Effect of Obstructive Sleep Apnea Treatment on Mail-In Cognitive Function Screening Instrument

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Abstract: *Background:* Obstructive sleep apnea syndrome (OSAS) may be associated with cognitive impairment (CI). The goal of this study was to evaluate the impact of risk factors and continuous positive airway pressure (CPAP) on a screening tool for cognitive function. *Methods:* The Mail-In Cognitive Function Screening Instrument (MCFSI) is a self-administered test designed to identify CI in the Alzheimer's Disease Cooperative Study. It was administered to 88 consecutive patients with OSAS attending the Medical University of South Carolina Sleep Clinic. An MCFSI score ≥5 was considered abnormal. *Results:* Data were analyzed on 61 patients after excluding missing and duplicate data. The MCFSI score was abnormal in 15 patients (25%). African Americans were more likely to be CPAP-noncompliant. Female gender and smoking were associated with abnormal MCFSI scores. CPAP-compliant patients were more likely to have normal MCFSI scores, although the difference was not statistically significant (P = 0.06). *Conclusions:* CPAP-compliant patients showed a trend toward lower MCFSI scores. There may be gender and racial differences in CI related to OSAS, predisposing certain groups to worse morbidity. Appropriate treatment and compliance with CPAP could improve CI in OSAS. Larger studies with multivariate analyses are needed to identify relationships between individual OSAS and CI risk factors.

Key Indexing Terms: Sleep apnea; Cognitive impairment; Continuous positive airway pressure; Risk factors; Mail-in cognitive function screening instrument. **[Am J Med Sci 2014;348(3):215–218.]**

Obstructive sleep apnea syndrome (OSAS) is a common disorder with a high prevalence in the general population.[1] It is characterized by a decrease or cessation of normal airflow during sleep, which is often accompanied by symptoms of excessive daytime sleepiness (EDS), fatigue, cardiovascular[2] and metabolic sequelae.[3] As the prevalence of OSAS rises in an aging population with increasing obesity, data about its adverse impact on health continue to emerge.

There is increasing evidence that OSAS is associated with impaired cognitive functioning.[4] The cognitive domains that are most commonly affected by OSAS include vigilance,[5] executive function[6] and memory.[7] One important aspect of OSAS-associated cognitive impairment (CI) is that some populations may be particularly at risk. Therefore, screening tools that target populations such as the elderly[8] may allow improved clinical recognition of the disease state. Given the general irreversibility of most dementias, it is critical that any reversible etiologies for CI should be identified and treated.

Objective neurocognitive assessment requires intensive testing and trained personnel, both of which are time consuming and expensive. The Mail-In Cognitive Function Screening Instrument (MCFSI) was developed for the Alzheimer's Disease Cooperative Study Prevention Instrument Project as an open-access survey to evaluate whether a brief screening tool could be used to trigger a diagnostic evaluation in large dementia prevention trials.[9] The MCFSI is a short, self-administered, 14-point test meant to detect subjective memory impairment in nondemented individuals. Importantly, the MCFSI measures the degree of self-perceived CI with higher scores correlating with worse cognition. A correlation has been seen between the MCFSI total scores, the Mini-Mental Status Examination scores and the Clinical Dementia Rating Scores in healthy elderly individuals. We have adopted the MCFSI as a quick and easy to administer screening tool for CI in our OSAS population.

To assess the impact of continuous positive airway pressure (CPAP) treatment of OSAS on cognitive function, we evaluated the MCFSI scores in CPAP-compliant and noncompliant patients. We postulated that MCFSI scores would be lower in CPAP-compliant patients, thus suggesting evidence of better cognitive function with CPAP treatment.

METHODS

After approval from the Medical University of South Carolina's Institutional Review Board, waiver of informed consent was allowed to collect retrospective data on 88 sequential patients presenting to the Sleep Clinic from January 1, 2012 to August 30, 2012. Before seeing their physician for a clinic visit, patients were administered the MCFSI questionnaire. The components of the MCFSI are shown in Table 1. In addition to demographics, we collected data regarding known risk factors for OSAS and neurocognitive dysfunction. These risk factors included obesity, smoking and alcohol abuse, hypertension, diabetes mellitus, metabolic syndrome and use of psychoactive medications. Severity of OSAS was evaluated using the apnea hypopnea index (AHI) or respiratory disturbance index (RDI) from the most recent overnight polysomnogram. Patients with (1) an AHI or RDI ≥5/hr with symptoms or (2) an AHI or RDI ≥15/hr with/without symptoms were considered to have OSAS. Data on the oxygen desaturation index were not collected. CPAP compliance was defined as usage of CPAP for ≥4 hours per night for 70% of nights in a consecutive 30-day period within the past 3 months, in accordance with the Medicare definition of CPAP compliance.

Comparative data were analyzed using the 2-tailed Student t test for normally distributed continuous data and χ^2 analysis with Pearson correlation coefficient for categorical data (JMP, Cary, NC). MCSFI was not normally distributed; therefore, a Wilcoxon rank sums test was used for analysis. CPAP compliance was compared with demographics, AHI/RDI and

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TABLE 1. Mail-in cognitive function screening instrument components

Question	Yes = 1	No = 0	Maybe = 0.5
1. Compared to 1 year ago, do you feel that your memory has declined substantially?			
2. Do others tell you that you tend to repeat questions over and over?			
3. Have you been misplacing things more often?			
4. Do you find that lately you are relying more on written reminders?			
5. Do you need more help from others to remember appointments, family occasions or holidays?			
6. Do you have more trouble recalling names, finding the right word or completing sentences?			
7. Do you have more trouble driving?			
8. Compared to 1 year ago, do you have more difficulty managing money?			
9. Are you less involved in social activities?			
10. Has your work performance declined significantly compared to 1 year ago?			
11. Do you have more trouble following the news, or the plots of books, movies or TV shows, compared to 1 year ago?			
12. Are there any activities that are substantially more difficult for you now compared to 1 year ago?			
13. Are you more likely to become disorientated, or get lost, for example when traveling to another city?			
14. Do you have more difficulty using household appliances?			
Total score			

MCFSI scores. MCFSI scores (normal versus abnormal) were compared with demographics, AHI/RDI (whichever was greater) and known CI risk factors. P values of ≤ 0.05 were considered significant.

MCFSI scores ≥ 5 were considered abnormal for this study. The MCFSI has not been studied enough to have firmly established normal and abnormal values. However, the mean MCFSI in Alzheimer's Disease Cooperative Study subjects was 2.4. We chose values ≥ 5 to try to ensure significant results.

RESULTS

The Consort diagram is shown in Figure 1. A complete data set was available on 61 patients with OSAS. Twenty-seven patients were excluded because of duplicate visits or incomplete data acquisition. The individuals' demographics and test data are presented in Table 2. Average duration of CPAP use in the CPAP-compliant group was ≥ 6 weeks.

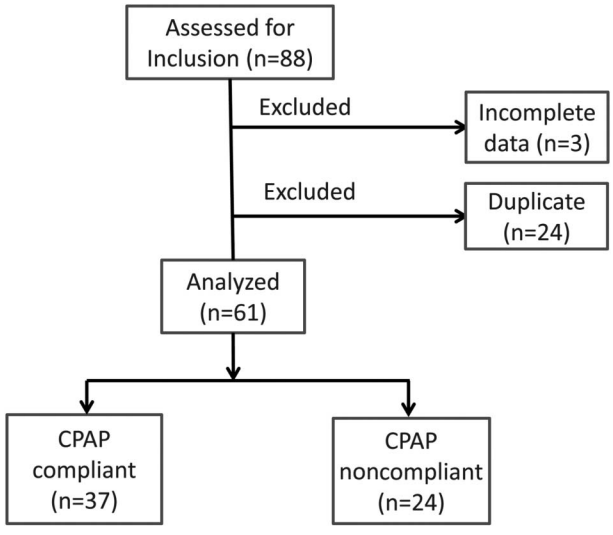

FIGURE 1. Consort diagram of subject inclusion and data analysis.

Age was similar in the CPAP-compliant and noncompliant groups and in subjects with normal and abnormal MCFSI scores. African American ethnicity was associated with a greater likelihood of CPAP noncompliance. In addition, African Americans and women were more likely to have abnormal MCFSI scores. These results were not adjusted for education level. The CPAP-compliant group had worse OSAS at baseline as defined by the AHI/RDI.

The MCFSI was abnormal (≥ 5) in 15 patients (25%). A greater percentage of CPAP-compliant patients had normal MCFSI scores as compared with the CPAP-noncompliant group, with a P value nearing significance ($P = 0.06$). The correlation between individual MCFSI scores and CPAP compliance is shown in Figure 2.

To further understand the relationship between OSAS and MCFSI scores, multiple univariate analyses were performed (Table 3). In addition to the gender and race differences described above, smoking was associated with abnormal MCFSI scores ($P = 0.01$). Use of psychoactive medications showed a trend towards abnormal MCFSI scores ($P = 0.06$).

DISCUSSION

This study shows a strong correlation between CPAP compliance and better cognitive functioning as measured by the MCFSI questionnaire. This proof of principal study was needed to assist in powering future studies and assuring the instrument was easy to use. Our real world effectiveness evaluation was helpful in the clinic and correlated in an anecdotal manner with reports of family and friends who accompanied patients to the clinic.

As we had expected, MCFSI scores are not normally distributed in the OSAS population. Most individuals score in the normal range, making screening research particularly difficult in this disease. There are several potential explanations for MCFSI variability. Because MCFSI is a self-perception of cognition, we would not expect all patients to recognize their CI due to insidious onset, mild impairment or potential denial. Variability also might occur day-to-day because impaired vigilance from EDS also impacts cognitive functioning.