Internal Medicine Section

Effect of Age and Hypertension on Cognition: A Cross-sectional Study

DEEPALAKSHMI KALIYAPERUMAL[1], VIJAYABAS KARAN SHANMUGA VARADHARAJAN[2],
VARSHA VISWANATHAN[3], MURALI ALAGESAN[4]

ABSTRACT

Introduction: Cognitive impairment has evolved as major health and social issue. As age advances cognitive tasks involving processing speed, working memory and executive function get affected. Cognitive impairment is also influenced by modifiable risk factors such as hypertension, diabetes mellitus and hypercholesterolemia.

Aim: To find out the effect of age and hypertension on cognition.

Materials and Methods: The total study participants were divided into three groups based on their age as group I (18-29) group II (30-59) and group III (above 60) with 20 participants (n= 20) in each group. Their cognition was assessed using Mini Mental State Examination, Picture word Learning test, Stroop colour word test, Letter digit coding test, Verbal fluency and Logic memory tests. Disease history and known co morbidities

(hypertension) were noted. Post-hoc test (Bonferroni) was employed to assess age-wise comparison of cognition and Pearson's chi-square test was used to compare cognition between hypertensive and normotensives.

Results: Group II had impaired cognition when compared with group I (p-value- 0.000). Group III had impaired cognition when compared with group I (p-value- 0.000) and group II (p-value 0.001). The hypertensives in group II and III had statistically significant impairment in cognition when compared with normotensives (p-value -0.001) in the same group.

Conclusion: Cognitive functions are impaired as a result of increase in age. Furthermore, there is also a significant decrease in cognitive functions amongst those suffering from hypertension. Hence, we conclude there is decrease in cognitive function as age advances and the co-existence of hypertension hastens this decline.

INTRODUCTION

The word cognition comes from the Latin verb *cognosco* meaning 'I know, perceive' or 'to recognise or conceptualise. Cognitive functions are those which include cerebral activities that lead to knowledge and encompass reasoning, memory, attention and language. Ageing can also have diverse effects on cognitive function. The spectrum of cognitive decline ranges from normal cognitive ageing (healthy" or "successful" Ageing), mild Cognitive impairment (does not prevent them from performing daily activities) and severe cognitive deficits (impede the ability to live independently [1]. Cognitive impairment has evolved as major health and social issue as the life span of both men and women has increased dramatically. Cognitive impairment accounts for about 40% of hospital admissions among the older individuals [2]. As age advances cognitive tasks involving rapid processing and transformation of information, which includes processing speed, working memory and executive function gets affected [3].

These age-related cognitive declining results from structural and functional changes that affect neuronal structure like loss of synapses and dysfunction of neuronal networks [4]. Cognitive impairment is also influenced by modifiable risk factors such as hypertension, diabetes mellitus and hypercholesterolemia [5]. Among these factors hypertension, which causes vascular changes resulting in cerebral infarction and diffuse ischaemic changes contribute to cognitive impairment [6].

Age related cognitive decline is already stated by several studies [7,8] earlier; but none of them used six tests which examine the different domains of cognition and there are only a few studies [9,10] that have included co-morbid condition such as hypertension to study the decline in cognition as age advances.

Hence, we aimed to conduct a study to find out the effect of age on cognition with the help of series of cognitive assessment tests.

In this study we also analysed the effect of more common and prevalent (33.8% in urban parts of India) [11] co-morbid condition, hypertension on cognition especially amongst the vulnerable elderly group of individuals.

MATERIALS AND METHODS

This cross-sectional study was conducted during the month of January 2014 for the period of two months among students, staff and patients of PSG Institute of Medical Sciences and Research, Coimbatore after obtaining the ethical clearance from institutional ethical committee (Ethics registration file No 13/328). A total of 60 participants after getting their written informed consent were included in the study. Participants were grouped based on their age Group-I (18-29), Group II (30-59), Group III (above 60). Participants younger than 18 years of age and those suffering from co-morbidities apart from hypertension such as diabetes mellitus; chronic respiratory diseases, chronic liver diseases, thyroid diseases, renal and neurological disorders were excluded from the study. Hypertensive participants (Systolic BP of more than 140mm Hg, Diastolic BP of more than 90 mm Hg) for more than two years duration and on anti hypertensive treatment were included the study.

Study participants were assessed for their cognitive performance by using a series of tests. An initial interview of subjects was conducted where they were asked about their education, occupation and age at retirement for group III. Disease history and known co-morbidities (hypertension) were noted.

Mini Mental State Examination [12]

It is an 11 question measure that tests five areas of cognitive function: orientation, registration, attention and calculation, recall and language. The maximum score is 30, a score of 23 or lower is indicative of cognitive impairment.

Picture Word Learning Test [13] Verbal Learning Test of Long-Term Memory

Fifteen pictures were successively presented at a rate of 1 per 2 seconds and the subjects were asked to recall as many pictures as possible. This was carried out three times. After 20 minutes delayed recall was performed. The main outcome variables are the accumulated number of recalled pictures over the three learning trials and the number of pictures recalled at delayed recall.

Stroop Colour Word Test [13]

This test involves reading colour names printed in incongruously coloured ink for example "green" printed in blue letters where the subject is to say "blue". The main outcome variable is the time needed for the test.

Letter Digit Coding Test [14]

This test is used as a measure of the speed of processing the general information. The subject is asked to fill in digits near letters, according to a key presented on the top of the test sheet (with 9 consonants in random order), and to work as fast as possible. The outcome variable in the total number of correct variable is 60 seconds.

Verbal Fluency [15]

The participant has to say as many words as possible from a category in a given time (usually 60 seconds). This category can be phonemic for example words starting with the letter "p". The outcome measure is the total number of words in 60 seconds.

Logic Memory I [16]

A story was read out to the participants and they were asked a few questions based on it. The outcome measure was the number of correct answers to the questions.

The test results were scored as good, moderate and severe and decline in cognition was noted. Data acquisition was done in an excel sheet and the scores were analysed among different age groups to study the effect of age and hypertension on cognitive function.

STATISTICAL ANALYSIS

Data was entered, analysed using SPSS software version 19. Descriptive statistics was employed for analysis. Data was expressed in percentages for categorical variables. Post-hoc Test – Bonferroni and Pearson's chi-square test was used to analyse categorical variables.

RESULTS

Study participants were divided into three groups based on their age as group I (18-29), group II (30-59) and group III (above 60) with 20 participants in each group and their mean age in each group was found to be 19.3,40.75,67.75 years, respectively. In group I there were 12 males and 8 females, group II comprised of 11 males and 9 females and group consisted of 15 males and 5 females. Group I had nil hypertensives whereas group II and group III had three and six hypertensives respectively.

On analysing the scores of the cognitive tests in the age group I (18-29), 15% of the individuals had cognitive impairment based on Picture Word Learning test, 5% based on Letter Digit Coding, 65% based on verbal fluency and 20% based on logic memory. In group II (30-59), we observed cognitive impairment in all the individuals based on verbal fluency, 70-75% based on picture word learning test and logic memory. Less (10-40%) individuals were found to have cognitive impairment based on Mini mental state examination, stroop colour word test and logic memory. In group III (above 60 years) cognitive impairment was found to be 100% based on verbal fluency, logic memory and picture word learning test, 45% impairment based on Mini mental state examination, stroop colour word test and 65% based on letter digit coding [Table/Fig-1]. Significantly low scores of cognition were observed in group II and group III when compared between the three groups [Table/Fig-2].

When the hypertensives and normotensives were compared, group II hypertensives showed a statistically significant impaired cognition based on stroop colour word, verbal fluency and logic memory test whereas group III did not show statistically significant difference in their cognition level [Table/Fig-3].

DISCUSSION

In the present study it was observed that certain cognitive domains are subjected to the decline as age advances. This may be due to physiological process such as inflammation, neurobiological changes, diet and life style [17]. In our study, we found that there is increase in cognitive impairment among older individuals when compared to middle-aged and younger individuals as there occurs changes in sensory perception inhibitory ability, processing speed, memory and reasoning which lead to cognitive decline.

Results from this study revealed ability of processing speed starts to decline from the third decade of life and the impact of the loss of speed processing affects other cognitive domains such as memory, spatial ability, reasoning, working memory, executive functions, orientation, recall ability, registration and calculation. Salthouse TA had also suggested that processing speed affects cognitive function [7].

Tests	Group I		Group II		Group III	
	Good cognition	Impaired cognition	Good cognition	Impaired cognition	Good cognition	Impaired cognition
Picture word learning test	85% (17)	15% (3)	30% (6)	70% (14)	10% (2)	100% (18)
Stroop colour word	100% (20)	-	70%(14)	30% (6)	55% (11)	45% (9)
Letter digit coding	95% (19)	5% (1)	60% (12)	40% (8)	35% (7)	65% (13)
Mini mental state examination	100% (20)	-	90% (18)	10%(2)	55% (11)	45% (9)
Verbal fluency	35% (7)	65% (13)	-	100% (20)	25% (5)	100% (15)
Logic memory	16% (16)	20% (4)	25% (5)	75% (15)	-	100% (20)

[Table/Fig-1]: Cognitive status among different age groups.

Comparison between Age Groups		p-value					
		PWL	SCW	LDC	MMSE	VF	LM
Group I	Group II	0.004*	0.256	0.057	1.000	0.000*	0.000*
Group I	Group III	0.000*	0.001*	0.000*	0.001*	0.000*	0.000*
Group II	Group III	0.001*	0.137	0.226	0.006*	1.000	0.021*

[Table/Fig-2]: Age-wise comparison of cognition – Post-hoc Test - (Bonferroni).
* Significant (p-value <.05) PWL – Picture Word Learning test SCW- Stroop Colour Word test LDC – Letter Digit Coding MMSE – Mini Mental State Examination VF – Verbal Fluency LM – Logic Memory

Tests	Age Groups		
	Group I	Group II	Group III
PWL	a	0.219	0.709
SCW	a	0.004*	0.850
LDC	a	0.448	0.584
MMSE	a	0.531	0.692
VF	a	0.001*	0.394
LM	a	0.038*	0.143

[Table/Fig-3]: Comparison of cognition between hypertensives and normotensives in different age groups (Pearson's Chi-square test).
aNo statistics were computed because HTN is a constant.
* Significant (p-value <.05)

Slowing of speed processing plays an integral role in age-related memory changes as well. In our study memory is found to be affected more in older and middle-aged individuals. Burke DM et al., had suggested that as age advances the word-finding difficulties may occur due to weaker memory system which is unable to link one unit to another [18]. Naveh-Benjamin M et al., had also proposed that associative memory deficit in older adults' is due to loss of episodic memory [19].

In our present study, changes were observed among group II and III in mini mental state examination, verbal fluency and stroop colour word tests which gives information on selective and divided attention of the individuals. Hasher L et al., had proposed that older adults' are unable to concentrate on irrelevant information while they are focusing attention on relevant information [20]. Attention impairment was found to be associated with increased incidence of automobile accidents among older individuals [21].

Genetic, medical, psychological, social and lifestyle factors which determines cognitive ageing that impaires people's independence and quality of life [22]. In our study there exists a significant increase in the cognitive impairment among hypertensives belonging to group II and III. It was well-supported by many longitudinal studies that elevated blood pressure is associated with cognitive decline [23].

In our study hypertensives belonging to the age group II showed a statistically significant impaired cognition based on stroop colour word test, verbal fluency and logic memory. Long standing hypertension in some patients may cause not only stroke but also chronic end organ damage of the brain in the form of demyelination of the white matter, with cognitive decline [24]. In the Framingham study, Elias MF et al., had opined that untreated BP level is inversely proportional to cognitive function [25]. Launer LJ et al., had reported in his study that midlife systolic blood pressure is a significant predictor of reduced cognitive function in later life. He also suggested that early control of systolic blood pressure levels may reduce the risk of cognitive impairment in old age [26].

Several follow-up studies conducted among hypertensives showed inverse relationship of systolic as well as diastolic blood pressure with their cognitive performance [25,27]. In a study conducted among hypertensives of various stages, Andre-Petersson L et al., observed stage 3 Hypertension was associated with lower performance on psychomotor, speed and visuo-spatial memory tests; stage 1 hypertension is associated with higher performance on tests measuring verbal and constructional ability [28].

LIMITATION

The small sample size is a limitation of this study. The factors like ethnicity, hyperinsulinaemia, homocystinaemia, duration of hypertension, level of blood pressure control and choice of antihypertensive treatment affect cognition. There are studies that

have mentioned the protective effect of antihypertensive drugs over cognitive decline on hypertensive patients as age advances. In this study these factors were not taken into account and add to the limitations.

CONCLUSION

Cognitive domains such as general intellect, reaction time, memory, vigilance and attention are impaired as a result of increase in age. Furthermore, there is also a significant decrease in cognitive functions amongst those suffering from hypertension. Hence, we conclude there is decrease in cognitive function as age advances and the co existence of hypertension hastens this decline.

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PARTICULARS OF CONTRIBUTORS:
1. Associate Professor, Physiology, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India.
2. Assistant Professor, Physiology, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India.
3. Intern, Internal Medicine, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India.
4. Professor, Internal Medicine, PSG Institute of Medical Sciences and Research, Coimbatore, Tamil Nadu, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Murali Alagesan,
Department of Medicine, PSG Institute of Medical Sciences and Research, Peelamedu, Coimbatore, Tamil Nadu, India.
E-mail: muralimd 2000@yahoo.com

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