Original Article

Mild Cognitive Impairment among Elderly Persons Residing in an Urban Resettlement Colony in Delhi

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Abstract

Background: Mild cognitive impairment (MCI) is a transitional state between normal cognition and clinical dementia. MCI is associated with an increased risk of dementia and mortality. Progression of MCI to dementia can be prevented by cognitive and lifestyle interventions. There is limited evidence on the burden and risk factors associated with MCI in India. To estimate the prevalence of MCI among elderly persons, and to study the factors associated with MCI. **Materials and Methods:** This community-based cross-sectional study was carried out among 365 persons aged 60 years or older, residing in an urban resettlement colony of Delhi. Participants with dementia (score <23 on the Hindi version of the Mini-Mental State Examination) were excluded. Objective cognitive impairment and functional disability were assessed by the Montreal Cognitive Impairment-Basic (MoCA-B) tool and Barthel's Activities of Daily Living, respectively. The prevalence of MCI was estimated by Petersen's criteria, i.e., subjective memory impairment, objective cognitive impairment (MoCA score 19–25), functional independence, and absence of dementia. Univariate analysis was performed, followed by stepwise multivariate logistic regression. The association of socio-demographic and other health conditions with MCI was assessed. **Results:** The prevalence of MCI was 9.3% [95% confidence interval (CI) 6.7–12.7], 13.3% (95% CI 8.8–19.7) among men, and 6.5% (95% CI 3.9–10.6) among women. The risk of MCI was higher among current smokers. **Conclusions:** MCI was common among the elderly. Early detection of MCI may be included in health programs for elderly persons.

Keywords: Activities of Daily Living (ADL), dementia, elderly, mild cognitive impairment (MCI), Montreal Cognitive Impairment-Basic (MoCA-B), urban

Introduction

Mild cognitive impairment (MCI) is a transitional state between normal cognition and clinical dementia.[1] MCI causes impairment in the domains of language, visuo-perception, conceptual thinking, memory, and attention. However, it does not interfere with the functional abilities of a person's daily living. According to Petersen's criteria, a person has MCI if there is subjective memory impairment, along with objective cognitive impairment, preserved independence in functional abilities, and no clinical dementia.[2]

Individuals with MCI are at an increased risk for progression to dementia[3] and mortality.[4] There is sufficient evidence of improvement in MCI through nonpharmacological modalities, such as cognitive interventions, social participation, and physical activities.[5,6] Hence, it is imperative to detect and treat MCI before its deterioration into dementia.

In India, the proportion as well as the absolute number of elderly persons is increasing due to an increase in life expectancy. However, the evidence on the burden and risk factors associated with MCI in India is limited. Therefore, we aimed to estimate the prevalence of MCI among the elderly in an urban resettlement colony in Delhi and to study the factors associated with MCI.

Materials and Methods

Study design

This community-based cross-sectional study was carried out among persons aged 60 years or older, residing in

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an urban resettlement colony in Delhi for more than six months. The health workers carried out an annual census in the study area. Apart from socio-demographic information, vital events were also recorded. This information was stored in a computerized Health Management Information System (HMIS). The total population living in the study area was approximately 36,000, which included nearly 2,900 persons aged 60 years or older.

We used the formula $z^2p\ (1-p)/d^2$ for prevalence study to estimate the sample size. In the formula, z denotes the standard normal variate, and p denotes the prevalence of MCI. We considered p as 26%, as reported by Mohan *et al*.[7] in urban Kerala. Assuming an absolute precision of 4%, and type 1 error of 5%, the required sample size was 462. Allowing for a nonresponse rate of 10%, and death and migration of 10%, the revised sample size was 578 which was rounded off to 580.

The HMIS was used to generate a list of eligible persons more than 60 years of age. We identified study participants by simple random sampling from the list of eligible persons.

Data collection

A single trained investigator collected data during November and December 2020, through home visits. Participants with severe visual impairment (unable to see hand movement with either eye) or hearing impairment (as assessed by whisper test) were excluded from the study. The selected participant was explained about the purpose of the visit. Participant information sheet, in local language, was provided following which a written informed consent was sought. Through a pre-tested semi-structured interview schedule, we collected information on socio-demographic details, self-reported health conditions, medication use, and engagement in physical and leisure activities. The Hindi version of the Mini-Mental State Examination (MMSE)[8] was administered. Participants with scores <23 were classified as having dementia and were excluded from any further investigation. History of subjective memory complaint was enquired, both from the participant as well as from their close family members. The Hindi version of the Montreal Cognitive Assessment-Basic (MoCA-B) was used for the assessment of objective cognitive impairment.[9] The Barthel's Index for Activities of Daily Living (ADL)[10] was used to assess the functional independence of the participants. Body weight was measured with participants dressed in light clothes using a digital weighing scale, and recorded to the nearest 100 g. An inelastic tape was used to measure the arm span. The reading was recorded to the nearest centimeter.

Study tools

Hindi version of HMSE

HMSE is a 22-item scale that provides a brief assessment of the participant's current level of cognitive functioning. It is suitable for use among illiterate persons and is validated for the Hindi-speaking population.[8] A score of <23 out of 30 indicated dementia.

Montreal Cognitive Assessment-Basic (MoCA-B)

MoCA tool was developed as a screening tool for MCI with high sensitivity (90%) and specificity (87%),[9] and has Cronbach's alpha score of 0.64.[10]

It is available in more than 200 languages, including Hindi. MoCA-B was developed for detection of MCI in illiterate persons, and persons with low literacy.[11] The MoCA-B evaluates similar cognitive domains as the original MoCA, i.e., executive functions, immediate recall, fluency, orientation, calculation, abstraction, delayed recall, visuo-perception, naming, and attention. The range of possible score is from zero to 30. To correct any residual education bias, one point is added to the total score for those persons who are illiterate, and those with less than four years of education. A score between 19 and 25 is indicative of MCI. A score of <19 suggests major cognitive impairment, while score >25 indicates normal cognition.

Barthel Index for ADL

Barthel Index for ADL is an ordinal scale to assess performance in activities of daily living. It's a 20-point scoring system and a score <20 indicates decreased activity.[12]

Training of investigator

The investigator was trained for seven days (21 h) by a neurologist for the administration of HMSE and MoCA. An ophthalmologist trained the investigator for 9 h spread over three days. Training for assessment of hearing impairment was provided by an expert in otorhinolaryngology for one day (1 h), and by a psychiatrist for assessment of depression using PHQ 9 for one day (3 h).

Online certificate training from the MoCA website

The investigator also completed a 1 h online training to administer and score the Montreal Cognitive Assessment, MoCA.

Operational definitions

Elderly persons: Persons aged 60 years or older.[13]

Mild cognitive impairment: As defined by Petersen's criteria, a participant was considered to have MCI if all the following four criteria were met.[2]

a. Self/informant reported memory complaint
b. Objective cognitive impairment
c. Preserved independence in functional abilities
d. Absence of dementia

Body mass index (BMI) is body mass (weight in kg) divided by the square of arm span (length in meters) expressed in kg/m^2. Studies have shown that arm span is a better measure than height in elderly.[14] BMI was categorized into the following categories:[15]

1. Underweight (<18.5 kg/m^2)
2. Normal (18.5–22.9 kg/m^2)
3. Overweight/obese (>22.9 kg/m^2).

Current smoker: A person who smoked a tobacco product at the time of study or had smoked tobacco products within

the past 1 year.[16] ***Past smoker:*** A person who used to smoke tobacco products in his/her lifetime, but had not smoked in the past 1 year. ***Never smoker:*** A person who had never smoked tobacco products in his lifetime.

Economically dependent: A person who self-reported to be financially dependent on his/her care provider(s). ***Economically partially dependent:*** If one had some personal income or any monetary benefit from social welfare scheme but it was perceived insufficient to maintain oneself. ***Economically independent:*** A person who did not feel dependent on others financially, as his/her personal income or monetary benefits from social welfare schemes was perceived to be sufficient to maintain himself/herself.

Working: A person who was currently engaged in productive activity, including a homemaker. ***Not working:*** A person who was not engaged in any occupation or household work at the time of the study. ***Physical activity:*** Participants engaged in physical activity included homemakers, persons engaged in occupational activities, persons going for walks or open gymnasium, etc., ***Illiterate:*** A person with an inability to read or write fluently in any language. ***Vegetarian:*** A person who does not consume eggs, meat, or fish. ***At least once a week nonvegetarian:*** A person who consumes eggs, meat, or fish at least once a week. ***Occasional nonvegetarian:*** A person who consumes fish, eggs, or meat occasionally, i.e., less than once a week.

Ethical issues

The study was conducted after obtaining approval of the study institute vide letter No. IECPG-661/19.12.2019. The participants provided a written informed consent. Participants identified with dementia or MCI were referred to the neurology department of the study institute for further management.

Analysis

Data were entered in Microsoft Excel version 2010. Analysis was done using STATA version 12 (College Station, Texas, USA). Univariate analysis was followed by multivariate logistic regression analysis. Variables with a *P*-value <0.2 in univariate analysis were considered for multivariate analysis. The *P*-value <0.05 was considered statistically significant.

Table 1: Prevalence of MCI among study participants according to Petersen's criteria

Criteria	Men (*n*=150) *n* (%)	Women (*n*=215) *n* (%)	Total (*n*=365) *n* (%)
Subjective memory impairment	48 (32.0)	64 (29.8)	112 (30.6)
Objective cognitive impairment (MoCA 19–25)	81 (54.0)	52 (24.2)	133 (36.4)
Preserved independence in functional abilities	147 (98.0)	209 (97.2)	356 (97.5)
MCI *n* (%; 95% CI)	20 (13.3); (8.8–19.7)	14 (6.5); (3.9–10.6)	34 (9.3); (6.7–12.7)

Results

Out of 580 individuals selected randomly from the HMIS list of all individuals aged 60 years or older, 59 were dead, 29 had migrated, while six were excluded due to hearing impairment and five due to visual impairment. Out of the remaining 481 individuals potentially available for the study, 44 could not be contacted despite three house visits, while 37 did not consent to participate in the study. Thus, the response rate (400 off 481) was 83.2%.

Of the 400 participants, 35 participants scored <23 in HMSE. They were classified as having dementia and were excluded from the study. All further analyses, therefore, refer to the final set of 365 participants. Table 1 shows the prevalence of MCI according to Petersen's criteria among the study participants. About 30% of the participants (32.0% men and 29.8% women) had subjective memory impairment. A total of 133 (36%) participants had MoCA-B scores between 19 and 25 that indicated objective cognitive impairment. The mean (SD) MoCA-B score was 17.5 (4.6) [19.8 (4.5) for men, and 15.9 (4.0) for women]. The mean (SD) MoCA-B score was 20 (4.5) for the literate, and 15.9 (3.9) for the illiterate participants, respectively. As the level of education increased, there was an increase in the median MoCA-B scores, and it was statistically significant.

Almost all of the participants (97.5%) had normal ADL score. As per Petersen's criteria, i.e., all of the four features present in the same individual, the prevalence of MCI was 9.3% [95% confidence interval (CI) 6.7–12.7]. The prevalence of MCI was almost double in men (13.3%) compared to women (6.5%).

The socio-demographic profile of the participants with MCI is shown in Table 2. Out of 365 participants, 215 (58.9%) were women. Majority (66%) were in the age group of 60–69 years, while 6.9% were aged 80 years or older. The prevalence of MCI was more (9.5%) in the age group of 60–69 years. The mean (SD) age of the participants was 67 (6.0) years. Majority (66.4%) were currently married. The prevalence of MCI was higher among the currently married (11.5%), as compared to others (4.9%). Sixty percent of the participants were illiterate. Majority (64.7%) were financially dependent on the care providers, and 144 (39.4%) were currently working.

Table 3 shows the distribution of the lifestyle-related factors, and clinical characteristics among the participants with MCI. One-fifth (21.6%) of the participants had smoked tobacco in their lifetime, and nine percent were current smokers. The prevalence of MCI was higher among the current smokers (21.2%) as compared to never smokers (7.7%). Nearly 33% were vegetarian. A total of 159 (43.6%) participants did not report any chronic morbidity. The most common self-reported chronic morbidity was hypertension (39.2%), followed by diabetes (24.6%) and chronic respiratory

Table 2: Distribution of study participants with MCI by socio-demographic variables

Variable	Category	Number of participants	MCI present *n* (%)	Odds ratio (95%CI)	*P*
Age group (years)	60–69	241	23 (9.5)	Reference	
	70–79	99	9 (9.1)	0.94 (0.42–2.13)	0.89
	80 and above	25	2 (8.0)	0.82 (0.18–3.72)	0.63
Sex	Male	150	20 (13.3)	Reference	
	Female	215	14 (6.5)	0.45 (0.22–0.93)	0.03
Years of education	Less than 10	315	25 (7.9)	Reference	
	10 or more	50	9 (18.0)	2.5 (1.11–5.83)	0.03
Type of family	Extended	322	29 (9.0)	Reference	
	Nuclear	43	5 (11.6)	1.33 (0.49–3.64)	0.58
Economic independence	Independent	129	15 (11.6)	Reference	
	Partially independent	57	7 (12.3)	1.06 (0.41–2.77)	0.89
	Fully dependent	179	12 (6.7)	0.54 (0.14–0.25)	0.13
Marital status	Currently Married	243	28 (11.5)	Reference	
	Unmarried/divorced/widow/widower	122	6 (4.9)	0.42 (0.15–0.99)	0.04
Living arrangement	With family	332	30 (9.0)	Reference	
	Living alone/With spouse only/others	33	4 (12.1)	1.38 (0.46–4.22)	0.56
Occupation	Working	144	14 (7.0)	Ref	
	Not working	221	20 (9.0)	0.92 (0.45–1.89)	0.83

Table 3: Distribution of study participants with MCI by selected lifestyle factors and clinical conditions

Variable	Category	Number of participants	MCI present *n* (%)	Unadjusted odds ratio (95% CI)	*P*
#Chronic disease	Absent	159	12 (7.6)	Reference	
	Present	206	22 (10.7)	1.46 (0.70–3.10)	0.30
Smoking	Never smoker	286	22 (7.7)	Reference	
	Ex-smoker	46	5 (10.9)	1.46 (0.52–4.08)	0.467
	Current smoker	33	7 (21.2)	3.23 (1.26–8.28)	0.015
Psychiatric illness	Absent	355	33 (9.3)	Reference	
	Present	10	1 (10.0)	1.08 (0.13–8.83)	0.94
BMI category	Underweight	19	1 (5.3)	Reference	
	Normal	192	17 (8.9)	1.76 (0.20–14.0)	0.59
	Overweight/obese	154	16 (10.4)	2.07 (0.26–6.57)	0.49
Food habits	Vegetarian	122	13 (10.6)	Reference	
	At least once in a week nonvegetarian	169	14 (8.2)	0.76 (0.34–3.42)	0.49
	Occasional nonvegetarian	74	7 (9.5)	0.88 (0.33–2.31)	0.78
Physical activity	Absent	28	1 (3.6)	Reference	
	Present	337	33 (9.8)	2.93 (0.39–22.27)	0.30

Nearly 39% of the participants hypertension, 24.6% had diabetes, 6.6% had chronic respiratory disease, and 4.5% had cardiovascular disease

disease (6.6%). Two participants (0.5%) reported a history of head injury, and eight (2.2%) reported a history of fall in the last six months. Nearly 92% of participants were engaged in physical activity.

Nearly half of the participants (52.3%) had normal BMI, 42.5% were overweight/obese, and nearly 5% were underweight.

In univariate analysis, male sex, educated for ten years or more, being economically dependent, living alone, and being current smoker were associated with a higher risk of MCI. Other variables like current occupation, chronic diseases, history of psychiatric illness in the family, BMI, food habits, and physical and leisure activity did not have any statistical association with MCI.

In multivariate analysis, at a 0.10 level of significance, the odds of having MCI were higher among current smokers [OR (95% CI): 2.8 (0.9–8.9) *P*-value = 0.05] compared to their counterparts. Other variables were not associated with MCI [Table 4].

Discussion

Globally, the reported prevalence of MCI among elderly persons ranges from 1.7% to 42%.[17-19] This wide range of prevalence may be due to multiple reasons, including different levels of literacy among study participants, age distribution, culture, the prevalence of behavioral risk factors, and medical risk. Further, the tools used to measure MCI were different. Over the years, researchers had used various tools to diagnose

Table 4: Association of socio-demographic and other factors with MCI by multivariate analysis

Independent variable	Category	Number of participants	MCI present *n* (%)	Unadjusted odds ratio (95% CI)	*P*	Adjusted odds ratio (95% CI)	*P*
Sex	Male	150	20 (13.3)	Reference		Reference	
	Female	215	14 (6.5)	0.5 (0.22–0.93)	0.03	0.9 (0.35–2.52)	0.91
Years of education	Less than 10	315	25 (7.9)	Reference		Reference	
	10 or more	50	9 (18.0)	2.5 (1.11–5.83)	0.03	2.4 (0.93–6.28)	0.07
Economic independence	Independent	129	15 (11.6)	Reference		Reference	
	Partially independent	57	7 (12.3)	1.1 (0.41–2.77)	0.89	1.8 (0.66–5.35)	0.24
	Fully dependent	179	12 (6.7)	0.5 (0.14–0.25)	0.13	0.8 (0.34–2.02)	0.69
Marital status	Currently married	243	28 (11.5)	Reference		Reference	
	Unmarried/divorced/ widow/widower	122	6 (4.9)	0.4 (0.15–0.99)	0.05	0.44 (0.16–1.20)	0.11
Smoking status	Never smoker	286	22 (7.7)	Reference		Reference	
	Ex-smoker	46	5 (10.9)	1.5 (0.52–4.08)	0.467	1.1 (0.35–3.47)	0.86
	Current smoker	33	7 (21.2)	3.2 (1.26–8.28)	0.015	2.9 (0.99–9.04)	0.05

the objective memory impairment, viz., Addenbrooke's Cognitive Examination (ACE-III),[6] Kolkata test battery,[20] and Short Test of Mental Status.[21]

In our study, the prevalence of MCI was 9.3%. Other studies in India reported prevalence rates ranging from 1.2% to 26%.[6,21] This difference might be due to the use of different tools. Mohan *et al*. (2009), in their study, used ACE-III,[6] Das *et al*. (2007)[20] used Kolkata test battery,[21] while Raina *et al*. (2016)[22] used MMSE (Bharmouri) for assessing MCI. Therefore, a direct comparison of MCI prevalence rate reported across studies is not appropriate. This variation also highlights the importance of having a standardized tool for diagnosing MCI in Indian settings. Recently, the Indian Council of Medical Research (ICMR) conducted a study titled "Developing neuropsychological battery in different Indian languages for diagnosis of MCI." This battery has now been developed and validated in five Indian languages. This tool is considered to be valid for illiterate persons as well. According to ICMR, the tool would be free of cost, and it would help understand the burden of MCI in low- and middle-income countries besides India.[23] At the time of the development of protocol and conduct of our study, the ICMR battery had not become available. Hence, we used the tool (MoCA-B), which is considered suitable for persons with low literacy. The MoCA-B tool is validated in India, and available in the Hindi language, and the reported sensitivity (90%) and specificity (87%) are high for MCI.

The mean (SD) MoCA score in our study was 17.5 (4.6). In contrast, Tsoy *et al*.[24] in Kazakhstan reported a mean MoCA score of 21.6. The lower mean scores in our study may be due to a lower proportion of literate study participants (40%), as compared to 95% in the study by Tsoy *et al*. (2019).[24]

We found that only 16 (4.4%) participants had scored 26 or more in MoCA-B. A possible explanation for this could be the difficulty in comprehending and answering the questions in certain domains of the MoCA-B tool. Similar results were reported by Kumar and Neupane (2018) in Bangalore, who used the MoCA questionnaire.[25]

Some authors have used different cut-off scores, adjusted for education, for assessing MCI. Griffiths *et al*. (2020),[26] in rural Thailand, used MoCA-B (Thai version) with a cut-off score of 17, and reported a prevalence of 71.4%. Alkhunizan *et al.* (2018)[18] used adjusted cut-off points, i.e., <14 for illiterate individuals, <20 for individuals with 1–6 years of education, and <25 for individuals with seven or more years of education. It has been reported that education of less than 7 and 12 years negatively influences the MoCA-B and MoCA scores, respectively.[27] Thus, there is a lack of consensus on the appropriate cut-off MoCA score that would account for the literacy status of the participant. Hence, we may need to revise the MoCA-B cut-off score for the Indian population to account for different levels of literacy. If we were to use a different MoCA-B cut-off value to diagnose MCI, the observed prevalence rate would change.

Studies have consistently shown that smoking is associated with a higher risk of cognitive impairment.[28,29] In our study, the prevalence of MCI was more among current smokers (21.2%) compared to the nonsmokers (7.7%), and ex-smokers (10.9%). The odds ratio (OR) of MCI among current smokers was 2.9 (95% CI 0.9–9.04, $P = 0.05$). The lower bound of the CI was just below 1.0. Therefore, the statistically significant association of current smoking with MCI was missed. However, considering the value of OR, as well as the upper bound of CI, we are inclined to believe that the possibility of an association between smoking and MCI does exist, as reported in published literature.

It has been reported that adequate physical activity is protective for cognition.[29,30] However, we did not find any association of physical activity with MCI. We had recorded physical activity status as self-reported by the participants. Thus, the measurement of physical activity was subjective in nature. It is possible that participants provided a socially desirable response rather than the actual status.

The sample size in our study was adequate for estimating the prevalence of MCI. However, another study with a bigger

sample size would be able to provide a more conclusive evidence regarding factors associated with MCI.

Community-based nature of the study, simple random sampling technique, and high response rate were some of the strengths of the study. The study highlights the need for a standardized tool for detecting MCI in the Indian setting. The progressively aging population in India may result in an increasing number of people with cognitive impairment in the future. Hence, screening for MCI and regular follow-up may be considered for elderly persons.

Conclusions

MCI was common among the elderly persons. Screening for MCI may be included in health programs for the elderly.

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Conflicts of interest

There are no conflicts of interest.

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