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A STUDY OF COGNITIVE IMPAIRMENT AMONG PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE COMPARED TO NORMAL INDIVIDUALS

Dr. Gaurav R. Dubey Assistant professor, Department of T.B and Respiratory medicine, PDMMC, Amravati.

Dr. Pranay Gandhi Assistant professor in community medicine, GMC, Chandrapur.

ABSTRACT The present study was conducted with the aim of evaluating the prevalence of cognitive impairment in patients with COPD in comparison to normal individuals.

Materials and Methods:
In this case-control study, 87 patients with COPD, whose diagnoses were confirmed by a pulmonologist based on the spirometry test findings, were included. The mini-mental state examination (MMSE) questionnaire was administered for assessing the cognitive impairment.

Results: In the case group, 42 patients (48.27%) had no cognitive impairment, 39 (44.82%) had mild, and 6 (6.89%) had moderate cognitive impairment. In the control group, 38 (63.33%) had no cognitive impairment, 20 (33.33%) mild and 2 (3.33 %) moderate cognitive impairment.

Conclusion:
According the results of the present study, COPD increased the risk of cognitive impairment significantly and is related to the severity of COPD, arterial oxygen saturation, and higher age.

KEYWORDS : COPD, Cognitive impairment

Introduction:
More than 14% of individuals aged more than 65 years have COPD; an increase in its prevalence and mortality is predicted in coming decades(1). A systematic review reported that the cognitive function of patients with COPD is impaired in relation to normal people(2). COPD is a major risk factor for cognitive disorders(3). The prevalence of cognitive disorders in these patients has been reported to be 10% to 48%(4), and COPD can increase the risk of cognitive disorders by approximately 2.5 times(5–7). There is a direct relationship between the severity of COPD and cognitive disorders (2, 8–10). However, some studies could not find any association between COPD and cognitive disorders(1). Concurrency of COPD and cognitive disorders leads to an increase in the mortality and hospitalization due to all causes and not pulmonary causes alone(11). In a systematic review, cognitive disorders were found in the severe form of COPD alone(12). It is known that brain hypo-perfusion occurs in patients with COPD and that an important cause for cognitive impairment is the lack of oxygen usage in hypoxemic patients(5). However, cognitive disorders have been found even in non-hypoxemic patients in some studies(13).

To have a better understanding of COPD, the present study was conducted with the aim of evaluating the prevalence of cognitive impairment in patients with COPD in comparison to normal individuals.

Materials and methods:
In this case-control study, 87 patients with a history and symptoms of COPD were assessed by a pulmonologist. These patients underwent the spirometry test. The goals of the study were described to the patients, and the informed consent was obtained from each patient. Patients were considered to have COPD if they had FEV1/FVC < 0.7, and if it remained < 0.7 fifteen minutes after the administration of two puffs of the salbutamol inhaler; moreover, their FEV1 should not have increased by 12% or 200 cc. Patients with COPD were divided into mild, moderate, severe, and very severe, according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria.

The exclusion criteria were illiteracy and history of myocardial infarction or cerebrovascular accident. The MMSE questionnaire was administered to all the patients by the interviewer. The MMSE questionnaire had 11 questions and 30 points that assessed cognitive disorders involving registration, orientation, recent memory, attention, calculation, spatial thinking, and verbal function domains. An arterial oxygen saturation below 90% was considered hypoxemia.

All cases and controls were divided into three groups for cognitive impairment, according to the MMSE score: mild (19 ≤ score < 23), moderate (10 ≤ score < 19) and severe (score<10). T-test was done to compare the MMSE scores between the two groups and the regression test was performed to assess the relation of the above-mentioned variables with the MMSE score.

Results:
In the case group of 87 patients, 8 (9.2%) were women and 79 (90.8%) were men; in the control group, 19 (31.67%) were women and 41 (68.33%) were men. The average age of the cases was 60.47 ± 9.83 years (range, 40–83 years) and that of the controls was 58.15 ± 9.8 years (range, 40–80 years). In patients with COPD, 7 (8.04%) had mild, 35 (40.23%) moderate, 29 (33.33%) severe, and 16 (18.39%) very severe forms of COPD.

In the case group, 42 (48.27%) patients had no cognitive impairment, 39 (44.82%) had mild and 6 (6.89%) had moderate cognitive impairments. In the control group, 38 (63.33%) patients had no cognitive impairment, 20 (33.33%) had mild and 2 (3.33%) had moderate cognitive impairments. There was a significant relationship between FEV1% and the MMSE score (p-value < 0.0001) and an inverse relationship between the severity of COPD and MMSE score (p-value < 0.0001; Figure 1).

There was a significant difference between the MMSE scores of the cases and controls (p-value < 0.0001; mean difference, 1.12).

There was a significant difference between the MMSE scores of the control group and the scores of non-hypoxemic patients with COPD in the case group (p-value < 0.001; mean difference, 0.7).

To answer the question of which domains of cognition were more impaired due to the severity of COPD, bivariate and Kendall correlation analyses were performed; according to them, the relationship of the severity of COPD was significant with questions 1,

4, 5, 7, and 11; these questions were related to the time orientation, calculation, recent memory, attention, and spatial thinking, respectively (Table 2).

Discussion:

In the present study 51.71% of patients with COPD and 36.66% of the control group had cognitive impairment; these values were 36% and 12%, respectively in a study that was conducted in 2012(2). In some studies, cognitive impairment was found in severe COPD alone (7). In the previous study that had a 20-year follow up for patients with COPD, it was shown that COPD led to a two-fold increased risk of cognitive disorders and Alzheimer disease (14). The prevalence of cognitive disorders among patients with COPD varies from 61% to 27% in different studies, according to the patient selection and severity of the disease (12, 15). However, the difference in cognitive impairment between the case and control groups was not significant in some studies (10, 16); this differed from the findings of our study.

Short-term hypoxemia and short-term oxygen therapy have no effect on cognitive impairment. In a study conducted on patients with COPD who experienced short-term hypoxemia because of air travel, there was no significant change in the cognitive impairment(17). In another study, there was no change in the cognitive impairment and no improvement in driving after the use of oxygen therapy during driving in patients with COPD(18).

In a study conducted in 2010, the role of hypoxemia and home oxygen therapy in cognitive impairment was well-defined(4). A systematic review conducted in 2012 reported that there was a direct relationship between the severity of cognitive impairment, and hypoxemia and the severity of COPD; however, the effect of this cognitive impairment on the quality of life and daily activity of the patient is not understood to date(19).

In two other studies, it was shown that even nonhypoxemic patients had significant cognitive impairment in comparison to normal people; however, this cognitive impairment did not have a considerable effect on their quality of life(9, 13). In our study, there was a significant difference in the cognitive impairment between nonhypoxemic patients with COPD and the control group.

Another study reported a decrease in the cerebral blood flow of patients with COPD, especially in the frontal area, and patients had a remarkable decrease in the verbal memory, recent memory, and attention, compared to the control group. The decrease in verbal memory was found in all patients with COPD; however, the recent memory and attention impairment were only found in hypoxemic patients(10).

Conclusions:

In the present study, there was a significant difference in the MMSE scores between the case and control groups; patients with COPD had a higher risk for cognitive impairment, compared to the control group.

Tables:

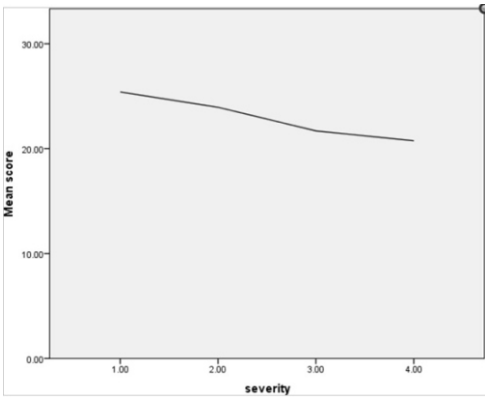
TABLE 1: The relationship between MMSE score and age, O2 saturation and %FEV1

Variable	B coefficient	p-value
Age	−0.053	0.019
O2 sat	0.124	0.018
FEV1	0.21	0.042

Table 2: The relationship between %FEV1 and the questions of the MMSE questionnaire

No. of question	Correlation Coefficient	p-value
1	0.13	0.042
2	−0.057	0.398
3	−0.079	0.247
4	0.432	0.000
5	0.489	0.000
6	-	-
7	0.377	0.000
8	0.031	0.654
9	-	-
10	0.081	0.238
11	0.209	0.002

Figure 1: Score of MMSE questionnaire according to severity of COPD in the case group.



REFERENCES

1. Mannino DM, Buist AS. Global burden of COPD: risk factors, prevalence, and future trends. Lancet 2007;370(9589):765–73.
2. 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(6):1516–23.
3. 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(10):1839–46.
4. hakur 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. Antonelli Incalzi R, Marra C, Giordano A, Calcagni ML, Cappa A, Basso S, et al. Cognitive impairment in chronic obstructive pulmonary disease--a neuropsychological and spect study. J Neurol 2003;250(3):325–32.
6. Dodd JW, Getov SV, Jones PW. Cognitive function in COPD. Eur Respir J 2010;35(4):913–22.
7. Hung WW, Wisnivesky JP, Siu AL, Ross JS. Cognitive decline among patients with chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2009;180(2):134–7.
8. Dodd JW, Chung AW, van den Broek MD, Barrick TR, Charlton RA, Jones PW. Brain structure and function in chronic obstructive pulmonary disease: a multimodal cranial magnetic resonance imaging study. Am J Respir Crit Care Med 2012;186(3):240–5.
9. Gupta PP, Sood S, Atreja A, Agarwal D. A comparison of cognitive functions in non-hypoxemic chronic obstructive pulmonary disease (COPD) patients and age-matched healthy volunteers using mini-mental state examination questionnaire and event-related potential, P300 analysis. Lung India 2013;30(1):5–11.
10. Ortapamuk H, Naldoken S. Brain perfusion abnormalities in chronic obstructive pulmonary disease: comparison with cognitive impairment. Ann Nucl Med 2006;20(2):99–106.
11. Shirtcliffe P, Weatherall M, Marsh S, Travers J, Hansell A, McNaughton A, et al. COPD prevalence in a random population survey: a matter of definition. Eur Respir J 2007;30(2):232–9.
12. Dodd JW, Charlton RA, van den Broek MD, Jones PW. Cognitive dysfunction in patients hospitalized with acute exacerbation of COPD. Chest 2013;144(1):119–27.
13. 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(4):351–6.
14. Rusanen M, Ngandu T, Laatikainen T, Tuomilehto J, Soininen H, Kivipelto M. Chronic obstructive pulmonary disease and asthma and the risk of mild cognitive impairment and dementia: a population based CAIDE study. Curr Alzheimer Res 2013;10 (5):549–55.
15. Li J, Huang Y, Fei GH. The evaluation of cognitive impairment and relevant factors in patients with chronic obstructive pulmonary disease. Respiration 2013;85(2):98–105.

16. Shim TS, Lee JH, Kim SY, Lim TH, Kim SJ, Kim DS, et al. Cerebral metabolic abnormalities in COPD patients detected by localized proton magnetic resonance spectroscopy. Chest 2001;120(5):1506–13.
17. Martin SE, Bradley JM, Buick JB, Crossan A, Elborn JS. The effect of hypoxia on cognitive performance in patients with chronic obstructive pulmonary disease. Respir Physiol Neurobiol 2011;177(1):36–40.
18. Pretto JJ, McDonald CF. Acute oxygen therapy does not improve cognitive and driving performance in hypoxaemic COPD. Respirology 2008;13(7):1039–44.
19. Schou L, Østergaard B, Rasmussen LS, Rydahl-Hansen S, Phanareth K. Cognitive dysfunction in patients with chronic obstructive pulmonary disease--a systematic review. Respir Med 2012;106(8):1071–81.
20. Hjalmarsen A, Waterloo K, Dahl A, Jorde R, Viitanen M. Effect of long-term oxygen therapy on cognitive and neurological dysfunction in chronic obstructive pulmonary disease. Eur Neurol 1999;42(1):27–35.