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Physiology

ASSESSMENT OF COGNITION IN PREHYPERTENSIVE INDIVIDUALS

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ABSTRACT

Background: Diagnosis of hypertension at young age is an alarming sign of ill effects of the present sedentary lifestyle which includes a decline in cognitive functions. Recent studies are aiming at screening for the same at the prehypertensive stage.

Methodology: 100 prehypertensive individuals and 100 normotensives were subjected to cognitive test by the Montreal Cognitive Assessment scale. The cognitive scores were compared between the groups.

Results: 72 prehypertensives and 19 normotensives had cognitive decline as per the cut off score of 26. The mean MoCA score in cases group was 24.04 ± 2.603 as against 27.12 ± 1.924 in control group. This difference was statistically significant. Also there was a deficit in the domains of executive / visuospatial function, memory and attention domains.

Conclusion: There exists a cognitive impairment in prehypertensive individuals especially in the domains of attention and memory, thereby stressing on the importance of earlier detection and strict control of high normal blood pressure levels.

KEYWORDS : Cognition, Montreal Cognitive Assessment, Prehypertension, Hypertension.

INTRODUCTION

Hypertension is one of the most common non communicable disease which is now present even at an younger age owing to the sedentary life style and food habits. High blood pressure has its own course starting from vague symptoms of headache to fatal intra cerebral bleeds. Unless intervened at an earlier stage it can result in wide range of cardiovascular and cerebrovascular complications and lead to life disabling morbidities.

Cerebrovascular accidents lead on to progressive deterioration of brain's functions. One important among them is cognitive impairment, which further goes on to produce diseases like dementia and Alzheimer's disease. Several researches have established the fact that there is a decline in the cognitive functions in hypertensive individuals (Vinyoles, De La Figuera, & Gonzalez-Segura, 2008). Improvement in cognition is seen after bringing the blood pressure back to normal with drugs(Gao et al., 2013).

Prehypertension is defined as blood pressure of 120 to 129 / ≤80. Those who are in prehypertensive range of blood pressure have more chances of progression to hypertension when compared to normotensive people. A few studies have pointed out that prehypertension apart from being a risk factor for future cardiovascular events, can also lead to mild cognitive impairment (Vasan et al., 2001). Study by Karren et al., has shown an impairment in the processing speed, executive tests and verbal episodic memory during follow up after a decade. They had also postulated that this declination would have begun at the prehypertensive levels itself (Chen, Henderson, Stolwyk, Dennerstein, & Szoeke, 2015).

Cognition can be assessed by various standardised tools like Mini Mental Status Examination, Montreal Cognitive Assessment, Addenbrooke's Cognitive Examination. All these tests assess the performance in domains of attention, memory, visuo spatial ability, fluency, language.

Of these Montreal Cognitive Assessment is used widely to diagnose mild cognitive impairment. Montreal Cognition Assessment was found to be sensitive in early detection of mild cognitive impairments in a study conducted by Kaur et al(Kaur, Kumar, & Singh, 2013).

The Cooper Center longitudinal study also used the Montreal Cognitive Assessment for establishing relationship between asthma and cognitive dysfunction (Rogliani, Ora, Puxeddu, Matera, & Cazzola, 2017). Study by Min Li et al., has used MoCA for assessing mild cognitive impairment in hypertensive individuals in China (Jose, 2017). Study by Jose et al., utilised MoCA in prehypertensives in their study(Jose, 2017).

Recent studies are aiming at detecting the complications of hypertension at the prehypertensive levels. Very few studies have been done to assess cognition in prehypertensive stages. This study aims to assess the cognition levels in individuals who have their blood pressure in the prehypertensive range.

METHODOLOGY

After obtaining ethical clearance, the study was conducted in our hospital's Non Communicable Diseases department. Males of age 40 – 50 years were screened. Blood pressure was measured by LED sphygmomanometer. 3 readings were taken in sitting posture. The readings were taken at 5 minutes interval each. The lowest among them was taken as the blood pressure of the individual. Those with systolic Blood Pressure of 120 – 129 with a normal diastolic pressure were chosen. Detailed history and clinical examination was done to rule out the following.

- History of treatment for hypertension, diabetes, coronary artery disease, neurological and psychiatric illnesses, lung diseases.
- Drugs intake that can act on the central nervous system.

Only literates were chosen for the study. Acutely ill patients were excluded.

We recruited 100 prehypertensive individuals for the cases group and age matched 100 numbers of normal individuals for control group. The participants were administered the Montreal Cognitive Assessment questions. The importance of the test was explained to the participant and test administered only after the participant had consented. The test was conducted in a secluded room. The guidelines for administration were strictly followed.

RESULTS

We recruited males of 40 – 50 years in both the groups. The average age of participants in study group was 45.4 ± 2.88 and that of the control group was 44.59 ± 2.95. All the recruited candidates were of BMI less than 23.5 kg / m^2.

Fig 1 gives the distribution of the participants as per the education levels. They were grouped as below 5th standard, 6th – 8th standard, 9th – 12th standard. The numbers of participants under each category were approximately equal.

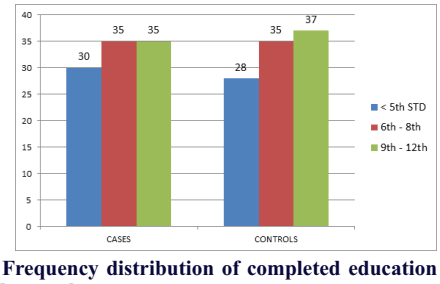

FIG 1: Frequency distribution of completed education levels of case and control group

Table 1 compares the overall cognitive score between the two groups. The difference in the score was statistically significant at p=0.001

Table 1: Comparison of cognitive scores between cases and control group

	CASES	CONTROL	'p' VALUE
MoCA SCORE	24.04 ± 2.603	27.12 ± 1.924	< 0.001

Table 2 compares the scores of the individual domains of the MoCA test between the cases and controls group. Though the scores in all domains were less in the prehypertensive group, scores in executive, attention and memory domains were alone significantly low.

Table 2: Comparison of scores of individual domains between the groups.

DOMAIN	CASES	CONTROLS	'p' VALUE
EXECUTIVE / VISUPSPATIAL (5)	3.63 ± 0.996	4.44 ± 0.637	0.000
ATTENTION (6)	4.31 ± 1.016	5.16 ± 0.821	0.000
MEMORY (5)	3.72 ± 0.884	4.6 ± 0.547	0.000
LANGUAGE (6)	5.05 ± 1.013	5.39 ± 0.614	0.004
ORIENTATION (6)	5.68 ± 0.466	5.76 ± 0.427	1.000
ABSTRACTION (2)	1.65 ± 0.476	1.77 ± 0.420	0.061

DISCUSSION

In our study we recruited only males of 40 – 50 years of age. Females were excluded so as to avoid the effect of menopause on cognition (McEwen, 2017). Literacy plays an important role in cognitive assessment. Hence we recruited subjects equally among all the education levels in both cases and controls group.

In our study we have found a significant decline in the cognitive score in the prehypertensive individuals when compared to the normotensives group. This goes in accordance with the study by Jennings et al. In that study they had followed participants in prehypertensive range over 2 years and evaluated with neuropsychological battery tests and performed cognitive tests in magnetic resonance imaging scanner. They had concluded that relation between prehypertensive levels of Systolic Blood Pressure (SBP) and cognitive and brain functions were modest but suggestive of a requirement of a midlife intervention(Jennings et al., 2017).

Study done by Piotrovskaya et al., has also given a similar conclusion. They had correlated metabolic syndrome and prehypertension with cognition and were of the view that prehypertension can lead to Mild Cognitive Impairment ——(Piotrovskaya & Neznanov, 2014). They assessed cognition using MMSE scale, Wechsler Memory scale and category fluency test.

A prospective study by Knecht et al had followed 377 individuals. Their conclusion was that SBP is inversely related to cognition even in the normotensives range. The study also suggested an earlier intervention to bring down high normal blood pressure to low normal values(Knecht et al., 2008).

Ditto et al., study done on teenagers were to suggest that those with parental history of hypertension and normatively elevated SBP performed lower on verbal learning factor score and spatial learning and memory factor score compared to boys with lower blood pressure (Ditto, Séguin, & Tremblay, 2006).

In the study by Jennings et al., the finding was that the domains of attention, working memory, executive functions and working memory were affected(Jennings et al., 2017). This is similar to our study where the same domains were significantly affected.

The mechanism for cognitive impairment in hypertensives is well established. Most commonly accepted mechanism is limitation of vascular reserve and vascular damage to neural structures. Long-standing hypertension causes lipohyalinosis of the media and thickening of the vessel walls with narrowing of the lumen of the small perforating arteries and arterioles which nourish the deep white matter (Skoog, 1998). The presence of white matter lesions are associated with impaired cognitive function(Frey et al., 2019).

In the study by Subathra et al., cognition in prehypertensives was assessed by P300 action potentials. In their studies, a prolongation in N100 and P200 was reported indicating a tendency towards memory loss although it was not prominent (Subathra, Pal, Dhanalakshmi, Nanda, & Swaminathan, 2016). But this study was done on a small sample size.

In prehypertensives, no single mechanism has been pin pointed to be behind the pathology. The above mentioned vascular mechanism may be a cause as per the study by Jennings et al (Jennings et al., 2017), although other mechanisms like blood-brain barrier disruption were yet to be studied. Changes in regional cerebral blood flow (rCBF) is seen in hypertensive people and it is also one of the mechanisms underlying cognitive dysfunction(Frey et al., 2019).

There are reports that impairment of endothelial progenitor cells affects endothelial repairing capacity in vivo in prehypertensive patients (Giannotti et al., 2010). Longstanding cases of prehypertension have derangement in autoregulation of BP that increases the possibilities of vascular stress, aneurysm formation and finally brain ischemia and infarction.

Another study had suggested dyslipidemia, insulin resistance and oxidative stress as mechanisms behind cognitive dysfunction although there are no studies correlating these parameters with cognitive dysfunction in prehypertensives (Duschek, Muckenthaler, Werner, & Reyes del Paso, 2009).

In a study by Pal et al., increased levels of Thiobarbituric acid reactive substances (TBARS) were seen in oxidative stress and it correlated with P300 in prehypertensives. Oxidative stress has been a cause of autonomic imbalance in prehypertensives (Pal et al., 2013). Hence it can be proposed that sympatho vagal imbalance might be a pathophysiological link between cognitive deficit and prehypertension (Subathra et al., 2016).

LIMITATIONS OF THE STUDY

We assessed cognition by MoCA which is basically a screening tool. Confirmatory tests like P300 could have given a better assessment. Exclusion of other causes of cognitive dysfunction was based on clinical history and examination alone. Undetected diabetes can still be present.

FUTURE SCOPE

Correlation with MRI studies and cerebral blood flow studies can aid in confirmation of cognitive decline.

CONCLUSION

With increasing prevalence of hypertension in modern day world and its numerous complications documented and addressed to, the research field has turned its attention to prevention of co-morbidities at the earliest. Cognitive functions are required for smooth functioning of day to day life. Some essential activities like driving, remembering everyday tasks become difficult as the former requires divided attention and latter requires working memory. If further studies can prove an association between cognitive deficit and prehypertension and prove that strict control of prehypertensive BP levels by lifestyle modifications can improve cognition, then screening programs for earlier detection of high BP levels will gain more importance. People can be educated and made aware of the importance of healthy lifestyle practices and routine monitoring of blood pressure.

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