

Stress And Multiple Risk Factors Of Cardiovascular Diseases. Is There A Link Between Them?*

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Summary:

The relationship of stress associated with occupational responsibilities to hypertension as well as hyperlipidemia and coronary atherosclerosis remains controversial. This comparison study carried out in employed men in T&T department and general population examined the strength of association between them. Patient's mental stress was determined by interview. In this analysis Hypertension was found in $55 \pm 6\%$ in T&T workers, $20 \pm 5\%$ in general population of same age, weight and height matched group. Average age adjusted, values of systolic and diastolic BP were highest in study group 162/105 mmHg, and lowest in general population 150/100 mmHg. Higher values were found in younger age group of study. Mean cholesterol level was 353 mg% & 223 mg% in T&T employees and general population respectively. Increased triglycerides (mean 361 mg%) and higher LDL/HDL ratio > 5 was observed in study group than control group and incidence of coronary artery was 50% hypertensive T&T workers versus 20% in general population. History of Familial HBP & DM was found in 64%, 32% in study group versus 30% & 6% in control group, other risk factors such as smoking, DM, alcohol were found almost same in both groups. Analysis of this study shows that increased incidence of HBP and prevalence of hyperlipidemia are due to the over work and stressful job responsibilities raise hypertension specially more in subjects having Familial HBP, Hyperlipidemia & DM.

The possible deleterious effects of prolonged stress on Hypertension and on Cardiovascular system as a whole have been the subject of intensive study uptill now and clinicians have long suspected that prolonged and repeated stress may lead to sustained Hypertension and Coronary Atherosclerosis¹.

People exposed to repeated psychogenic stress may develop Hypertension and Cardiovascular disease more frequently than same age group not so stressed².

Keeping that view in mind we designed the study protocol to assess and compare the incidence of Hypertension, Coronary Artery Disease and dyslipidemia, in association with occupational hazards.

Method:

Subjects of this comparative study were referred to Agha Khan Diagnostic Centre Hyderabad, from the T&T Department for Medical evaluation and treatment from July 1991 to Nov. 1994. The study group comprised Telephone Operators who were Hypertensives served as active subjects and

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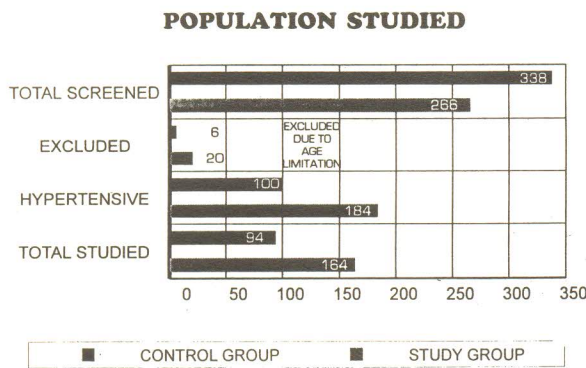


Table 1

non-hypertensive relatives were taken as control group. 266 Male subjects of study group ranged in Age from 25-65 years as compared to the Control group where 388 Males of same age group of different classes (Urban & Rural) were included. Amongst these 164 males found to be Hypertensive in studied group and 94 subjects in Control group. (Table No. 3).

Females of all age groups, Male patients with age of > 25 or < 65 years, patients with Acute MI of less than 6 months duration and known Hypertensive were excluded from this study.

Study Design:

Cardiovascular screening was performed by Participants:

- ~History (About symptoms if any)
- ~Physical Examination
- ~X-Ray chest PA view
- ~ECG at rest

These subjects completed questionnaire about Alcohol Consumption, Cigarette Smoking, H/O DM

and Family History.

Cardiovascular risk factors were evaluated in patients of this study with Biochemical profile including Lipid Profile, after 12 hours fasting & Random Blood Sugar and Cortisol levels at morning hours.

In study group Hypertension was more common 55 ± 6 than control group where the incidence was 20 ± 7 , ↑ incidence of dyslipidemia was found in 100 pts. (60%) versus 24 pts. (25%) of control group, surprisingly, there was ↑ ratio of cigarette smokers in control group 35 pts. (37%) than study group were 20 pts. (12%)⁶, which shows that stress was more common in non-smokers. ↑ number of subjects gave H/O Alcohol 14 (8.5%) in study group versus 10 (10.6%) in control group. Same was with incidence of DM & CAD which was more common in study group than control group (Table No. 5).

Blood Pressure:

BP comparison (Table No. 6) showed that Systolic BP was higher in study group average SBP 162 mmHg versus 153 mmHg in control group Diastolic BP ↑ was also seen in study group, average DBP was 105 mmHg and 100 mmHg in control group.

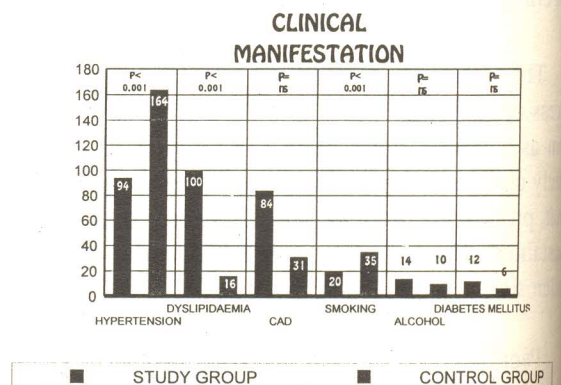


Table 2

There were significant changes seen in Grade & Age variation of BP (Table No. 7, 8), which showed that both systolic and diastolic BP were significantly higher at age 36-45 years, in comparison to control group of the same age and of all groups of study.

Marked rise in SBP was observed in 25-35 years age group and diastolic BP ↑ was significant in age group of 46-55 years, in study group than control group.

Biochemical Analysis:

Total lipids were assessed in both groups as seen in (slide No. 9). Average total cholesterol, serum triglycerides & LDL were found to be higher in study group compared to control group where HDL was found to be lower in study group. Serum cortisol level showed significant ↑ in study group

Age related distribution of SBP Amongst the hypertensives

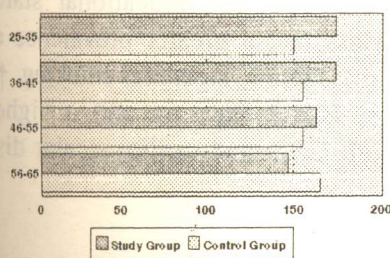


Table 3

19.1 verses 14.2 in control group (sample taken at 8-10 a.m.), as well as serum fibrinogen was raised in study group.

Other Bio-chemical tests were found to be same in both groups. (Table No. 10).

Age related distribution of DBP Amongst the hypertensives

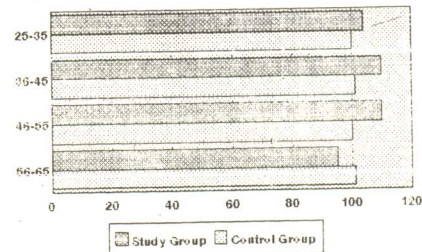


Table 4

Discussion:

According to Tom Pickening 1990, "The role of mental stress in the development of Hypertension remains uncertain. Its effects are likely to depend on an interaction of at least three factors:-

1. The nature of stressor,
2. Its perception by individual, and
3. The individual's physiological susceptibility.

People may become hypertensive not just because they are more stressed but because they responded differently to stress, great cardiovascular and sympathetic nervous reactivity to various laboratory stresses has been documented repeatedly in hypertensive and normotensive at higher risk for developing HBP uptill now. (Light et al 1992, Widgren et al 1992) showed that people exposed to repeated psychogenic stresses may develop HBP. Air traffic controllers who work under high level of psychological stress annually develop hypertension at a rate of 5.6 times greater than do non-professional Pilots who were initially comparable in physical characteristics. (Cobb & Ross 1973).

Stressed subjects exhibit greater cardiovascular reactivity and elevation of catecholamine, cortisol and testosterone during performing mental arithmetic & reaction to time task⁵. A mechanism exists for the translation of intermittent stresses into more sustained HBP. Intermittent adrenomedullary secretion of epinephrine may induce far greater and longer effects upon the Blood Pressure, than the relatively short fight and flight response, epinephrine may invoke a sustained ↑ in neuronal release of both epinephrine and norepinephrine in turn causing neurogenic vasoconstriction and a persistent rise in HBP (Floras 1992).

As well as ↑ catecholamine is linked with CAD by four possible mechanisms:⁶

- i) ↑ sympathetically mediated in HR.
- ii) ↑ BP and ↑ myocardial contractility leads to excessive ↑ in O₂ consumption in the presence of coronary stenosis that is severe enough to limit the flow ↑.
- iii) Enhanced coronary vasomotor tone with consequent primary reduction in coronary blood flow.
- iv) Activation of plateletes.

Other markers like ↑ levels of neuropeptide Y defects in functions of adenosine and dopamine

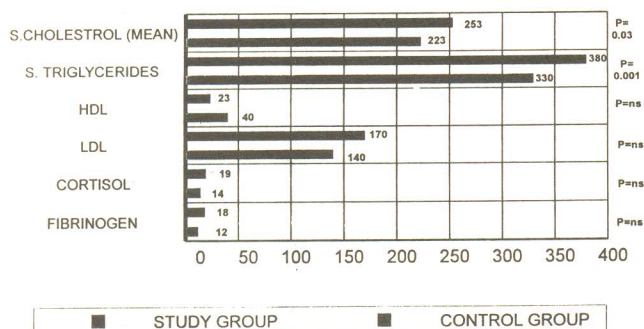


Table 5

may be part of the spectrum of CSNS involvement in stressed induced HBP. The sympathetic nervous system seems to be primary stimulator of free fatty acid mobilization following stress also. Free fatty acid ↑ during the states where there is ↑ in an ↑ plasma levels of catecholamine or ↑ activity of sympathetic system accompanying in quite different emotional states and other psychological situations may be due to direct effect of norepinephrine on fat cells even at means by which norepinephrine could not pass from adrenergic fibre to the fat cells and it is also possible that the sympathetic nervous system affects fatty cell mobilization by altering the blood flow through adipose tissue.

It is also possible that cholesterol or other lipid level change because of changes in the plasma volume producing hemoconcentration. These changes in the volume are perhaps due to vascular fluid shifts at least due to effects of acute stress.

There is also evidence of link of corticosteroid with CAD based on ↑ serum lipids leading to ↑ coronary atherosclerosis⁷.

People engaged in extraordinary mental and physical alertness and continuous involvement in multiple and diverse function subjects to time restriction with lower educational status and low social class had a greater prevalence of life style related risk factors, cigarettes smoking, ↑ cholesterol, diabetes, Blood Pressure and a higher mortality from both CAD and cardiovascular diseases.

Conclusion:

Following findings were higher in our study group.

- 1) Incidence of HBP
- 2) Average Blood Pressure
- 3) DM
- 4) Coronary Heart Disease
- 5) Cholesterol Triglycerides LDL
- 6) Cortisol
- 7) Fibrinogen level

↑ incidence of Hypertension and prevalence of Hyperlipidemia and Coronary Atherosclerosis are due to Over work & Stress, and stressful job responsibilities raise the Hypertension in subjects having family History of HBP, Hyperlipidemia & DM.

We conclude that occupational stress is associated with increased incidence of HBP, Diabetes Mellitus, Dyslipidemia and Coronary Artery Disease.

The presence of stress makes the study group more vulnerable for manifestation of multiple risk factors.

Occupational hazards should be considered in the management of the Cardiovascular Disease.

References:

1. Bord J, Fencel V, Hejl Z, Jirka J: Circulatory changes underlying Blood Pressure Elevation during Acute Emotional Stress (Mental Arithmetic) in normotensive and Hypertensive subject. (Clin, Sci 1959; 19: 269-279).
2. Friedman M, Rosenman RH: Association of specific over behaviour pattern with BP & cardiovascular findings; BP, Cholesterol, Blood clotting time, incidence of arcus senilis and clinical coronary artery disease. (J. AM Med Association 1959; 169, 1286).
3. Patterson et al from Bathesela, US in the journal of psychosomatic Medicine 1993 studied the acute effects of mental stress (Mental arithmetic) on serum cholesterol (Triglycerides, HDL-C & LDL-C) and plasma volume, results indicated a significant $p < .001$ increases in cholesterol, triglycerides, LDL-C & HDL-C.
4. Kitahara Y Imataka K. Nakaoka H, Ishibashi M, Yamaji T, Fuji T; Haematocrit increase by mental stress in Hypertensive Pts. (JPN Heart J. 1988; 29:429-435).
5. William RB: Type A behaviour and elevated physiological & neuro endocrine responses to cognitive tests science 1982; 218:483.
6. Specchia G, Falcon C et al.: Mental stress as a provocative test in patients with various clinical syndromes of coronary heart disease. Circulation 1990; 83 (Suppl II:-108-11-114).
7. Henry JP: Coronary Heart Disease and arousal of Adrenal Cortical axis in; Dembroski TM, Schmidt T, eds Biobehavioral Bases of Coronary Heart Disease based Karger 1983: 1-29.