



**ORIGINAL RESEARCH PAPER**

**Health Sciences**

**ANALYSIS OF COGNITIVE IMPAIRMENT IN OBSTRUCTIVE SLEEP APNEA SYNDROME (OSAS) WITH & WITHOUT COMORBIDITIES: A PROSPECTIVE, CROSS SECTIONAL STUDY**

**KEY WORDS:**

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**ABSTRACT**

**Introduction:** OSAS has become a significant public health problem with the increasing demands of modern society. It is often associated with serious and adverse consequences as it is most of the time associated with comorbid conditions.

**Objectives:** To assess the impact of OSAS with and without comorbidities on cognitive functions in either gender of different age groups.

**Method:** The sample of 205 patients diagnosed as having OSAS was divided into two groups depending on presence and absence of comorbid conditions. OSAS patients with comorbidities were 179 & 26 patients were without comorbidities. The patients were administered with the specific evaluation scale MoCA.

**Observation & Results:** In Group with Comorbidities- Strong correlation between MoCA components mean score was observed with degree of apnea & age. Affection in cognition was irrespective of gender.

In Group without Comorbidities- Degree of severity of apnea, gender & age had no effect on Cognitive functions in patients without comorbidities.

**Conclusion:** The impact of OSAS in patients without comorbidities was significantly less than in patients with comorbidities.

**INTRODUCTION**

Sleep apnea is a disorder that affects breathing during sleep. "Apnea" comes from a Greek word that stands for "want of breath." (ASA-2008)

"Obstructive sleep apnea syndrome is a clinical disorder marked by frequent pauses in breathing during sleep usually accompanied by loud snoring. These pauses cut off the oxygen supply to your body for a few seconds and halt the removal of carbon dioxide. As a result of this, your brain briefly wakes you up, re-opens the airways and re-starts breathing. This can occur many times during the night and makes proper sleep impossible. During the day you may experience excessive daytime sleepiness, difficulty in concentrating or headaches. At night, snoring is the most common feature." (WHO)

Severity criteria: The criteria of the severity of OSAS are a combination of the severity of anytime sleepiness and the value of apnea-hypopnea index (AHI) i.e. The number of apneas and hypopneas per hour of sleep, which is confirmed by electroencephalogram (EEG).

1. Mild: 5-15 events per hour.
2. Moderate: 15-30 events per hour.
3. Severe: more than 30 events per hour.<sup>1</sup>

Common symptoms of obstructive sleep apnea include: Snoring, Daytime sleepiness, Pauses in breathing, Difficulties with memory and concentration, Unusual moodiness or irritability, depression, Frequently, waking up to urinate at night, Morning headaches, Dry mouth or sour throat, Night time sweating, Fatigue, Decreased libido. (National clinical guideline;2003)

In India, the prevalence of OSA is high in Western India. Statistics reveal that OSA in Indian males varied from 4.4% to 19.7% while among females it ranged from 2.5% to 7.4%. (Public Health; 2017)

The comorbid conditions associated with OSAS are: Essential hypertension, obesity & type 2 diabetes mellitus were found to be most frequently associated with OSA. Other conditions include ischemic heart diseases, hypercholesterolemia, congestive heart failure, Diseases of the respiratory system, hypertrophy of tonsils etc.

Several studies have shown that OSA sufferers consistently show deficits in the cognitive domains of attention, episodic and verbal

memory, and executive functions.<sup>2</sup>

Occupational therapy is founded on the health-promoting benefits of occupational engagement. Sleep was recognized as necessary for ensuring health and balanced life of human being. Occupational therapy can serve a major role by evaluating problem areas and suggesting interventions that facilitate habits, roles, and routines that utilize meaningful occupations to promote desirable sleep behaviors and compliance with the patients of OSAS who are living compromised life and can add to the advanced research in the area of sleep. (American Occupational Therapy Association, 2008).

**AIMS**

To assess the impact of OSAS with and without comorbidities on cognitive functions in either gender of different age groups.

**OBJECTIVES:**

To assess the impact of OSAS with and without comorbidities on cognitive functions using Montreal Cognitive Assessment (MoCA).

**MATERIAL AND METHODS**

**Study Design:** Prospective Cross sectional observational study.

**Setting:** The study was carried out in Occupational Therapy Centre, GMCH, Nagpur.

**Duration Of Study:** Was period of 3 years and 6 months.

Patients referred by Pulmonologists, Otorhinolaryngologists diagnosed as OSAS by Polysomnography of either gender were selected for the study according to the eligibility criteria.

**INCLUSION CRITERIA:**

- Patients of OSAS of either gender aged between 18-75 yrs. willing to give written informed consent.
- Patients diagnosed as OSAS by Polysomnography and having symptoms for 6 months or more.
- OSAS graded as Mild (5-15), Moderate (15-30), Severe (>30) on AHI (Apnea Hypopnea Index).
- Patients with or without co morbidities like Obesity, Diabetes, Hypertension, Hypothyroidism, Bronchial Asthma, Chronic Alcoholism.

**EXCLUSION CRITERIA:**

- Patients having any Neurological, Psychiatric ailment, Upper

airway tumours or Nasal polyps and Cardiac disease excluding Hypertension.

- Patients received or receiving any treatment for OSAS in the form of Medical/Surgical/Lifestyle modification.

Comprehensive sleep history including presence or absence of comorbidities, physical examination, in patients suspected of OSA was done followed by Polysomnography.

Each participant underwent a single evaluation session, lasting roughly two hours. This included general OT evaluation i.e., demographics, history of illness, present and past history, comorbidity history, Polysomnography and other reports and current medication.

Non-probability convenient sampling technique was used. Estimated minimum sample size was 100. Out of total 267 patients who were diagnosed as having OSAS on Polysomnography & who were enrolled during the study period, final analysis was conducted on data gathered from MoCA scale on 205 patients due to drop outs.

The sample of 205 patients was divided into two groups depending on presence and absence of comorbid conditions.

Group A – {OSAS patients with comorbidities} -179 subjects  
Group B- {OSAS patients without comorbidities} -26 subjects

The **Montreal Cognitive Assessment (MoCA)**<sup>3</sup> was created in 1996 by Ziad Nasreddine in [Montreal, Quebec](#). It was validated in the setting of mild [cognitive impairment](#), and has subsequently been adopted in numerous settings clinically including sleep apnea. The MoCA assesses several cognitive domains. The short-term [memory](#) & delayed recall, [Visuospatial](#) abilities, executive functions, a phonemic fluency task, verbal abstraction task, Attention, concentration and working memory are evaluated using a sustained attention task, Language & Finally, orientation to time and place is evaluated.

**OBSERVATION & RESULTS**

**Statistical Analysis:**

- Statistical software STATA version 14.0 was used for data analysis. Wilcoxon rank sum test, one-way ANOVA, Independent t-test, chi<sup>2</sup>-test & Pearson correlation coefficient was used for appropriate analysis.

**RESULTS**

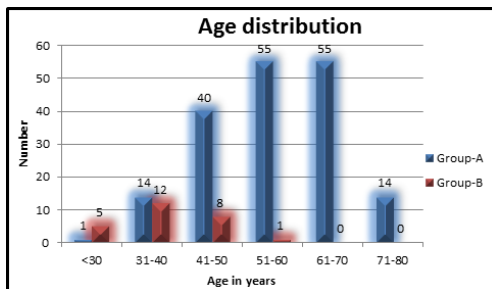


Figure (1): Age Distribution

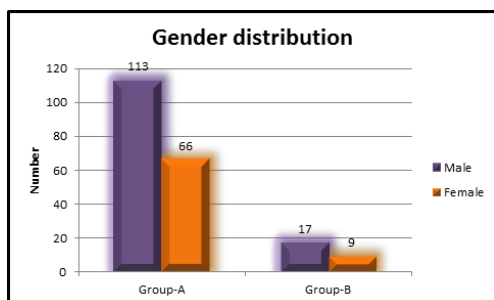


Figure (2): Gender Distribution

**ANALYSIS OF OSAS WITH CO-MORBIDITIES ON MoCA:**

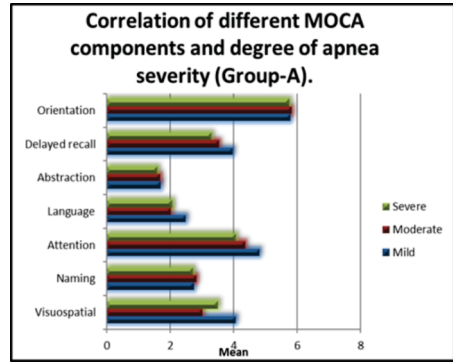


Figure (3): Different MoCA Components & Degree Of Apnea Severity Correlation (Group-A).

Table (1): Total MoCA Score & Severity Of Apnea.

MOCA Component	Mild	Moderate	Severe
Total Score	25.18	24.41	23

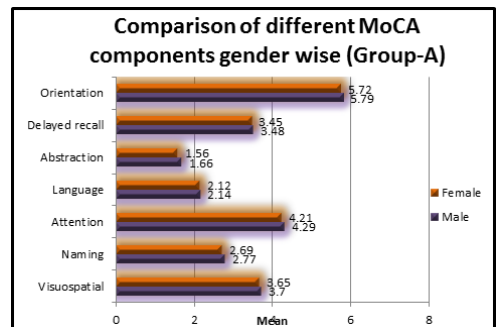


Figure (4): Gender Wise Comparison Of Different MoCA Components.

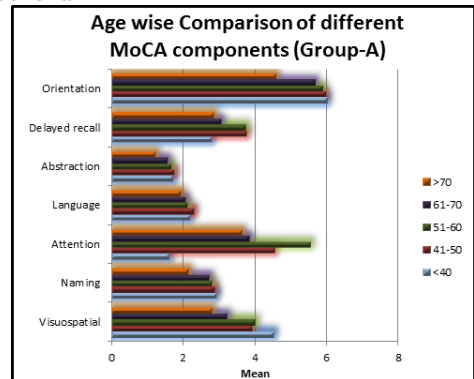
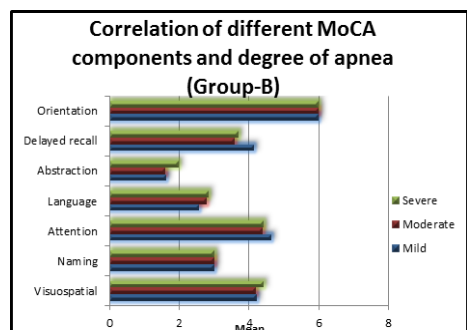


Figure (5): MoCA Components Age Wise Comparison.

Table (2): Total MoCA Component Score Age Wise (Group-A).

Total MoCA	<40	41-50	51-60	61-70	>70
Component Score	25.67	25.2	24.67	22.07	19.42

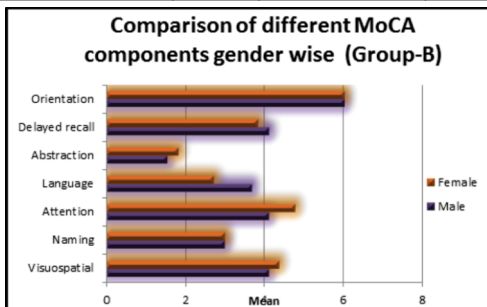
**ANALYSIS OF OSAS WITHOUT CO-MORBIDITIES ON MoCA:**



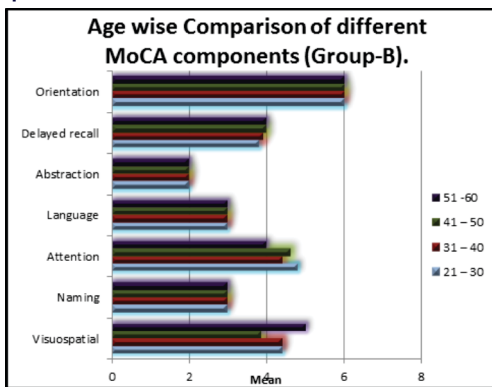
**Figure (6): MoCA Components & Degree Of Apnea Severity Correlation (Group-B).**

**Table (3): MoCA Component Total Score (Group-B).**

MOCA Component	Mild	Moderate	Severe
Total Score	26.42	25.6	25.57



**Figure (7): MoCA Components Gender Wise Comparison (Group-B).**



**Figure (8): MoCA Components Age Wise Comparison (Group-B).**

**Table (4): Correlation Of AHI With MoCA Score**

Variable	Group-A		Group-B	
	r-value	p-value	r-value	p-value
MOCA score	-0.1934	0.0095, HS**	0.0357	0.8627, NS

**DISCUSSION**

ANALYTICAL REASONING OF IMPACT OF OSAS WITH COMORBIDITIES (GROUP-A) & WITH OUT CO-MORBIDITIES (GROUP-B) ON COGNITIVE FUNCTIONS (MoCA).

OSAS likely causes cognitive impairment at a cellular level, through intermittent hypoxia, hormonal imbalance, and/or systemic inflammation, either independently or via the resultant endothelial dysfunction.

Sleep alters the molecular signaling pathways that regulate synaptic strength. Sleep deprivation can impair neuronal excitability, decrease myelination and lead to cellular oxidative stress and mis-folding of cellular proteins.

In Group-A, MoCA components- Visuospatial (p value 0.0062), Delayed recall (p value 0.0009) showed highly significant scores indicating strong correlation with degree of apnea severity. Whereas, Attention (p value 0.0348), Language (p value 0.0444), Orientation (p value 0.0255) had weak to moderate correlation.

Naming (p value 0.3353), Abstraction (p value 0.5229) showed no significance. The correlation of Total MoCA score with degree of severity of apnea showed high significance (p value 0.0001) indicating that with increase in severity of apnea, scores decreased.

These findings are supported by study done by Yagmur Inalkac Gemici, et.al.<sup>4</sup>, Romola S. Bucks, et.al.<sup>5</sup>, Lal C., et al.<sup>6</sup>, Wesam

Shaban Kenawy<sup>7</sup>.

In Group-B, p values for different MoCA components showed no significance, indicating degree of severity of apnea had no effect on MoCA component score.

However, the mean total scores of MoCA were 26.42 for Mild, 25.6 for Moderate and 25.57 for Severe apnea, indicating decrease in cognitive function with increase in degree of apnea severity, although statistically not significant.

The possible reason may be majority of the patients were in middle age group (30-50 yrs.) and without any comorbidity.

In Group-A, gender wise comparison of MoCA components, showed no significant difference in male and female scores. Affection in cognition was irrespective of gender.

In Group-B, gender wise comparison of MoCA components, showed significance only for Attention component. Male patients (65.38%) being affected more than females (34.62%).

A morphological study (Torelli et al., 2011) showed correlation between age and volumes of the total and left hippocampus, amygdale, and brain parenchyma in OSA patients.

This may be the probable reason, for above results. Also, correlation of Total MoCA component mean score and age revealed that with increase in age, Total MoCA component score decreased. These results are in accordance with the research done by Mak Adam Daulatzai<sup>8</sup>.

In Group-B, MoCA component total scores when compared age group wise, the p value, 0.0180 showed significance. This means with increase in age, the MoCA score decreased in this group also.

With increase in AHI value in Group-A, MoCA total score (p value- 0.0095) showed negative correlation and high significance i.e., cognitive functions decreased significantly. Daulatzai, noted that, result of ongoing brain hypoxia, or hypo perfusion mainly hypertension contributes to cognitive impairment by raising both oxidative stress and inflammatory response. However, AHI showed no correlation with MoCA score in Group-B.

**CONCLUSION**

- Strong correlation was observed between Visuospatial, Delayed recall & severity of apnea, weak to moderate correlation between Attention, Language & Orientation. Severity of apnea, increases cognitive functions decline in patients with comorbidities. Whereas, Degree of severity of apnea, gender & age had no effect on Cognitive functions in patients without comorbidities.
- Affection in cognition was irrespective of gender. With increase in age, Cognitive functions declined in patients of OSAS with & without comorbidities.
- With increase in AHI value, Cognitive functions decreased significantly in patients with & without comorbidities.

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