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An intergenerational analysis of cognitive impairment in healthy elders

VIR Dharam[1], Dipti Gupta[2,*], Nilanshu[3], Parul Sood[1], Harmesh Kumar[4], N K Panda[1]

[1]*Dept. of Otolaryngology, Post Graduate Institute of Medical Education and Research, Chandigarh, India*
[2]*Dept. of ENT, Baba Farid University of Health Sciences, Faridkot, Punjab, India*
[3]*SLP & Audiologist, Gurgaon, Haryana, India*
[4]*Clinical Psychologist, Therapeutic Residential Services, Chandigarh, India*

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ABSTRACT

Cognitive disorders are common in elderly population and are becoming an increasingly important public health problem, partly because of the rapid aging of the population. This study was conducted to find out the differences between cognitive ability between normal adults and healthy elders of north region. The mild cognitive impairment (MCI) resulting in limitations and delayed treatment of dementia, should be considered an entry point for researching recent changes in the lives of healthy elderly. In this study we have applied MoCA test on the 36 normal healthy elders belonging to high socioeconomic status and normal young adults. Results have shown that there was no significant difference amongst the young normal adults; all the participants had normal MoCA scores. The MoCA scores were significantly impaired in all the healthy elders and there was a significant difference between the normal young adults and healthy elders. Age has a significant influence on MOCA score in older adults. Hence there is a need for age specific stratification in cut-off scores.

1. Introduction

The Montreal Cognitive Assessment (MoCA) is a test that was designed as a rapid screening instrument for mild cognitive dysfunction. MoCA is a tool which takes about 10 minutes to administer making it a practical tool to use in a clinical setting. It assesses different cognitive domains including attention and concentration, executive functioning, memory, language, visuoconstructional skills, conceptual thinking, calculations and orientation.[1] MoCA is freely available for noncommercial, clinical, and academic purposes. MoCA due to its increased sensitivity for detecting patients with cognitive impairment is widely used in clinics.[2,3] Many of the elements are familiar or similar to other tests of cognitive function. Visuospatial abilities are assessed using a clock-drawing task and a trail-making task which is said to be useful in assessing fitness to drive. Attention, concentration and working memory are evaluated using a sustained attention task (target detection using tapping), a serial subtraction task and digits forward and backward. The MoCA also measures a wider range of abilities including executive functions.[4] The high-level cognitive abilities are required for the implementation of goal directed behavior. These activities demand high executive functioning which depend largely on the integrity of frontal lobe and its associated structures. It is generally agreed that intact executive functioning is necessary for efficient execution of a plan. To complete the testing a subject needs to first perceive the stimulus, than do its processing and than respond to the stimulus. Both sensory perception and processing speed decline with age, thus impacting test performance in many cognitive domains.

* *Corresponding author*.
E-mail address: diptidg15@gmail.com (D. Gupta).

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The total possible score in MoCA is 30 points; a score of 26 or above is considered normal. According to the validation study (Nasreddine et al., 2005), the sensitivity and specificity of the MoCA for detecting Mild Cognitive Impairment (MCI) (n=94 subjects) were 90% and 87% respectively.[5]

Cognitive abilities peak in 30s, plateau through 50s, 60s and slow decline typical for late 70s.[2–4,6] Chief complaint of cognitive decline such as memory and computing problems in Middle-aged and elderly people increase with age. Activities of daily living are impacted in varying degrees, with dementia in most severe cases, which is hard to deal with and may brought heavy burden to society and people's living conditions. Therefore, more research should be concentrated on early warning signals of cognitive decline. The main aim of this study was to assess the cognitive ability among the normal adults and among healthy elders and to compare the MoCA scores between normal adults and healthy elders.

2. Materials and Methods

It was a retrospective study. The data collection done at unit of audiology and speech language pathology at a tertiary care center in North India during 2011 and 2012 was analyzed. Participants were recruited from a geriatric neurology outpatient clinic and from general community.

2.1. Participants

Two groups of participants were included in the study. Group I included 18 elderly people (aged 62 to 82 years, with average age 78 years) with 10 males and 8 females. The participants had varied level of education .33.3 % of individuals had 12 years of education, while 66.7% had more than graduation level of education. Group II included normal 18 healthy adults (10 males and 8 females) with aged 22to 28 years, with average age 25 years). They all are graduates or post graduates.

2.2. Inclusion criteria

A community sample of older and younger adults without any history of neurological impairment or mood disorder or any psychiatric issues. The group of healthy elders and adults should be from high socioeconomic status.

2.3. Exclusion criteria

The adults with any neurological disorder or head trauma or any debilitating disease illness or with any significant history which can cause cognitive impairment are excluded from the study.

2.4. Procedure

This study was conducted at tertiary care center in North India, where each elderly individual underwent approximately 30 min of cognitive screening. At the single study session, informed consent was obtained by one of the assessors. The participants provided information about their age, gender, and highest level of education. A geriatric psychologist determined the diagnosis of a mood or neurocognitive disorder if applicable based on DSM-5 criteria. For all of the study participants MoCA was administered first. This paper-and-pencil assessment requires approximately 10 min to administer, and is scored out of 30 points. The cognitive domains assessed include: visuospatial skills, executive functions, memory, attention, concentration, calculation, language, abstraction, memory, and orientation. The three versions of the MoCA and their instructions are available on the official MoCA website (htt p://www.mocatest.org/). For this study, both assessors used the standard English version 1 (original) MoCA test with its associated instructions, to ensure accurate administration.

2.5. Data analysis

Raw scores for MoCA for each participant were recorded for the MoCA. No additional point was given on the MoCA for participants with 12 years of education. Cognitive status was defined by the number of errors on the 30 points Montreal Cognitive Assessment (MoCA) test; a score of 26 or above is considered normal. The error count was chosen to parallel the deficit count score in the adults and elders.

3. Results

In this study the mean MOCA score was 15.6± 4.9 for group1 which is lower than the average MoCA score of healthy adults i.e. group 2 where it was 28.2±1.5. On average, the chance of making errors increased from minimum 33.3% to maximum 100% in several cognitive domains of elderly as compared to the number of errors in adults. Changes in cognitive status were observed with higher percentage of errors among the elderly age group in short term memory recall task especially. Delayed recall 88.8% in males (N=10) and 100% in females (N= 8), Attention, Forward order 33.33% in both (M=10) and (F=8), Backward order 44.4% (M=10) and 33.3% (F=8), list of letters 44.4% (M=10) and 55.5% (F=8) and subtraction 77.7% (M=10) and 66.6% (F=8), Abstraction 88.8% (M =10) and 77.7% (F=8), Visuo-constructional (line drawing 44.4% (M=10) and 66.6% (F=8), Copy 77.7 % (M=10) and 44.4% (F=8) and Clock (Contour 44.4% (M=10) and 33.3% (F=8), numbers 55.5% (M =10) and 33.3% (F=8) and hands 55.5% (M=10) and 33.3% (F=8). and language (repeat 77.7% (M=10) and 66.6% (F=8), Fluency, 55.5% (M=10) and 66.6% (F=8). The naming and orientation were least impaired and there was no impairment found in the adults of

Table 1: Comparison of visuospatial and attention variables among normal adults and healthy elderly.

Variable			Mean	SD	P	P>Z
				1178511		
		LD1	.5			
	Line drawing	LD2	.66666667	1111111		
		Diff	-.1666667	1619709		
			Under Ho:	1643355	-1.01	0.310
		Copy1	.3888889	1149044		
	Copy	Copy2	1	0		
		Diff	-.6111111	1149044		
			Under Ho:	1535474	-3.98	0.000
		Clock				
Visuospatial		Contour1	5555556	.1171214		
		Contour2	1	0		
		Diff	4444444	.1171214		
			Under Ho:	.1385799	-3.21	0.001
		Number1	5555556	.1171214		
	Clock	Number2	1	0		
		Diff	4444444	.1171214		
			Under Ho:	.1385799	-3.21	0.001
		Hands1	5555556	.1171214		
		Hands2	1	0		
		Diff	4444444	.1171214		
			Under Ho:	.1385799	-3.21	0.001
		FO1	6666667	.1111111		
	Forward order	FO2	1	0		
		Diff	3333333	.1111111		
			Under Ho:	.124226	-2.68	0.007
		BO1	61111111	.1149044		
Attention	Backward order	BO2	1	0		
		Diff	3888889	.1149044		
			Under Ho:	.1319241	-2.95	0.003
		ll1	5	.1178511		
	List of letters	ll2	7222222	.1055718		
		Diff	2222222	.1582223		
			Under Ho:	.1624993	-1.37	0.171

north India. On the average of all normal adults were found more than 26 MoCA scores. These results show significant changes between healthy elderly and normal adults. The proportional test and two sample wilcoxon rank-sum test is applied for statistical analysis to compare the various cognitive domains between the healthy elderly and normal adults. The analysis of proportional test and wilcoxon rank-sum test is shown in table 1, 2,3 & 4. As expected the scores of healthy elderly group is significantly lower than normal adult group ($p<0.05$). It is most significant in the areas, copy (P=-3.98,P>Z=0.00), clock [numbers (P=-3.21, P>Z=0.001, contour (P=-3.21P>Z=0.001, hands (P=-3.21, P>Z=0.001)] attention [forward order (P=-2.68, P>Z=0.007), Backward order (P=-2.95, P>Z=0.003)], language [repeat (P=0.139, P>Z=0.00) fluency (P=0.194,P>Z=0.0001)], abstraction (P=0.165,P>Z=0.002, memory P=0.065, P>Z=0.0000) and less significant in list of letters (P=-1.37, P>Z=0.171) and naming (P=0.444, P>Z=0.1515) and more significant in orientation (P=0.5000, P>Z=0.000).

4. Discussion

We found that the use of the MoCA – was a valid cognitive screening method for complex mental capacity assessment. These cognitive screening tests provide useful information about an individual's cognitive state. In this study we have administered the MoCA on the normal adults and healthy elderly. First, we tried to find out the cognitive deficits with age. Our data must be interpreted with caution. This is not a comprehensive measure of all aspects of brain function. Cognitive aging is obviously more complex than errors on the MoCA. Even though, the data suggests that in some fundamental ways, brain aging corresponds to a more general pattern of aging seen in our earlier studies.[4,6]

We observed the differences in the MoCA scores of healthy elders and normal adults.[7] We have seen that

Table 2: Comparison of naming, memory and subtraction variables among normal adults and healthy elders (Two sample wilcoxon rank-sum test)

Variable		N	Rank sum	Expected	Z	Prob>Z	P{naming group(1>2)}	Unadjusted Variance	Adjustment For ties	Adjusted variance
Naming	1 Group	18	315	333						
	2 Group	18	351	333						
	Combined	36	666	666	-1.434	0.1515	0.444	999.00	-841.50	157.50
Memory	1 Group	18	192	333						
	2 Group	18	474	333						
	Combined	36	666	666	-4.569	0.0000	0.065	999.00	-46.76	952.33
Subtraction	1 Group	18	226.5	333						
	2 Group	18	439.5	333						
	Combined	36	666	666	-3.733	0.0002	0.171	999.00	-184.89	814.11

Table 3: Comparison of language variables among normal adults and healthy elders

Variable		N	Rank sum	expected	Z	Prob>Z	P {langGroup (1>2)}	Unadjusted Variance	Adjustment For ties	Adjusted variance
Language	Repeat									
	1 Group	18	216	333						
	2 Group	18	450	333						
	Combined	36	666	666	-4.354	0.0000	0.139	999.00	-276.94	722.06
	Fluency									
	1 Group	18	234	333						
	2 Group	18	432	333						
	Combined	36	666	666	-3.924	0.0001	0.194	999.00	-362.57	636.43

Table 4: Comparison of abstraction & orientation variables among normal adults and healthy elders

Variables		N	Rank sum	expected	Z	Prob>Z	P{abstract group(1>2)}	Unadjusted Variance	Adjustment For ties	Adjusted variance
	1 Group	18	224.5	333						
	2 Group	18	441.5	333						
	Combined	36	666	666	-3.711	0.0002	0.165	999.00	-144.00	855.00
Orientation	1 Group	18	333	333						
	2 Group	18	333	333						
	Combined	36	666	666	0	0.0000	0.5000	999.00	-999.00	0.00

the MoCA scores of healthy elders were decreased in all the cognitive domains like attention and concentration, executive functioning, memory and orientation. In this way, the data potentially contributes to our understanding of the cognitive impairment with aging. Donald L Round suggested similar findings in his own study.[7–9] The high fit suggests that, at some level of deficit accumulation, the number of deficits is more important than exactly which ones are present. If so, this has implications for the way that we think about the impact of specific diseases in aging, in the face of many other decrements. As many studies have cited poor MoCA score for Dementia and Alzheimer's diseases which corresponds to definite cognitive impairment.[7,8] of note, the introduction of separable background and incremental parameters also allows us to explore whether all risk factors that are associated with late life decrements, such as cognitive impairment, are equally associated with variability in both background and increments. These investigations have the potential to inform the modeling of ageing, perhaps by distinguished more fixed factors from more mutable ones.

Secondly, as the MoCA scores shown in results were more than 26 which suggest there was no significant cognitive impairment among normal adults. The results of the present study support the results of earlier investigations.

Thirdly, there was significant cognitive impairment between healthy elders. The results of MoCA scores of healthy elderly group is significantly lower than normal adult group ($p<0.05$). This could be because of structural and functional changes in brain at the level of neurons, synapses and hippocampus size. With increase in age atrophy of hippocampus and other neuronal degeneration occurs which is often associated with other factors like diabetes mellitus, hypertension, obesity, hypoxic brain injury further declining cognitive abilities.[10–13]

5. Conclusion

In total 36 subjects' healthy elders (n=18) and normal adults (n=18) the number of errors in a cognitive test corresponded to age-related changes in deficits. First, we tried to find out the cognitive deficits with age. Secondly, there was no significant cognitive impairment among normal adults.[10,11]

Thirdly, there was significant cognitive impairment between healthy elders and normal adults ($p<0.05$). Present study suggests that there is a definite cognitive impairment among healthy elders of high socioeconomic status. Age has a significant influence on MoCA score in older adults. Hence there is a need for age specific stratification in cut-off scores. In our study more than 90% of the subjects scored less than the current accepted cut off score. These findings highlight the need for large scale population studies for defining the cut-off score for MOCA in our population. The poor MoCA scores are not always associated with Dementia and Alzheimer's diseases or any other geriatric syndromes which corresponds to definite cognitive impairment. This may be the reason of maladjustment of geriatric population in today's family system. We should always look for the cognitive aspects among healthy elders for adequate adjustment.[12,13]

Future Implications: The future implications of this study are to study the limitations of the Western instrument and non-familiarity of the items of the test in North Indian elderly even though they understand and speak the English language. There is a tremendous need to develop cultural and language specific tool to measure the real cognitive decline in the elderly population.

6. Source of Funding

None.

7. Conflict of Interest

None.

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Author biography

VIR Dharam, Assistant Professor

Dipti Gupta, Assistant Professor

Nilanshu, Private Consultant

Parul Sood, SLP

Harmesh Kumar, Psychologist

N K Panda, Professor and Head

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