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*RESEARCH ARTICLE*

# A CORRELATIVE STUDY BETWEEN VISUAL REACTION TIME AND DURATON OF HYPERTENSION

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## *Abstract*

**Background:** Essential hypertension or Primary hypertension is the most common type of hypertension, affecting 95% of hypertensive patients. Prevalence of essential hypertension increases with age, and individuals with relatively high blood pressure at younger age are at increased risk for the subsequent complications of hypertension. Hypertension can increase the risk of cerebral, cardiac, and renal events.

**Aims And Objectives:** The purpose of this study was (1) to record the neurophysiological parameter visual reaction time and in all the subjects(2) To correlate the above parameters in control group and 3 groups of hypertensive according to the duration.

**Materials and Methodology:** Cross-sectional study on 160 subjects aged between 30-60years was conducted. They were divided into four groups. Group 1- control group (Healthy subjects), Group 2-subjects with hypertension for the past 2 years, Group 3-subjects with hypertension for the past 5 years, Group 4-subjects with hypertension for the past 10 years. Visual reaction time (VRT) were measured by Reaction timer.

**Result:** The results were analyzed by using ANOVA test and were considered as statistically significant with 'p' value was less than 0.05 with respect to Visual reaction time (VRT )compared with the duration of hypertension

**Conclusion:** This study concludes that the Visual reaction time (VRT) increases as the duration of hypertension increases.



## Introduction:-

Complications of hypertension are clinical outcomes that result from persistent elevation of blood pressure[1]. Hypertension is a risk factor for all clinical manifestations of atherosclerosis since it is a risk factor for atherosclerosis itself. It is an independent predisposing factor for heart failure, coronary artery disease, stroke, renal disease, and peripheral arterial disease[2].Hypertension is also associated with impaired cognition in an aging population, Hypertension-related cognitive impairment and dementia may be a consequence of a single infarct due to occlusion of a "strategic" larger vessel or multiple lacunar infarcts due to occlusive small vessel disease resulting in subcortical white matter ischemia. Several clinical trials suggest that antihypertensive therapy has a beneficial effect on cognitive function, although this remains an active area of investigation[3]. Hypertension is one of the most

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common complex disorders.However; several risk factors have been identified. The etiology of hypertension differs widely amongst individuals. Hypertension may be secondary to other diseases but over 95% of patients have essential hypertension which is of unknown origin. It is observed though that having a personal family history of hypertension increases the likelihood that an individual develops hypertension[4].

Visual reaction time is the time between the presentation of visual stimuli and subsequent motor response to stimuli visual reaction time is considered as an ideal tool for measuring sensory motor association. Reaction time (RT), is the elapsed time between the presentation of a stimulus and the subsequent behavioral response to occur. It is considered to be an index of speed of processing. The behavioral response is typically a button press. It has physiological significance and is a simple and non-invasive test for peripheral as well as central neural structures.

Measure of visual reaction time has been used to evaluate the processing speed of central nervous system and coordination between sensory and motor system[5].Keeping this as a background the present study was undertaken to compare the neurophysiological parameters among the hypertensive patients with varied duration. The current study was designed to know the effects of hypertension on Visual Reaction time correlate with the duration of disease in the age group between 30-60 years and with control group.

## Materials and Methodology:-

A cross sectional study was conducted among 160 subjects aged between 30-60 years from Jan 2014 – Dec 2014. All the subjects were recruited from medical OPD of VMKVMC, Salem. The subjects were divided into 4 groups. Group 1- control group (Healthy subjects).Group 2-subjects with hypertension for the past 2 years.Group 3-subject with hypertension for the past 5 years.Group 4-subject with hypertension for the past 10 years.After detailed medical history of the subjects those with history of smoking, alcoholism diabetes milletus &complications, obesity, cardiovascular diseases, diminished vision and hearing, neurological disorders, cerebro vascular accidents were excluded from this study.Subject's clinical history and details were taken according to the standard Performa. Institutional ethical committee clearance was obtained. The subjects were recruited after a detailed history and thorough physical examination.Written informed consent was taken from all the subjects.Blood pressure was recorded for all the subjects .The parameters measured is as follows :Visual reaction time(VRT).**PC 1000 Hertz Reaction Timer**: Built in house and manufactured by vivek electronics to measure visual reaction time. PC 1000 is a 1000 hertz square wave oscillator which had a soft key for start and stop function. PC 1000 Reaction timer instrument has two components (A &B) connected to each other[6,7].• First component (A) had a start button and it was handled by the examiner only. Second component (B) had a stop button which will be handled by the subject alone and also it had a small red LED and head phone (1000 hertz's tone) which received the visual respectively. Red light was selected for the experiment as it persists for a long time in retina. Component A and component B was in turn connected to a personal computer which has audacity software installed in it. Audacity city software records the reaction time in 0.001sec accuracy in wave format. Best 3 measurements were taken as subject RT respectively[8].**Visual Reaction Time (VRT) Measurement** : Examiner presses the START button in first component(A) which was out of the view of the subject .Subject was instructed to press the STOP button in second component(B) as soon as he/she saw the red light in the instrument. Reaction time was recorded in audacity software.

## Results:-

All the 160 subjects underwent basic blood pressure measurement with the help of manual sphygmomanometer under normal resting conditions. The mean systolic and diastolic BP in group I was 117.5 and 75 respectively. In group II it was 131 and 87.25, in group III it was 132 and 88 and in group IV it was 135.25 and 90.25. So a steady increase was seen in both systolic and diastolic pressure from group I to group IV. It can also be inferred that there was not much difference between group II and group III in systolic and diastolic pressure. As seen from table the mean VRT had shown a steady increase from group I to group IV. whereas VRT is usually lower among normotensives and higher in the hypertensive.. The F value (ANOVA value) was calculated for group II by comparing it with group I and for group III by comparing it with group I and II and for group IV the F value was calculated by comparing it with group I, II and III. It is inferred from the table that there was a statistically significant decrease in CFF value in group II and group IV. Similarly there was a statistically significant increase in VRT levels in group II and group IV.

Similarly there was a statistically significant increase in VRT levels in group II and group IV. The VRT levels had not shown a statistically significant difference in group III when compared with group I and II. Whereas the VRT

levels showed a positive correlation with duration of hypertension where their level increases with the duration of hypertension

**Table 1:-**.Mean, Standard Deviation And Confidence Interval Of The Blood Pressure Among The Study Population

| **Study group** | **Mean** | | **Standard deviation** | | **Confidence interval** | |
|---|---|---|---|---|---|---|
| | **Systole** | **Diastole** | **Systole** | **Diastole** | **Systole** | **Diastole** |
| **Group I (Normal BP)** | 117.5 | 75 | 10.06 | 5.54 | 106.8 – 128.2 | 58 – 92 |
| **Group II (Hypertension for 2 yrs)** | 131 | 87.25 | 12.15 | 6.40 | 127.2 – 134.76 | 85.25 – 89.25 |
| **Group III (Hypertension for 5 yrs)** | 132 | 88 | 12.44 | 5.16 | 128.15 – 135.85 | 86.4 – 89.60 |
| **Group IV (Hypertension for 10 yrs)** | 135.25 | 90.25 | 15.18 | 5.76 | 130.55 – 139.95 | 88.47 – 92.03 |

Table 1 shows the mean, standard deviation and the confidence interval of blood pressure among the study population. The mean systolic and diastolic BP in group I was 117.5 and 75 respectively. In group II it was 131 and 87.25, in group III it was 132 and 88 and in group IV it was 135.25 and 90.25. So a steady increase was seen in both systolic and diastolic pressure from group I to group IV. It can also be inferred that there was not much difference between group II and group III in systolic and diastolic pressure.

**Table 2:-** Mean, SD and 95% Confidence interval of CFF, VRT and ART among the study population

| Parameters | Group I (Normal BP) N = 40 | Group II (Hypertension for 2 yrs) N = 40 | Group III (Hypertension for 5 yrs) N = 40 | Group IV (Hypertension for 10 yrs) N=40 |
|---|---|---|---|---|
| VRT - Mean ± SD (95%CI) | 245.12 ± 38.42 ( 233.2 - 257.02) | 252.87 ± 13.21 (248.78 - 256.96) | 258.42 ± 11.87 (254.74- 262.1) | 265.67 ± 6.36 ( 263.67 – 267.67) |

Table 2 shows the mean, standard deviation and confidence interval of Visual reaction time (VRT). The mean VRT had shown a steady increase from group I to group IV. whereas VRT is usually lower among normotensives and higher in the hypertensive.

**Table 3:-** ANOVA analysis for CFF, VRT and ART among the study groups.

| Parameter | | F value (ANOVAvalue) | P value |
|---|---|---|---|
| VRT | Group II (Hypertension for 2 yrs) | 2.187 | 0.028 |
| | Group III (Hypertension for 5 yrs) | 1.846 | 0.154 |
| | Group IV (Hypertension for 10 yrs) | 2.765 | 0.015 |

Table 3 shows the ANOVA analysis for VRT among the study subjects considering group I as the control group. The F value (ANOVA value) was calculated for group II by comparing it with group I and for group III by comparing it with group I and II and for group IV the F value was calculated by comparing it with group I, II and III.

**Table 4:-** Pearson Correlation between the Duration of hypertension and VRT.

| **Parameters** | **r value** |
|---|---|
| **CFF** | -0.719 |
| **VRT** | 0.327 |
| **ART** | 0.494 |

Table 4 shows the pearson correlation between the duration of hypertension and VRT among the study subjects. It is inferred from the table that the VRT levels showed a positive correlation with duration of hypertension where their level increases with the duration of hypertension.

## Discussions:-

This study was designed to assess the overall relation between blood pressure (SBP) and Visual reaction time (VRT). Total peripheral resistance is determined largely at the arterioles and so, it is likely that even modest changes in arteriolar function are associated with measurable alterations of visual function.[10,1] Hypertensive neuropathy (DN) is one of the complications accounting for 28% of all the complications in hypertension. It is a disorder of the nerve caused by hypertension which may be diffused, affecting several parts of the body, or focal, affecting a specific nerve and part of the body. Symptoms usually develop gradually over years and are non-specific.There is a need for tests to identify HT before the development of serious complications like cognitive disabilities and CAD. Similarly in chronic hyperglycemia in diabetic patients affects peripheral nerves in the somatosensory and auditory system. It also slows psychomotor responses and has cognitive effects on those individuals without proper metabolic control, all of which may affect reaction time. In view of this, present study has been undertaken to assess and compare the auditory and visual reaction time in diabetics and normal healthy controls and also to correlate the reaction time in hypertensive and diabetics with respect to the duration of diabetes[12].The first finding of our study was that the visual reaction time (VRT) was found to be longer in the healthy participants as well as the hypertensive patients[13]. This may be due to the fact that the visual reaction time (VRT) involves chemical changes in its occurrence and the visual pathway has many collateral pathways to various association areas and hence a greater delay in comprehension of visual stimulus. Reaction time is dependent on several factors like arrival of stimulus at the sensory organ, conversion of the stimulus by the sensory organ to a neural signal, neural transmissions and processing, muscular activation, soft tissue compliance, and the external measurement parameter. The auditory stimulus takes only 8-10 milliseconds to reach the brain, but on the other hand a visual stimulus takes 20-40 milliseconds.This implies that the faster the stimulus reaches the motor cortex, faster will be the reaction time to the stimulus. Therefore since auditory stimulus reaches the cortex faster than the visual stimulus the auditory reaction time is faster than the visual reaction time[14,15].

This finding of our study was in accordance with similar studies done in the past. Mohan et al, studied visual and auditory reaction times in patients of hypertensive and aged matched normal controls and found visual reaction time was longer in controls as well as diabetics. The second finding was that there is a significant prolongation VRT in hypertensive as compared to normal healthy controls. The possible mechanism being that, the raised blood pressure causes inflammatory changes in nerves and damages blood vessels that carry oxygen and nutrients to the nerves. The perfusion deficit is sufficient to cause endoneural hypoxia. These early events occur well before the development of clear pathological alterations to nerve capillaries such as basement membrane thickening, and are accompanied by functional deficits such as reduced Nerve Conduction Velocity, hence increased reaction time.PrabhojotKaur, MamanPaul,Jaspal Singh Sandhu found that both the VRT and ART was more in type 1 diabetics along with hypertension[16] . The third finding was that the ART and VRT in group-1 diabetics and hypertension (duration of 1-5 years) is faster than in group-2 diabetics and hypertension (duration of 5-10 years). As a consequence of longstanding hyperglycemia and hypertension, a downstream metabolic cascade leads to peripheral nerve injury through an increased flux of the polyol pathway, enhanced advanced glycation end-products formation, excessive release of cytokines, activation of protein kinase C and exaggerated oxidative stress. Sparse vascular supply with impaired auto regulation is likely to cause hypoxic damage in the nerve. Such dual influences exerted by long-term hyper glycaemia and hypertension are critical for peripheral nerve damage, resulting in distal-predominant nerve fibre degeneration. The axonal degeneration of both the myelinated and unmyelinated fibres, axonal shrinkage, thickening of the basement membrane and micro thrombi are responsible for delayed motor nerve conduction and hence, the increased reaction time.In the present study auditory reaction time is shorter than visual reaction time. The reason being for auditory reaction time, sound entering the ear can reach appropriate receptors with particular no loss of time for visual reaction time. For visual reaction time the rods and cones are not excited by light directly and the intervening photochemical process takes appreciable time[17]. It is shown that when sound is applied to the ear of cat, activity begins in the auditory nerve with latency of 1-2 ms whereas when a light thrown into the eye, activity reaches visual cortex in 20-40ms,but when retina is by passed by direct electrical stimulation for the optic nerve, the cortical latency is as little as 2-5ms. Compared with the ear the eye takes long time to get its message started along the nerve to brain[18.] Thus, one can account for most and perhaps all of the differences between visual and auditory reaction time.

## Conclusion:-

From this study we concluded that the Visual reaction time (VRT) increases as the duration of hypertension increases. So a positive correlation between Visua reaction time (VRT) and duration of hypertension.

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