TO EVALUATE CARDIOVASCULAR RISK BY ASSESSING ATHEROGENIC INDEX OF PLASMA IN PREHYPERTENSIVES AND HYPERTENSIVES

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Abstract: **Background & objectives**: Coronary heart disease is typically the clinical sequence of arteriosclerosis, a process that became evident in adolescence and early adulthood. Causes of cardiovascular disease are diverse but atherosclerosis and hypertension are most common. The aim of present study was to know cardiovascular risk factors in pre-hypertensive and hypertensive**. Methods**: Blood pressure of 200 subjects of 30-50 years of age was taken. 105 subjects were selected for the study. Out of which 35 subjects who were having Blood pressure between Systolic blood pressure-120-139mmHg &Diastolic blood pressure 80-89mm Hg) were classified as Prehypertensives. Subjects who were having Blood pressure Systolic blood pressure <120mmHg Diastolic blood pressure <80mmHg were classified as Normotensive, 35 subjects having Blood pressure>140/90mmHg served as Hypertensive. Candidates were evaluated for body mass index, fasting blood sugar, and lipid profile was taken for calculating Atherogenic index of Plasma and Cardiovascular risk by using Framingham Heart Scale. **Results and Interpretation**: Cardiovascular risk had increased with the increase in blood pressure from Normotensives to hypertensive. Atherogenic index of plasma [log(TG/HDL)] showed significant positive co-relation with body mass index and 10 years general cardiovascular risk in prehypertensive and hypertensive subjects. **Conclusion**: Prehypertension is a precursor of clinical Hypertension and is closely related with the increased incidence of cardiovascular disease. Individuals who are Prehypertensives should be advised to practice lifestyle modifications to intervene and prevent or delay the cardiovascular disease from developing.

Key Words: Arteriosclerosis, Prehypertension, Atherogenic index of plasma, Cardiovascular risk

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Introduction:

Cardiovascular disease is the leading cause of death and serious illness. The causes of cardiovascular disease are diverse but atherosclerosis and hypertension are the most common. In1948, the Framingham Heart Study under the direction of the National Heart Institute (now known as the National Heart, Lung and Blood Institute or NHLBI) embarked on an ambitious project in Health Research. “Framingham Heart Study” is the longest running multigenerational longitudinal study in medical history. It has helped identify several “RISK FACTORS” & their cumulative Influence on the manifestation of Cardiovascular disease. The term “RISK FACTOR” was coined by Framingham investigators. Framingham reported that blood pressure was directly associated with cardiovascular risk regardless of how labile it was[1]. It was reported that isolated systolic hypertension was also a powerful predictor of cardiovasculardisease[2]. Framingham and other epidemiological studies demonstrated that systolic and diastolic blood pressure has a continuous, independent, graded and positive association with cardiovascular disease.[3-6]

In light of these studies, the JOINT NATIONAL COMMITTEE VII report developed a new classification of Blood pressure for adults aged 18years or older including a new category called **“Prehypertension”** since these individuals are at increased risk of progression to hypertension and show an independent increased risk of cardiovascular disease.

Atherogenic Index of Plasma (AIP) is defined as: Log TG/HDL AIP has recently been proposed as a marker of Plasma athero-genecity because it is increased in people at higher risk for coronary heart disease and inversely Co-related with LDL particle size. The athero-genic index of plasma which is a mathematical relationship between TG and HDL has been successfully used as an additional index.

Material and Methods:

The present study was conducted in Department of Physiology Sardar Patel Medical College, Bikaner. Study was performed on Subjects of both the genders of age group 30-50 years.

Patients grouped as follows:-

Group 1: consists of 35 Normotensive subjects Systolic blood pressure < 120 & Diastolic blood pressure < 80 mm Hg.

Group 2: consists of 35 Pre-hypertensive subjects having SBP 120-139mm Hg & DBP 80-89mm Hg.

Group 3: consists of 35 Hypertensives subjects having SBP ≥ 140mm Hg & DBP ≥ 90mm Hg.

Parameters to be used:-

(I)ANTHROPOMETRIC MEASUREMENTS

1 Body mass Index BMI= Weight(Kg)/Height (m)²

2. Waist circumference (cm)

(II) BP measurement by Sphygmomanometer.

(III)Biochemical analysis:-

a) Blood glucose

b) Serum lipid profile

c) Atherogenic index of plasma

Procedure:

1. Blood Investigation:

Blood glucose: By Glucose oxidase method using enzymatic kits {GOD-POD method}

2 Serum Lipid Profile :

TC-By using enzymatic kit {CHOD-POD method}

TG- By using enzymatic kit { GPO-POD method}

HDL- By using enzymatic kit {Precipitating reagent}

VLDL- Friedwald formula- TG/5

LDL:Total Cholesterol-{HDL+VLDL}

3. Measurement of blood pressure by Sphygmomanometer: In sitting position, mean of two readings were recorded

Atherogenic index of Plasma (AIP):

AIP= (log TG/HDL), TG & HDL values were taken in mmol/lt or mg/dl.

AIP< 0.11- LOW RISK

AIP(0.11-0.21)- INTERMEDIATE RISK

AIP > 0.21- INCREASED RISK

4. **10 Years general Cardiovascular risk** was assessed by using FRAMINGHAM HEART SCALE.(Individuals with low risk have 10% or less CHD risk at 10 years , with intermediate risk 10-20% and with high risk 20% or more.)

For statistical comparison of data, ANOVA test was applied using SPSS software.

Results:

Table 1 is depicting the classification of three groups according to their age and gender. Table 2 is showing the comparison of Systolic blood pressure among the three groups. A significant difference in SBP was found in all age group of Normotensives, Prehypertensive and Hypertensive.

Table 3 depicts comparison of Atherogenic index of plasma among the three blood pressure groups. Atherogenic index of plasma had shown an increasing trend with the blood pressure, from Normotensives to hypertensive group. In 31 – 35years of age group in between Normotensives & Prehypertensive difference in mean values was 0.198 which was more than critical difference if 0.141. Thus this difference is statistically significant. In 36 – 40 years of age group in between Prehypertensive & Hypertensive difference in mean values was 0.192, which was more than critical difference of 0.125.Thus this difference is statistically significant.

It is evident from Table 4 comparison of cardiovascular risk among the three blood pressure groups that cardiovascular risk had increased with the increase in blood pressure from Normotensives to hypertensive. Difference in mean values of cardiovascular risk in < 30 years was 1.35, which was found to be less than critical difference value of 2.92 and thus was insignificant ,similarly in age group (41-45) years it was 1.88 which was less than critical difference value of 2.53, thus it was also insignificant. All other age group showed significant differences

Table: 1 Classification of subject on the basis of Gender

Age (Yrs.)	Normotensive			Prehypertensive			Hypertensive		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
≤30	1	1	2	1	1	2	1	1	2
31-35	4	2	6	4	2	6	4	2	6
36-40	6	4	10	6	4	10	6	4	10
41-45	3	2	5	3	2	5	3	2	5
46-50	7	5	12	7	5	12	7	5	12

Table 2: Comparison of Systolic Blood Pressure

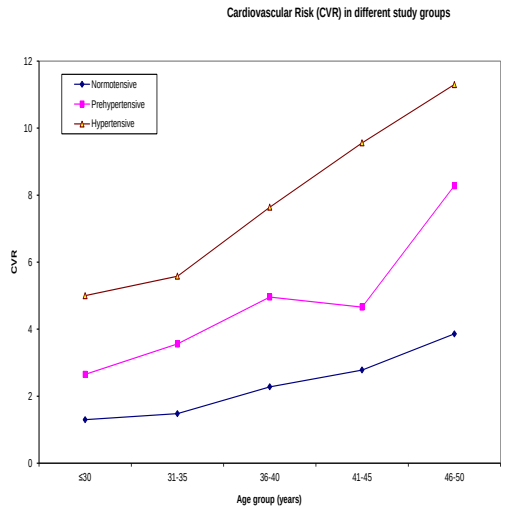
Age (Yrs.	Normotensive	Prehypertensive	Hypertensive	Critical deviation 5%)
≤30	110.00	132.0±2.82	150±	7.02
31-35	114.67±3.72	130.67±4.13	151±9.83	9.24
36-40	112.40±5.56	128.80±3.67	146.60±8.16	5.03
41-45	116.00±3.46	129.60±2.96	148±8.36	7.61
46-50	114.83±3.35	133.50 ± 4.98	147.00±11.52	6.23

Table 3 Comparison of Atherogenic Index of Plasma

Age (Yrs.	Normotensive	Prehypertensive	Hypertensive	Critical deviation (5%)
≤30	-0.001±0.168	0.142±0.045	0.239±0.04	0.48
31-35	0.036±0.046	0.234±0.130	0.289 ± 0.142	0.141
36-40	0.077±0.203	0.079±0.056	0.271±0.075	0.125
41-45	0.059±0.078	0.148±0.061	0.212±0.078	0.123
46-50	0.107±0.053	0.149± 0.51	0.183±0.104	0.061

Table 4 Comparison of Cardiovascular Risk

Age (Yrs.	Normotensive	Prehypertensive	Hypertensive	CD (5%)
≤30	1.30±0.42	2.65±0.91	5.00±0.42	2.92
31-35	1.48±0.46	3.56±0.74	5.58±1.19	0.81
36-40	2.28±0.978	4.960±2.52	7.640±3.011	1.71
41-45	2.78±0.709	4.66±2.05	9.56±2.31	2.53
46-50	3.86±1.28	8.28±2.63	11.30±2.44	1.83



Discussion:

Our study results are very much similar with the study of Zanchetti et al which stated that dyslipidemia is a potent factor for increased atherogenic index of plasma in hypertension.[7]

Clarice D. Brown stated that body mass index increases with the increase in mean values of systolic and diastolic blood pressures, and our results are in close conformity with their statement.[8]

Akuyam S.A. found increasing trend in total cholesterol, with increase in blood pressure level and the results of our present study was in close agreement with their study .[9]

In our study two or more cardiovascular risk factors were present in higher proportion of hypertensives and prehypertensives compared to normotensive subjects, similar findings were reported by Yadav S. et al.[10]

High normal prehypertension (130-139/85-89mm Hg) was associated with increased 10 years general cardiovascular risk as compared to prehypertension (120-129/80-84mm Hg), similar findings were reported by Heather A. et al.[11]

Role of Atherogenic index of plasma (AIP) in Hypertension and Cardiovasular disease risk:-In our study Atherogenic index of plasma(AIP) showed significant positive co-relation with BMI and 10 years general cardiovascular risk. Atherogenic index of plasma reflects metabolic interaction within the whole lipoprotein complex. Associated atherogenic lipoprotein phenotype with prehypertension considerably enhances the cardiovascular risk. Hypertension and hyperlipidemia individually exerts many similar effects on the arterial wall. The increase in oxidative stress, a mechanism common to both conditions may activate genes involved in generating an inflammatory response that in the presence of hyperlipidemia lead to the formation of atherosclerotic plaque. Thus it led to atherosclerosis, which is a major cause of cardiovascular diseases.

Role of Prehypertension and Hypertension as a factor for causing Cardiovascular disease risk:-In our study a significant increase in cardiovasular risk was observed between all the blood group from normotensive to hypertensives. The link among prehypertension , cardiovascular disease morbidity and mortality may be explained by the pro-inflammatory nature of prehypertension and the association of this condition with increased C-reactive protein level, [12] tumor necrosis factor ά, amyloid A, and homocysteine [13].Morever endothelial dysfunction is known to be prevalent at the high end of normotension spectrum.[14]Thus endothelial dysfunction and a generalized inflammatory state, coupled with a high prevalence of cardiovascular risk factors, together provide a likely explanation for the increased rate of cardiovascular disease events among prehypertensive subjects.

A strong association exist between hypertension and coronary artery disease. Patients with hypertension are at much higher risk of developing all types of occlusive vascular disease, including coronary artery disease. Coronary artery disease may limit myocardial perfusion and therefore supply of oxygen also gets affected. Myocardial oxygen demand is increased for two reasons: first because of the increased output impedance to left ventricular ejection; and second because hypertension can cause left ventricle hypertrophy. This combination of decreased oxygen supply and increased oxygen demand is particularly pernicious and explains why hypertensive patients are more likely (than normotensives) to develop angina, to have a myocardial infarction, or other major coronary event and to be at higher risk of dying following myocardial infarction.

Conclusion: -

In our study a significant increase in cardiovascular risk was observed in both prehypertensive and hypertensive. A rising trend of atherogenic index of plasma was observed from Normotensives to hypertensives in all blood pressure groups. Atherogenic Index of plasma shown a positive Co-relation with cardiovascular risk. Prehypertension is a precursor of clinical hypertension and is closely related with the increased incidence of cardiovascular disease. Prehypertension is not a disease category. Rather it is a designation chosen to identify individuals at high risk of developing hypertension, so that both patients and clinicians are alerted to this risk and encouraged to intervene and prevent or delay the disease from developing. Lifestyle modification includes smoking cessation, physical activity, weight reduction, DASH diet (dietary approach to stop hypertension), reduced salt intake in order to reduce their risk of developing hypertension in the future and thus can be saved from developing cardiovascular disease in future.

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