

## Impact of Prehypertension on Carotid Artery Intima Media Thickness

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**ABSTRACT:** *Background:* Recent evidence supports that the prehypertension is associated with target organ damage, though there is lack of information regarding common carotid artery intima media thickness (CIMT) in prehypertensive individuals. We aimed to study the role of prehypertension in target organ damage in the form of CIMT.

*Methods:* Carotid CIMT was measured by B-mode ultrasonography by an experienced hand blinded to all clinical data in fifty prehypertensive subjects and compared with fifty normotensive persons and another fifty hypertensive patients.

*Result:* In this age and sex matched study the mean CIMT of prehypertensive subjects were significantly higher compared to normotensive persons ( $0.694 \pm 0.048$  mm vs.  $0.607 \pm 0.004$  mm,  $p$  value  $<0.001$ ). It was highest among hypertensives ( $0.736 \pm 0.540$ mm) and lowest in normotensive ( $0.607 \pm 0.004$  mm) persons.

*Conclusion:* it is clearly seen that there is increased target organ damage in the form of increased CIMT in prehypertensive group and hypertensive group compare to normotensive group justifying separate entity of prehypertension and early treatment of prehypertensive patients.

**KEY WORDS:** carotid artery intima media thickness (CIMT), prehypertension.

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### I. INTRODUCTION

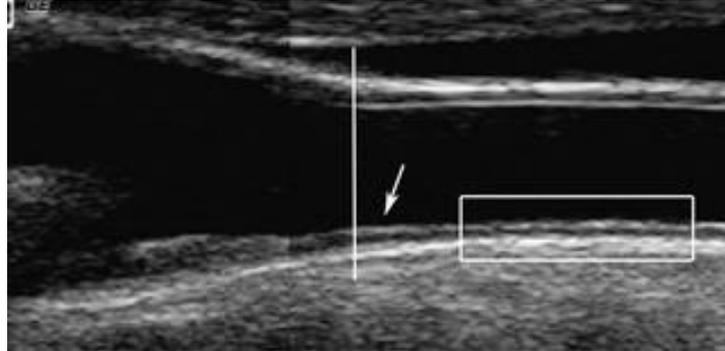
The term “prehypertension” [1] introduced by 7<sup>th</sup> report of JNC was defined as systolic BP (SBP) 120 – 139 mm of Hg and diastolic BP (DBP) of 80 - 89 mm of Hg in more than 2 or more separate reading in two or more separate occasions. The reasoning behind this new category was that long term epidemiological studies has indicated a progressively increasing risk of cardiovascular events [2] on SBP > 110 mm hg [1]. Although recent evidence support that the pre hypertension is associated with target organ damage [3-5], there is lack of information regarding common carotid artery intima media thickness (CIMT) in pre hypertensive individuals. In this study we want to assess the extent of CIMT in prehypertensive adults in compare to normotensive individuals. Our objective was to establish the role of prehypertension in target organ damage in the form of CIMT, to establish the need for treatment of prehypertension.

### II. METHODS

In this Institution based comparative observational cross sectional study we evaluated 50 prehypertensive adults and compared them with 50 normotensive persons and also with 50 newly diagnosed (within one month) hypertensive patients from July 2013 to September 2013. Patients attending our medical outpatient departments and indoors aged > 18 years who gave signed informed consent are included in this study. The study protocol was approved by local ethical committee of our Institution. Patients having diabetes mellitus, known heart diseases, dyslipidemia, obesity ( $BMI > 30$  kg/m<sup>2</sup>), renal insufficiency, blood pressure difference in both arms > 20 mm of Hg in SBP and > 10 mm of Hg in DBP and Hypertensive patients with history of treatment with drugs were excluded from this study.

**BP measurement:** BP has been measured in each arm using a mercury sphygmomanometer in consecutive 3 days in case of indoor patients and in 1 week apart in case of outpatient departments. In each day, BP has been measured three times in both sitting and lying down position and the mean value of BP was obtained. Participants were divided in 3 subgroups according to BP level: Normotensive ( $<120/80$  mm hg), Prehypertensive ( $139$  mm hg  $\geq$  SBP  $>120$  mm Hg and  $89$  mm of hg  $\geq$  DBP  $>80$  mm of Hg) and Hypertensive ( $BP \geq 140/90$  mm Hg).

**Carotid Artery Ultrasonographic Measurements:** The left and right CCA were examined in the anterolateral, postero-lateral, and medio-lateral directions with a high-resolution ultrasound Doppler system (Acuson 128XP), equipped with a 7-MHz linear array transducer. The ultrasonographic assessment of CIMT done by experienced sonographers blinded to all clinical data in our vascular laboratory.



Picture 1: showing common carotid artery intima media thickness.

**RESULT**

Table 1: Demographic profile and clinical data of three groups.

variable	Normotensive	Prehypertensive	Hypertensive	P value
Age(in years)	33.74±3.89	33.76±3.77	33.18±3.81	0.691
Sex(M:F)	42:8	43:7	42:8	0.949
CIMT( in mm)	0.607±0.004	0.694±0.048	0.736±0.006	<0.001

The mean age and gender distribution in three groups of study population were more or less similar and no statistically significant difference was found (p value 0.691 and 0.949). So the study population was age and sex matched. The mean CIMT in prehypertensive patients were 0.694±0.048 mm, in normotensive persons were 0.607±0.004 mm and in hypertensive patients were 0.736±0.006 mm. The difference was significant after ANOVA test (p value <0.001). Applying Tukey HSD as post hoc test for multiple comparisons it is evident that the CIMT of pre-hypertensive group is significantly higher than normotensive group ( p value <0.001). CIMT was highest in hypertensive patients and lowest in normotensive individuals (p value <0.001 and <0.001 in both respectively).

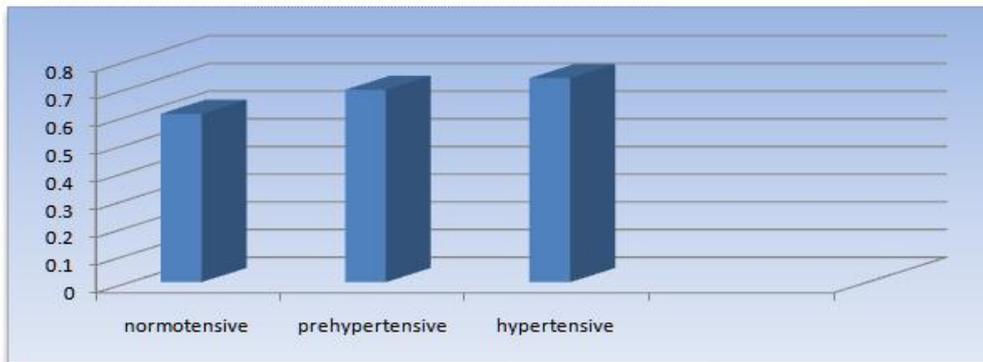


Diagram 1: showing CIMT in three study groups.

**III. DISCUSSION**

JNC 7, issued in 2003, defines a BP of <120/80 mm Hg as "normal" and values from 120/80 to 140/90 mm Hg as a new category, "prehypertension". JNC 7 may have led to more problems than solutions. The Second National Health and Nutrition Examination Survey (NHANES II) population who met the JNC 7 classification for prehypertension at baseline had a significantly increased risk for all-cause and CV mortality compared with those with normal BP at baseline. When data were adjusted for the presence of risk factors, however, mortality was not increased in individuals who had prehypertension without any additional CV risk factors. the TROPHY (Trial of Preventing Hypertension) study [6] ask loudly for treatment of prehypertension group. Through our study we want to see if there is any positive correlation of prehypertension with common carotid artery intima media thickness to justify the new term "prehypertension".

Our study showed that prehypertensive subjects had higher CIMT value than their normotensive counterparts, even after adjustment for baseline characteristics. Previous studies have demonstrated associations of prehypertension between inflammatory markers and atherosclerotic disease [7-9]. The authors concluded that prehypertension might be a proinflammatory condition, promoting subclinical atherosclerotic disease. Our findings indicate that prehypertension may increase the risk of atherosclerosis [10], implying that the increase in CIMT is an earlier preclinical atherosclerotic change. This finding is in line with one report that documented an independent association between borderline hypertension and intima-media thickening. Certain limitations of the present report need to be addressed. According to the guidelines of the JNC-7, the classification of prehypertension requires two or more office visits. In previous study published in Stroke Journal [5] prehypertension was classified during a single office visit, although BP was taken with caution and the average of 3 measures was used. But in our study this limitation has been overcome. But the cross sectional design of the present study does not allow us to establish a cause-effect relationship between prehypertension and carotid intima-media thickening.

#### IV. CONCLUSION

In conclusion, it was clearly seen that there was increased target organ damage in the form of increased CIMT in prehypertensive group compared to normotensive group justifying early treatment of prehypertensive group. Though large scale long term prospective follow up study is required to see the outcome of treatment of prehypertensive patients.

#### REFERENCES

- [1]. The seventh report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure: The JNC 7 report. *JAMA*. 2003;289:2560-72.
- [2]. Chambless LE, Heiss G, Folsom AR, Rosamond W, Szklo M, Sharrett AR, Clegg LX. Association of coronary heart disease incidence with carotid arterial wall thickness and major risk factors: the Atherosclerosis Risk in Communities (ARIC) Study, 1987-1993. *Am J Epidemiol*. 1997;146:483-494.
- [3]. Chambless LE, Heiss G, Folsom AR, Rosamond W, Szklo M, Sharrett AR, Clegg LX. Association of coronary heart disease incidence with carotid arterial wall thickness and major risk factors: the Atherosclerosis Risk in Communities (ARIC) Study, 1987-1993. *Am J Epidemiol*. 1997;146:483-494.
- [4]. Greenlund KJ, Croft JB, Mensah GA. Prevalence of heart disease and stroke risk factors in persons with prehypertension in the United States, 1999-2000. *Arch Intern Med*. 2004;164:2113-2118.
- [5]. Papamichael, Savas Toumanidis, Eleftherios Stamboulis, Konstantinos Vemmos and Nikolaos Efstathios Manios, Georgios Tsivgoulis, Eleni Koroboki, Kimon Stamatelopoulos, Christos Zakopoulos. Impact of Prehypertension on Common Carotid Artery Intima-Media Thickness and Left Ventricular Mass. *Stroke*. 2009;40:1515-1518.
- [6]. Julius S, Nesbitt SD, Egan BM, et al; the Trial of Preventing Hypertension (TROPHY) Study Investigators. Feasibility of treating prehypertension with an angiotensin-receptor blocker. *N Engl J Med*. 2006;354
- [7]. Chrysoshoou C, Pitsavos C, Panagiotakos DB, Skoumas J, Stefanadis C. Association between prehypertension status and inflammatory markers related to atherosclerotic disease. The ATTICA Study. *Am J Hypertens*. 2004;17:568-573.
- [8]. Papadopoulos D, Makris T, Krespi P, Poulakou M, Stavroulakis G, Hatzizacharias A, Perrea D, Votteas V. Adiponectin and resistin plasma levels in healthy individuals with prehypertension. *J Clin Hypertens*. 2005;7:729-733.
- [9]. Pauletto P, Palatini P, Da Ros S, Pagliara V, Santipolo N, Baccillieri S, Casiglia E, Mormino P, Pessina AC. Factors underlying the increase in carotid intima-media thickness in borderline hypertensives. *Arterioscler Thromb Vasc Biol*. 1999;19:1231-1237.
- [10]. Wattanakit K, Folsom AR, Chambless LE, Nieto FJ. Risk factors for cardiovascular event recurrence in the Atherosclerosis Risk in Communities (ARIC) study. *Am Heart J*. 2005;149:606-612.

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