Assessment of Cognitive Function Status in Patients of COPD by Montreal Cognitive Assessment Test (MOCA) Hindi Version

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ABSTRACT

Introduction: In the current scenario of increasing burden of COPD it is predicted that, it will be fourth leading cause of death globally by year 2030. In the management of COPD, besides giving antibiotics, bronchodilators and anti-inflammatory treatment, simultaneous management of co-morbidities, is key for good recovery. Present study aimed to evaluate the presence of cognitive impairment in COPD patients using MOCA.

Material and Methods: This was a prospective case control study, where sequential patients satisfying criterion were included. Study was done in TB and Chest OPD of UCMS and GTB Hospital, a tertiary care teaching hospital situated in Dilshad Garden Delhi, from January 2015-July 2016. In study group there were 95 subjects and in control group there were 78 subjects. Cases and control were matched for educational and socio-economical background. Their cognitive function was assessed by MOCA test (Hindi version)

Results: The mean age of cases was 56.4±10.79 Years compared to 50.8±10.52 in control groups. Mean score was 19.87±4.39 with 10 (10.2%) achieving score equal to or above cut off value of 26 and among the controls it was 24.6±2.51 with 32 (42.1%) achieving score equal to or above cutoff value of 26. These data clearly shows the MOCA is an effective tool to assess cognitive function in COPD patients.

Conclusion: Among patients of COPD cognitive impairment is an important co-morbidity and MOCA is a quick and easy tool to diagnose it in OPD setting.

Keywords: Chronic Obstructive Pulmonary Disease, Montreal Cognitive Assessment Test, Memory, Abstraction, Orientation.

INTRODUCTION

COPD is usually caused by the long term exposure to smoke in the form of cigarette / bidi [a type of cheap cigarette made of unprocessed tobacco flakes wrapped in *tendu* leaves (Asian ebony tree or Piliostigmaracemosum)], use of biomass fuel for cooking etc or occupational exposure to it. In the years to come COPD burden will increase because of continuous exposure to risk factors and increasing life expectancy. It is proposed that COPD will be fourth leading cause of death by the year 2030.[1] Inspite of the fact that it is preventable and treatable disease.

By definition[2] COPD is defined on the basis of post-bronchodilator spirometery with FEV_1/ FVC <70% with FEV_1 at various levels depending on stages of disease. It is characterized by the irreversible loss of lung function, but this is only one aspect of disease. In any given patient of COPD other medical conditions also contributes to the morbidity and mortality of disease, these are called co-morbidities of COPD. They may or may not be directly caused or affected by COPD. Presence of these co-morbidities is independent of degree of airflow limitation. Thus labeling COPD as systemic disease leads to holistic approach in its management and better patient outcome.

Co-morbidities associated with COPD[3] are cardiovascular, musculoskeletal, psychological disruptions, lung cancers, anaemia, metabolic syndrome, GERD, lung cancers etc.

Cognitive impairment in COPD can be found in up to 77% patients with hypoxaemia.[4] Several aspects of disease contributes to impaired cognitive function including hypoxaemia and co-morbid cardiovascular diseases. It is also suggested that impaired performance in neuropsychatric tests may be a predicator of mortality and disability in certain COPD population.[5]

Although there is definable links between COPD and cognitive impairment but the literature in this direction is insufficient. This may be due to diagnostic uncertainty, non-uniform diagnostic criterion, small sample size or lack of appropriate reference group.

To fill this gap in knowledge we designed this study to find out prevalence of cognitive impairment in patients of COPD and among them which domain of cognition is affected using the Montreal Cognitive assessment (MOCA) test.

The Montreal Cognitive assessment test is a very effective test for screening, diagnosis and follow up of mild cognitive impairment. It also assesses different cognitive domains, has good psychometric properties and now widely used for mild cognitive impairment. it was designed because Mini-Mental State Examination (MMSE) has poor sensitivity for differentiating between patients of mild cognitive impairment and normal elderly persons.[7]

The objective of our study was to determine the prevalence of cognitive impairment in patients with COPD using MoCA test and to compare it from matched controls.

MATERIALS AND METHODS

This study was conducted in TB and Chest OPD of GTB Hospital affiliated to University College of Medical Sciences, Dilshad Garden Delhi. The duration of study was January 2015 to July 2016. This was a prospective case control study where sequential patients were included. Permission to use MOCA test (Hindi version) was obtained from the original developer of this test Mr. Z Nasruddin MD. All patients were given informed consent prior to participation.

MOCA was designed as a rapid screening instrument. It has different domain likes, Alternative trial making,

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Visuoconstructional skills (Cube and Clock), Naming, Memory, Attention, Sentence Repetition, Verbal Fluency, Abstraction, Delayed recall and Orientation. It is a 30 point test that takes around 10 to 15 minutes to complete and determine several cognitive domains. Mild cognitive impairment is present when score is less than 26. Visuospatial abilities are assessed by using a clock drawing task (3 points), and a three-dimensional cube copy (1 point). Various aspects of executive functions are assessed using a trail-making task (1 point), a phonemic fluency task (1 point), and a two-item verbal abstraction task (2 points). Assessment of language was done by using a three item confrontation naming task with familiar animals (3 points) and repetition of two syntactically complex sentences (2 points). Evaluation of short term memory is done by a task that involves two learning trials of five nouns and delayed recall after approximately 5 minutes (5 points). Sustained attentions task was used for attention, concentration and working memory (target detection using tapping, 1 point), digits forward and backward (1 point each) and a serial subtraction task (3 points). At last, orientation and place is evaluated (6 points).

Subjects

Case: 95 patients satisfying below mentioned inclusion and exclusion criterion were included in the study.

Inclusion Criteria

- Age >35 to <75 years
- Diagnosis of stable COPD in stage I to III as per gold guidelines
- Minimum high school education
- No history of neurological or neuropsychiatric illness
- No exacerbation of symptoms in last 3 months.

Exclusion criteria

- Not willing to participate
- Illiterate
- Out of range ages
- Addiciton to alcohol or other substances of abuse
- On long term oxygen therapy
- Any visual or hearing impairment
- Sever cardiovascular co-morbidities.
- History of head injury, brain tumors, dementia, epilepsy.
- Use of medications like sedatives and antipsychotics.

Along with 95 cases, 78 healthy subjects' controls with normal spirometer were enrolled as controls. Both groups were matched for age, sex distribution, level of education and socio-economical background.

Both the groups underwent exhaustive clinical and biochemical examination to rule out endocrine disorders, h/o alcoholism and medications known to affect cognition. The spirometry was done by electronically printable spirometer. After this MOCA test was applied on both study and control groups and results were analyzed.

STATISTICAL ANALYSIS

Data was collected and analyzed using SPSS v.20.0 (SPSS Inc, Chicago, IL, USA) and is presented as mean ± standard deviations in case of continuous variables with Gaussian distribution, median and interquartile range for continuous variables without Gaussian distribution or percentages for categorical variables.

To assess the significance of the differences between groups, the ANOVA along with Bonferroni post-hoc (means, Gaussian populations), Kruskal-Wallis and Mann-Whitney-U (medians, non-Gaussian populations) tests were used. Continuous variables distributions were tested for normality using Shapiro-Wilk test (if the p value was higher than 0.05, Gaussian distribution was assumed) and for homoscedasticity using Levene's test. The strength of correlations between variables was assessed using Spearman's correlation coefficient and its statistical significance with t-distribution test. In order to evaluate the involvement of multiple confounding variables on the MOCA score, a multivariate regression model was built, having as outcome the MOCA score. The predictors were added in the model using a forward-stepwise method, the principle of adding or removing one term from the regression equation being based on the information entropy principle; it was chosen the model having the lowest corrected Akaike's Information Criterion score.

A p-value of <0.05 was considered the threshold for statistical significance.

RESULTS

There were 95 patients in study group and 78 persons were enrolled as controls.

Among 95 cases 81(85.2%) were male and among controls 46(59.0%) were male. Mean age of patients in cases was 56.4±10.79 years and in control group was 50.8 ± 10.52 years. The distribution of age in both groups are shown in Table 1.

On analysis of MOCA score we found that among cases only 10 subjects were able to achieve score >26 (cutoff for normal) where as in control group 32 were able to achieve score of 26 or more, giving the p value of 0.000 which is highly significant (Table 2).

Among the cases the mean score was 19.87±4.39 with 10(10.2%) achieving score equal to or above cutoff value of 26 and among the controls it was 24.6±2.51 with 32 (42.1%) achieving score equal to or above cutoff value of 26. These data clearly shows the MOCA is an effective tool to assess cognitive function in COPD patients.

On analysis of individual domain of MOCA score we found that 55.3% cases were able to achieve best score of 3 while naming

Age groups	Cases		Controls	
	Number	%	Number	%
<40	10	10.5	16	20.5
41-50	15	15.8	23	29.5
51-60	37	38.9	25	32.1
61-70	26	27.4	13	16.7
>71	7	7.4	1	1.3

Table-1: Age distribution in both the groups

Score range	Cases(n=95)	Controls(n=78)
<15	11	1
16-20	44	9
21-25	30	36
>26	10	32
P=0.000.		

Table 2: MOCA score in both groups

the animals, which means that they were able to name all animals in question. The worst hit area of cognition was attention where only 17% were able to achieve best score of 6 i.e. read the list of digits, letters and serial 7 subtractions (Table 3, Figure 1).
Comparative analysis of number of subjects achieving full score in various aspects of cognition in study and control groups (Table 4).

DISCUSSION

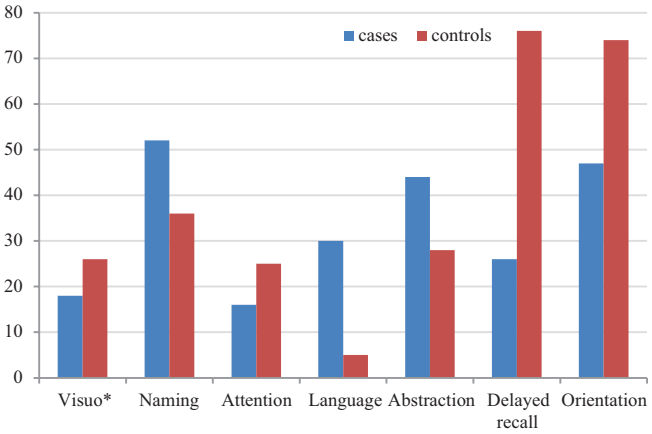
Chronic Obstructive Pulmonary Disease and cognitive impairment are highly prevalent chronic disease and are associated with multi morbidity and mortality in elderly population. In COPD cognitive impairment is the more advance and progressive disease which latter become severe disease. Orientation, executive functions and memory seems most affected.
The brain particular, may be vulnerable to the systemic effects of COPD, several features of the disease may contribute to impaired cognitive function, including hypoxemias and comorbid cardio vascular disease.
Age and educational level are demographic variables thought to strongly relate to neuropsychological performance in all populations. Cognitive impairment affects older patient's abilities to adequately perform self-care activities in a number of ways. Deficit in memory and attention may impair to ability to learn and remember information needed to perform preventative behaviors.
In the present study we found that mean age of cases was 56.4±10.79 Years compared to 50.81±10.52 years in control groups. Similar age range were also found by Dogra et al.[8] Most of patients on our study were males 73.4% compared to 63% by Megan M Dulohery et al.[9]
Dysfunction in cognition reduces the level of functioning evaluated by activities of daily living and is related with poor compliance with both medication and oxygen therapy and this poor compliance increases the risk of acute exacerbation.
The mean cognitive function as assessed by MOCA was 19.87±4.39 with 10.2% score is above cut off of 26 in cases and 24.6±2.51 with 42.1% scoring above cut off of 26 in controls. The mean MOCA score in other study was 24.41±3.52[8], 20.2±2.4[10], 19.37±2.99.[11] Among cases 44/95 (46.3%) subjects achieved score of 16-20 and in control 35/76 (47.3%) score of 21-25, is meaning that MCOA assesses well overall decline in cognitive function.
Several studies have confirmed decline in a number of cognitive function e.g. memory, reaction time abstract reasoning and complex visuo-spatial process in COPD patients.[8,10,11]
In our study attention, visuo-spatial/executive function and delayed recall were more affected and then language, abstraction, naming objects and orientation skills as described in table number-3. A poor performance of these tasks as assed by MOCA can be explained due to frontal hypo perfusion in patients of COPD, mean result of cases and controls of their domains are shown in table number -4.
Current evidence suggests that hypoxemia alone is not enough to entirely account for the cognitive deficits which occur in COPD and various factors are responsible, factors like tissue hypoxia, systemic inflammation, and oxidative stress. Another hypothesis is that nicotine released during cigarette smoking, which over a period of time causes oxidative stress by generation of free radical which leads to damage of neuronal cells. This could be one of the causes of cognitive deficit in non-hypoxemic who have normal baseline oxygen saturation.

Area of cognition	Number of subjects achieving full score			
	Cases (n=95)	%	Controls (n=78)	%
Visuo-spatial/ executive function	18	19.1	26	33.3
Naming	52	55.3	36	46.1
Attention	16	17.0	25	32.05
Language	30	31.9	5	6.41
Abstraction	44	46.8	28	35.8
Delayed recall (memory)	26	27.6	76	97.4
Orientation	47	50.0	74	94.87

Table-3: Different area of cognition in both groups

Domain	Cases	Controls
Visuo-spatial/ executive function	2.51±1.78	3.67±1.23
Naming	2.33±0.89	2.46±0.50
Attention	3.54±1.60	4.67±1.38
Language	2.04±0.83	2.03±0.36
Abstraction	1.24±0.79	0.74±0.96
Delayed recall	2.73±1.87	5.0±0.00
Orientation	4.91±1.42	5.92±0.42

Table-4: Mean score of various components of MOCA



VIsuo*= Visuo-spatial/ executive function.

Figure-1: Different area of cognition in both groups

CONCLUSION

From current study we concluded that COPD affects many aspects of cognition. The most commonly affected area is attention followed by the delayed recall and least affected area is naming domain. Hence we can say that MOCA is highly dependable easy to administer, less time consuming test in out-door setting. A easy and reliable test for diagnosis of cognitive impairment in patients of COPD in OPD setting.

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