease severity and ageing process [4].

Cognition is an act or process of knowing, including awareness, reasoning, judgement, intuition and memory [8]. COPD patients with cognitive impairment may exhibit negative impact on adherence and compliance to pulmonary rehabilitation programme and gain less benefit from it compared to cognitively intact person.

The study done by Mitra Samareh Fekri et al. (Kerman, Iran 2017) on "Cognitive impairment among patients with chronic obstructive pulmonary disease compared to normal individuals". The prevalence of cognitive impairment among patients with COPD was 51.71% when assessed by MMSE questionnaire [7]. The aim of the study is to find the prevalence of cognitive impairments in persons with chronic obstructive pulmonary disease.

2. Materials and Methodology

Present study is an observational study. The study was ethically approved by the institutional ethical committee. The study was conducted in various hospitals and outpatient clinics of Ahmedabad City.

- **Population:** Healthy young males and females with age of 18 to 40 years.
- **Study Duration:** Data was collected over a period of 4 months.
- **Sample Size:** Total 188 samples were selected based on inclusion and exclusion criteria.
- **Sampling:** Convenience sampling

Inclusion Criteria

- All clinically diagnosed COPD patients (both male and female)
- All stages according to GOLD classification
- Age group: 40 – 60 years
- Smokers, non-smoker, and ex-smokers (since more than one year)
- SpO₂: 80 – 100%
- Patients willing to participate
- Literate patients (above 7th standard)
- Competent with English or Hindi

Exclusion Criteria

- Any pulmonary disease other than COPD
- Any cardiovascular condition
- Any other systemic illness (musculoskeletal and neurological conditions)
- Any psychological condition
- Any recent thoracoabdominal surgery
- Mechanically ventilated patients
- Illiterate patients

2.1 Materials

- 1) Pen
- 2) Paper
- 3) Pencil
- 4) Rubber
- 5) Consent form
- 6) Assessment Proforma
- 7) MoCA Questionnaire
- 8) Pulse oximeter
- 9) Weighing scale
- 10) Measure tape

Outcome Measures:

Montreal Cognitive Assessment scale (MoCA): Hindi and English translation.

**Procedure:**

The study was conducted in various hospitals & outpatient clinics of Ahmedabad city. The participants were approached individually and invited to participate as volunteer in the study. The participants were selected

according to inclusion and exclusion criteria. Participants were provided with the proper information regarding the study and they were explained about the purpose of the study and then, the written consent was taken from the participants. Henceforth, the demographic data and other relevant information were obtained from the participants.

Depending on the values of FEV₁, the patients were classified into four stages of COPD as per the Global Initiative for Chronic Obstructive Lung Disease (GOLD) spirometric guidelines.

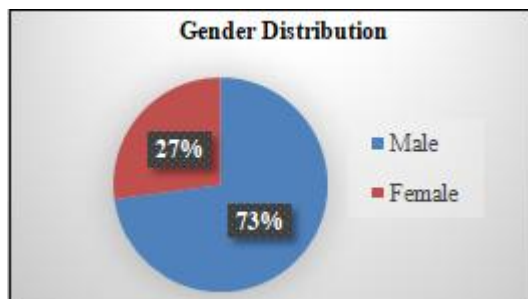
STAGES	FEV ₁ values
GOLD 1	≥ 80%
GOLD 2	50 – 79%
GOLD 3	30 – 49%
GOLD 4	<30%

Data was collected with the help of Montreal Cognitive Assessment scale. The English or Hindi translation of the Montreal Cognitive Assessment questionnaire was explained to the patients and administered to all the patients by the interviewer. The questionnaire took almost 10-15 minutes to be completed. Thereby, the total MoCA score was calculated and recorded and analysis was done.

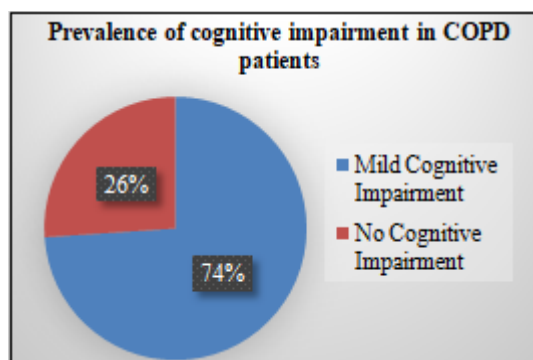
**3. Results**

In this study, 188 subjects diagnosed with COPD were included. The mean age was 52.18±5.04, mean BMI was 19.57±3.31 and mean FEV₁ was 58.05±19.15. Amongst 188 COPD subjects, 61 were smokers, 81 were non-smokers and 46 were ex-smokers. All the participants who met the inclusion criteria completed/filled the questionnaire. The level of significance was kept at 5%. The prevalence of cognitive impairment in COPD patients was analyzed by using simple percentage technique. Statistical analysis was done by using Microsoft excel 2010.

Total population	Male	Female
n=188	n=137	n=51



Overall prevalence of cognitive impairment in COPD patients		
COPD patients	Cognitive Impairment	No Cognitive Impairment
n=188	n=139	n=49



4. Discussion

COPD is a multicomponent inflammatory disease that affects physical and nonphysical functions, one of which is cognition. In present study, the overall prevalence of cognitive impairment was calculated. The mean MoCA scoring (21.40 ± 4.33) in COPD patients indicates that most of the subjects are suffering from cognitive impairment. The result of the present study showed 73.93% (n=139) prevalence of cognitive impairment in COPD patients (n=188).

In different studies, the prevalence of cognitive impairment in patients with COPD ranges from 12% to 88%, depending on the study population & neuropsychological assessment and the prevalence rate of cognitive impairment in the present study is comparable with their result [6].

In the prospective study conducted by Rusanen M et al. in 2013, it was shown that COPD and asthma led to two-fold increased risk of mild cognitive impairment and dementia later in life [8].

In a systematic review by Lone Schou et al. in 2012, they concluded that the most affected cognitive domains in this review were memory and attention but also speed, coordination, and learning abilities were reduced in COPD patients [9].

The possible pathogenic mechanism of comorbid cognitive impairment in COPD patients are also complex and could be caused by various independent factors such as hypoxemia, hypercapnia, systemic inflammation, smoking etc.

Oxygen deficiency can cause increased blood viscosity, reducing the blood supply to some brain regions, which may lead to decrease in the perfusion of the brain's prefrontal lobe. Moreover, oxygen deficiency can increase the production of oxygen free radicals and decrease cellular metabolism which can cause damage the neurons [10]. Reduction of brain perfusion is correlated with impairment in verbal memory, attention, and delayed memory [6].

In the study by Antonelli-Incalzi et al., it was shown that the anterior cerebral blood flow was reduced in patients with COPD, they had impairment in five domains, including spatial thinking, copying the painting, verbal fluency and recent verbal and visual memory [11].

Inflammatory markers, C-reactive protein, interleukin-6, and fibrinogen are elevated and tend to increase with the progression of the disease. Inflammatory markers may also damage the white matter integrity. C-reactive protein has direct neurotoxic effect and contributes to cerebral atherosclerosis. Further, IL-1 β , IL6, Tumour Necrosis Factor- α , and Alpha1-antichymotrypsin have been associated with cognitive impairment [6].

5. Conclusion

The prevalence of cognitive impairment in COPD patients was found to be 73.93%. So, thus it could be concluded from the study that the cognitive impairment is present in patients suffering with chronic obstructive pulmonary disease.

6. Clinical Implication

Cognitive impairment has a negative impact on the personal characteristics of COPD patients including conscientiousness, psychological profile and general ability to understand and communicate. The prevention of cognitive impairment by early intervention is therefore important for treating, delaying or postponing its underlying processes and dealing with potential functional impairments that can act as barriers to the therapeutic management of COPD.

Cognitive function should be a part of the initial respiratory assessment to treat/prevent the cognitive impairment. Timely detection of cognitive impairment and awareness of this extrapulmonary factors is of great importance as actions can be taken to minimize or even reverse the cognitive decline and its consequences. And MoCA questionnaire is a questionnaire that can easily diagnose cognitive function clinically.

7. Future Research

Further research should use detailed neuropsychological testing to evaluate domain-specific cognitive impairment. Further studies should focus on the interventions with the aim to optimize cognitive functions of the patients with COPD.

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