Cognitive Function Among Obstructive Sleep Apnea Patients in North East Malaysia

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Abstract: Introduction: Obstructive sleep apnea patients may develop deficits in the cognitive domains of attention, concentration, executive function, verbal and visuospatial memory, constructional abilities, and psychomotor functioning. As cognitive performance will improve with the treatment, early screening for cognitive dysfunction should be done to prevent further deterioration.

Objective: We aim to evaluate the cognitive function of obstructive sleep apnea patients by using the 'Mini Mental State Examination'.

Methodology: This was a cross sectional study to evaluate the cognitive function of moderate and severe obstructive sleep apnea patients with age ranged from 18 to 60 old who attended our sleep clinic. These patients were confirmed to have moderate and severe obstructive sleep apnea by Type 1 polysomnography (attended full overnight study). The age, gender and ethnicity were noted and other relevant data such as weight, height, body mass index and apnea and hypopnoea index were recorded accordingly. The cognitive function was evaluated using validated Malay version of Mini Mental State Examination which measured 5 areas of cognitive functions comprising orientation, registration, attention and calculation, word recall and language abilities, and visuospatial.

Results: A total of 38 patients participated in this study. All 19 patients of moderate group and 14 patients of severe group had normal cognitive function while only 5 patients in severe group had mild cognitive function impairment. There was a statistically significant difference between the moderate group and severe group on cognitive performance (p value = 0.042).

Conclusions: Severe obstructive sleep apnea patients may have impaired cognitive function. Mini Mental State Examination is useful in the screening of cognitive function of obstructive sleep apnea patients but in normal score, more sophisticated test batteries are required as it is unable to identify in 'very minimal' or 'extremely severe' cognitive dysfunction.

Keywords: Cognitive function■Obstructive sleep apnea■Mini Mental State Examination

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INTRODUCTION

Excessive daytime sleepiness (EDS) is one of the commonest symptoms in patient suffering from obstructive sleep apnea (OSA). EDS makes people less alert and impairs their performances. In untreated cases, patients will develop cognitive dysfunction, inability to concentrate, memory and judgement impairment, irritability and depression.[1,2] Impaired performance in OSA patients has been reported in tests of various cognitive functions such as attention, memory, psychomotor performance and executive functioning.[3,4] The cognitive deterioration of untreated sleep apnea is probably due to sleep apnea hypoxic condition for many years as sleep fragmentation and comorbidities may also contribute to this effect.[4,5] Kales et al.[6] found 76% of OSA patients had suspected or mild to severe deficits in domain of attention, concentration, executive function, verbal and visuospatial memory, constructional abilities, and psychomotor functioning. Out of these, 46% of OSA patients had short term memory impairment and 32% of OSA patients had long term memory difficulties. This will result in greater potential for being distractable, confused and irritable that can cause disruption in their lives involving their families, social interactions and work situations.

Assessments of cognitive performance in OSA patients have been conducted using a variety of neuropsychological tests, usually conducted with pen and paper or by computer.[7,8] Each test battery has a specific domains assessment. In order to measure different cognitive functions, different test battery needs to be used. Generally, these tests differ not only in their target function but also with respect to difficulty, reliability and additionally involved cognitive subfunctions. Thus direct comparison of performance levels between the test batteries has validity limitation.[9,10] Some neuropsychological tests may not be sensitive enough to detect mild executive or other cognitive dysfunction.[11]

Most of these tests are time consuming and several hours are required to assess every patient. This poses a problem as most of cognitive dysfunction patients could only cooperate fully for a short period of time. Folstein et al[12] proposed a quick and easy test for evaluation of the cognitive function: the Mini Mental State Examination (MMSE). It only takes approximately 7 min to perform the whole test.[13] MMSE test has been applied to numerous neurological deficit in which mental deterioration can be expected. This test measures a broad range of cognitive function and divides into five areas. The areas are orientation, registration, attention and calculation, word recall and, language

abilities and visuospatial. This test is divided into two sections. The first section tests the oral response, orientation to time and place, memory and attention test with a maximum score of 21. The second tests the capacity of naming, comprehending oral and written commands, and writing and copying a drawing, with a maximum score of 9. The total score for MMSE test is 30 points. Score more than or equal to 24 points (out of 30) is effectively normal cognitive performance. Mild cognitive impairment is present when score is between 21 and 24 points. Score between 10 and 20 points is considered as moderate cognitive impairment. Patient with severe cognitive impairment is diagnosed when the score is less or equal to 9 points.

Due to language barriers and cultural differences, the English version of MMSE was found not suitable for use in Malaysia. Thus, Zarina et al[14] performed the validation of Malay version of MMSE. This test was chosen in our study as it is quick to perform and takes approximately seven minutes to complete.[13] Most of other test batteries using English version are not suitable for our local environment due to language barrier and culture differences. This may impact the outcome as patients do not understand the task that they should perform. This problem is overcome as MMSE has already been validated to Malay version, thus the language does not cause a problem.[14,15] MMSE measures a broad range of cognitive function and can detect the changes in a patient's cognitive state.[16] It has a good reliability and validity.[17]

As cognitive performance will improve with the treatment, early screening for cognitive dysfunction should be done to prevent further deterioration. The Validated Malay MMSE is an easy and effective screening tool in the evaluation of cognitive performance. Thus, we aimed to evaluate the effect of moderate and severe OSA on the cognitive performance of our patients by using the Validated Malay MMSE.

METHODOLOGY

This was a cross sectional study done to evaluate cognitive performance obstructive sleep apnea patients. The study population was moderate and severe obstructive sleep apnea patients between 18 and 60 years old who attended our sleep clinic. These patients were confirmed to have moderate and severe OSA by Type 1 polysomnography (attended full overnight study). A convenience sampling was performed from the list of patients under follow up that fulfilled the inclusion and exclusion criteria.

The inclusion criteria were apnea hypopnea index (AHI) $>$ 15, duration of sleep was 6 h or more and age eighteen to sixty years old. Exclusion criteria were patient without a successful polysomnography (duration of sleep was less than 6 h or dislodged leads), patient with central or mixed sleep apnea, patient who had underwent surgery for OSA or on CPAP treatment for more than one year, patient with particular medication that could interfere with sleep and cognitive efficiency (hypnotic drugs, antidepressants, benzodiazepines) and any patient with history of psychiatric illness, history of head injury with cerebral insult, alcohol or drug abuse and learning disabilities.

The study protocol was reviewed and approved by Research Ethics committee (Human), Universiti Sains Malaysia (USMKK/PPP/JEPeM[239.4(2.6)]) and was performed in adherence with the Declaration of Helsinki. Participants were identified and selected from the list of patients in our clinic who had undergone successful Type 1 polysomnography. Consent to participate in this study was taken after the patient has been thoroughly explained and understood the purpose, importance and benefits of the study. Consented patients would then complete the study by undergoing the validated Malay version Mini Mental State Examination.[14] Patients involved in this study gave voluntary participation and consent and they were allowed to refuse or withdraw from the study at any time, without jeopardizing the medical benefits to which the patients were otherwise entitled.

The age, gender and ethnicity were noted and other relevant data such as weight, height, body mass index (BMI) and apnea and hypopnea index were recorded accordingly. The cognitive performance was evaluated using validated Malay version of MMSE which measured 5 areas of cognitive function which is orientation, registration, attention and calculation, word recall and language abilities, and visuospatial. In orientation test, it was divided into time and place orientation test. In time orientation test, patient was asked the date of today (year, month, date, day and time). One point was given for each correct answer with the total score of 5. For place orientation test, patient was asked where he or she was now (country, state, town, hospital and floor). One point was given for each correct answer with maximum score of 5. In registration test, patient was given name of 3 objects, and was asked to repeat again the object's name. Six times trial were given if they could not remember it. One point was given for each item which was correct for the first trial with total score of 3. In attention and calculation test, patient was asked to keep subtracting 7 from 100 and stopped after 5 answers (93, 86, 79, 72 and 65) or alternatively patient had to spell the word "DUNIA" backwards (A, I,N, U and D). One point was given for each correct answer with the total score of 5. In recall test, patient was asked to recall the three objects that he said earlier in registration test. One score was given for each correct answer. This test was skipped if patients did not