Online Data Supplement

Title: Detection of mild cognitive impairment in middle-aged and older adults with obstructive sleep apnea.

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DETAILED METHODS

Participants

The following recruitment methods were used: reference from the Department of Pulmonology of the Hôpital du Sacré-Coeur de Montréal (n=35), newspaper ads asking volunteers for a study on sleep and cognitive health (n=63) and reference from other laboratories based on suspected obstructive sleep apnea (OSA) (n=33). We included participants aged between 55 and 85 years, with at least 7 years of education, without neuropsychological evaluation in the last year, and with French or English as their mother tongue. We excluded participants with a diagnosis of dementia based on the neuropsychological assessment (see Table E1), sleep disorders other than OSA (e.g. insomnia, restless leg syndrome, narcolepsy, rapid eye movement sleep behavior disorder), morbid obesity (body mass index >40 kg/m^2), and neurological (e.g. Parkinson's disease, previous stroke, brain tumors, epilepsy) or psychiatric disorders (e.g. diagnosed major depression and anxiety disorder). The use of medication (e.g., hypnotics, antidepressants, anticonvulsants, opioids) and/or drugs known to affect cognition, sleep, or cerebral functioning also led to exclusion.

Questionnaires

Because they may be associated with increased risk of MCI [1-9], we documented conditions such as depression and anxiety symptoms, poor sleep quality and cardiovascular diseases using the following instruments: the Beck Depression Inventory-II [10], the Beck Anxiety Index [11], the Pittsburgh Sleep Quality Index [12], and the Epworth Sleepiness Scale [13, 14], the Activities of Daily Living Inventory filled by patients themselves and/or relatives [15], and the Vascular Burden Index [16].

Sleep data acquisition and analysis

All participants had a full-night in-laboratory polysomnographic recording. This protocol was extensively described in previous studies [17-19]. Briefly, we used 18 electroencephalographic channel montage combined with electrooculograms, electromoyograms and electrocardiogram. We monitored respiration with thoraco-abdominal strain gauges, an oronasal thermistor and a canula, in addition to a transcutaneous finger pulse oximeter to measure oxygen saturation. Sleep and respiratory events were scored according to the standard method [20, 21]. Apneas and hypopneas were summed and divided by the total hours of sleep to create the apnea-hypopnea index.

Neuropsychological procedure

We first administered the Montreal Cognitive Assessment (MoCA), followed by the Mini-Mental State Examination (MMSE) and all other neuropsychological tests. Questions related to orientation, such as date, month, year, day of the week, place, and city, were asked only during the MoCA. We then added the orientation score to the MMSE. According to the MoCA standard procedure, an extra point was given to participants with 12 years of education or less. Neuropsychological tests and measures were selected to assess five cognitive domains: 1) attention and speed processing; 2) executive functions; 3) visual and verbal episodic learning and memory; 4) visuospatial abilities; 5) language. All neuropsychological tests, normative data and selected measures, as well as criteria to define mild cognitive impairment (MCI) are presented in Table E1.

TABLES

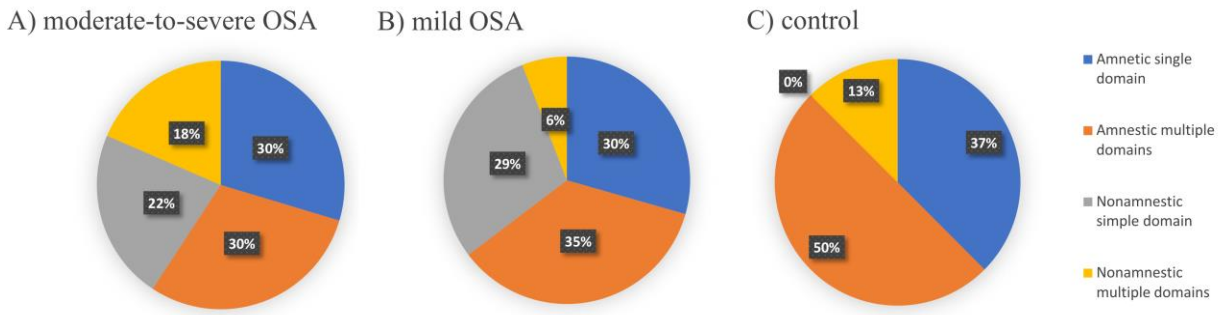
Table E1. Neuropsychological tests and variables used to identify MCI.

Tests	Variables	Criteria for domain impairment
Attention and speed processing		
CPT-II [22]	Omission % (T score) [22]	
	Variability of standard error (T score) [22]	
CWIT [23]	Part 1 (time) [23]	2/5 results ≥1.5 SD
Coding [24]	Scale score [24]	
TMT [25]	Part A (time) [26]	
Executive functions		
Digit Span [24]	Backward (scale score) [24]	
TMT [25]	Part B - Part A (time) [26]	
CPT-II [22]	Commission % (T score) [22]	
CWIT [23]	Part 3 – Part 1 (scale score time) [23]	2/7 results ≥1.5 SD
	Part 4- Part 3 (scale score time) [23]	
TOL [27]	Total move [27]	
	Total time [27]	
Verbal and visual episodic learning and memory		
RAVLT [28]	Sum of trials 1 to 5 [29]	
	List B [29]	2/7 results ≥1.5 SD
	Delayed recall [29]	
	Delayed recognition [29]	

BVMT-R [30]	Total recall (trials 1 to 3) [30]	
	Delayed recall [30]	
	Discrimination index [30]	
Visuospatial abilities		
ROCF [31]	Copy score [32, 33]	
BLOJ [34]	Number of correct answers [34]	2/4 results ≥1.5 SD
Bells test [35]	Number of omission [35]	
Blocs [24]	Scale score [24]	
Language		
BNT [36]	Number of correct answers [36]	
Vocabulary [24]	Scale score [24]	2/4 results ≥1.5 SD
Verbal fluency [23]	Phonemic (number of words) [23]	
	Semantic (number of words) [37]	

BLOJ, Benton Line Orientation Judgment; BNT, Boston Naming Test; BVMT-R, Brief Visuospatial Memory Test-revised; CPT-II, Continuous Performance Test – II, CWIT, Color-Word Interference test; MCI, mild cognitive impairment; RAVLT, Rey Auditory Verbal Learning Test; ROCF, Rey-Osterrieth Complex Figure; SD, standard deviation; TMT, Trail Making Test; TOL, Tower of London.

Figure E1. Proportions of MCI subtypes in (A) moderate-to-severe OSA, (B) mild OSA, and (C) control participants.



We observed a similar proportion of amnestic single domain between (C) the control (37%), (B) mild OSA (30%) and (A) moderate-to-severe OSA (30%) groups. The proportion of nonamnestic simple domain was similar in the mild OSA (29%) and the moderate-to-severe OSA (22%) groups, but there was no nonamnestic simple domain in the control group (0%). A higher proportion of amnestic multiple domains was observed for the control group (50%) compared to the mild OSA (35%) and the moderate-to-severe OSA (30%) groups. Inversely, we observed a lower proportion of nonamnestic multiple domains for the control and mild OSA participants compared to the moderate-to-severe OSA group. However, we found no significant group differences according to the type (amnestic versus non-amnestic) or number (single versus multiple) of cognitive domains impaired.

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