Evaluation of Cardiovascular Risk Factors in Patients with Essential Hypertension

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Three hundred patients with essential hypertension, attending the hypertension clinic of Mayo Hospital, Lahore were evaluated for other cardiovascular risk factors. The BP was measured carefully following standard procedure. The risk factors studied were diabetes mellitus, hyperlipidaemia, smoking, obesity, left ventricular hypertrophy, hyperuricaemia, physical inactivity and occupational stress. A detailed history was taken and complete physical examination was performed. Personal bio-data like age, sex, weight, height, occupation, life style and history of cigarette smoking was collected. Laboratory investigations included total serum lipid profile, fasting and 2 hours postprandial blood sugar levels, blood urea, serum creatinine and serum uric acid levels. Electrocardiogram (ECG) and echocardiography were done to determine left ventricular hypertrophy. Mean systolic blood pressure was 170 mm Hg while mean diastolic blood pressure was 104 mm Hg. Family history of hypertension was present in 35% of the patients. The prevalence of other cardiovascular risk factors was as follows: diabetes mellitus 49%, hypercholesterolaemia 39.3%, smoking 34%, obesity 49.3%, physical inactivity 44.3%, hyperuricaemia 40.3% and left ventricular hypertrophy in 26%. Patients with essential hypertension frequently have other cardiovascular risk factors. It is therefore recommended that hypertensive patients should routinely be screened for such risk factors to determine the overall cardiovascular risk. This is important to optimize their treatment in order to reduce the mortality and morbidity from the cardiovascular disease.

Key Words: Essential hypertension, Coronary heart disease, Obesity, Hyperlipidaemia, Smoking, Diabetes mellitus, Sedentary life style, Left ventricular hypertrophy, Hyperuricaemia.

Hypertension is the commonest cardiovascular disorder and a major public health challenge all over the world. In the Framingham study, 18% of the men and 16% of the women were found to be hypertensive.[1] Hypertension is a major contributor to cardiovascular disease which imparts a three fold increase risk over that of normotensive persons of the same age.[2] It accelerates atherogenesis, promoting premature coronary disease, which is now its most common complication. The effect of elevated blood pressure on cardiovascular morbidity and mortality in general, and on coronary heart disease in particular is independent of the influence of other predisposing atherogenic co-factors. It has been observed that elevated blood pressure is more often associated with hyperlipidaemia, hyperglycemia, hyperuricaemia, excessive weight, elevated fibrinogen and ECG abnormalities. These co-existing risk factors exert a great influence and multiply the overall cardiovascular risk.[3] However the exact relationship between hypertension and other conditions is not exactly clear. There appears to be a common genetic predisposition.[4] The purpose of our study was to determine the incidence of these risk factors in our own population.

Patients and Methods

The study was carried out on 300 patients, both male and female visiting Hypertension Clinic, Mayo Hospital Lahore.

Inclusion criteria:

1. Known hypertensive patients attending our clinic (Normal blood pressure while on medication).

2. Blood Pressure equal to, or greater than 140/90 recorded under resting conditions at least on two different occasions, one week apart.

3. Borderline high BP with target organ damage.

Exclusion criteria:

1. Acute elevation in BP as seen in anxiety, pregnancy or glomerulonephritis.

2. Secondary hypertension.

3. Children (<18 years).

While measuring blood pressure, following precautions were observed:

- A mercury sphygmomanometer with standard cuff (23 cm x 12 cm) was used.
- The individual was seated and the arm supported on the table.
- The room temperature was controlled and surroundings relaxed.
- No food, smoking or exercise had been carried out in the preceding half an hour.
- Systolic pressure was recorded as Korotkov phase 1 and diastolic as phase 5.

The risk factors to be studied were carefully investigated and recorded. For the purpose of our study different conditions were defined as follows:

- Diabetes Mellitus: This was assumed to be present if any of the following was found:
  Known diabetic already on treatment.
  Random blood sugar more than 200 mg/dl.
  Fasting blood sugar more than 140 mg/dl.
  On OGTT any two values exceeding 200mg/dl.
- Cholesterol: This was estimated from the fasting blood sample by the enzymatic method. Patients were

subdivided according to their serum cholesterol level. A cholesterol value less than 200 mg /dl was taken as normal, 200-239 mg/dl was considered to be borderline high and greater than 240 mg/dl as significantly high.[5]

- Triglycerides: This was measured by the enzymatic method. Hypertriglyceridaemia was present when the serum triglycerides level was more than 150 mg /dl.
- Body mass index was calculated from weights and heights of the individuals and following categories were made.
  BMI of <20, underweight
  BMI of 20-25, normal
  BMI of 25-27, overweight
  BMI of 27-30, mild obesity
  BMI of 30-40, moderate obesity
  BMI of > 40, morbid obesity
- Hyperuricaemia: Male patients having serum uric acid levels above 7 mg/dl and females above 6 mg/dl were labeled as hyperuricaemics.
- Left ventricular hypertrophy (LVH):
  On ECG voltage of R wave in V5 or V6 over 27 mm; S wave in V1 or V2 over 30 mm; or a combination of above > 40.[6]
  On echocardiography interventricular septum or left ventricular posterior wall thickness was measured. Hypertrophy was diagnosed if any value equaled or exceeded 11 mm.[7]
- Cigarette smoking: A smoker was defined as an individual who had smoked cigarettes for more than 6 months and had not stopped smoking within last 2 years.
- Occupation and physical activity: Depending upon the physical activity patients were divided into three groups according to WHO's prescribed criteria for classification of physical activity.
  Sedentary and light activity e.g. office workers, housewives, teachers.
  Moderate activity e.g. shopkeepers, street-hawkers, and mess-waiters.
  Heavy manual work e.g. labourers, farmers.

Precordial examination was performed to detect signs of left ventricular hypertrophy. Blood pressure was also recorded in the lower limbs to rule out coarctation of aorta. A careful search for thyroid disease, renal disease including bruit and adrenal mass was made. Following investigations were performed in all patients. Blood complete examination, urine complete examination, fasting blood sugar, total lipid profile, blood urea, serum creatinine, serum uric acid, ECG and echocardiography.

Results

Out of 300 hypertensive patients who were evaluated for other cardiovascular risk factors 218 (72.7%) were females and 82 (27.37%) were males. Their mean age was 49.7 ± 9.2 years and mean weight was 68.2 ± 13.9 kg.

Regarding hypertension, mean systolic blood pressure was 170 mm Hg and mean diastolic blood pressure was 104 mm Hg. According to the calculated body mass index (BMI) 4.3% were underweight, 28% were normal, 18.3% were slightly overweight, 20.7% had mild obesity, 27.3% were moderately obese and 1.3% were classified as having morbid obesity.[8] The characteristics of our study population are shown in Table 1.

Table 1. The characteristics of our study population.

Physical Characteristics	Mean value	Standard Deviation
Age	49.72	9.28
Height (cm)	157.45	9.36
Weight (kg)	68.12	13.97
Body mass index (BMI)	27.78	8.72
Systolic BP	170.39	22.04
Diastolic BP	104.15	12.26
Mean BP	126.23	13.67
Duration of hypertension	5.65	4.45
Blood sugar fasting	127.21	64.51
Blood sugar postprandial	187.53	98.23
Serum cholesterol	194.90	50.72
Serum triglycerides	174.19	104.87
Low density lipoproteins (LDL)	123.13	46.76
High density lipoproteins (HDL)	48.03	25.67
Serum uric acid	5.98	1.70
Septal thickness	9.81	1.52
Posterior wall thickness	9.94	1.46

A fairly large percentage of patients had hyper-cholesterolaemia and hypertriglyceridemia; 41.3% men and 39.9% women had fasting serum cholesterol exceeding 200 mg/dl whereas 49% of both men and women had fasting serum triglycerides in the abnormal range. Low-density lipoproteins (LDL) were high in 24% and high-density lipoproteins (HDL) were abnormally low in 32% in each sex. It is to be noted that having low HDL constitutes a risk factor. Lipid abnormalities were particularly more common in those patients who were also diabetics. There was also a relationship between hypertension and weight. Only 28% of the individuals had ideal body weight. Rest had variable degrees of obesity, ranging from being slightly overweight to having morbid obesity, as determined from their BMI. A total of 49% individuals were either known diabetics or had their fasting blood sugar > 140 mg/dl or postprandial > 200 mg/dl. In the recent years left ventricular hypertrophy has also emerged as an independent risk factor over and above hypertension. In our study it was present in 26.4% and 40.3% of the study participants based on ECG and echocardiography respectively. A higher percentage of hypertrophy on echocardiography compared with electrocardiography is due to the fact that the later is a much more sensitive tool to detect hypertrophy. A summary of our results and their comparison with other available data is presented in Table 2 and Figure 1.

Table 2. Cardiovascular risk profile of hypertensive patients.

| Risk Factor	Male		Female		n=	
	No	%	No.	%	No.	%
Smoking	28	34.1	2	0.97	30	10
Diabetes mellitus	35	42.7	112	51.4	147	49
Hypercholesterolaemia >200mg/dl)	28	34.1	90	41.3	118	39.3
High LDL (>150 mg/dl)	20	24.4	51	23.4	71	24
Low HDL (>35 mg/dl)	26	31.8	70	32	96	32
High triglycerides (>150 mg/dl)	40	49	109	51	149	49.7
Obesity	36	44	112	51	148	49.3
Left ventricular hypertrophy (ECG)	7	2.3	17	5.7	24	7.9
Left ventricular hypertrophy (Echo)	24	8	55	8	79	26.3
Hyperuricaemia	27	32.7	95	43	122	40.3
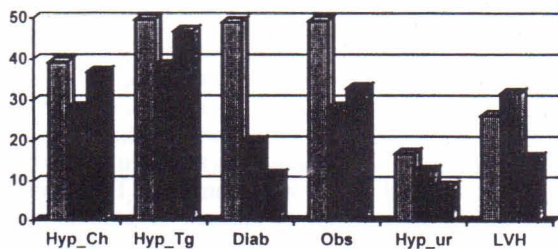
Fig. 1. Chart shows the incidence of various risk factors in hypertensive population in our own study in comparison with that of Yonga et al and Govalda et al.

Discussion

Hypertension is undoubtedly an important risk factor for coronary heart disease. Presence of other known risk factors multiplies the total risk rather than simply adding to it. In several studies it was observed that these risk factors, particularly diabetes mellitus, hyperlipidaemia, hyperuricaemia and obesity are more frequently seen in hypertensive patients compared to normotensive individuals. The exact link between hypertension and other factors is however not clear. Probably life style, diet, insulin resistant state or genetic factors are involved. What ever the explanation may be, for the clinician it is important that, in order to fully appreciate the benefits of treating hypertension, it is essential to diagnose these factors and treat them as 'multiple risk factors intervention strategy'. Our study showed that a total of 40% hypertensive patients had hypercholesterolaemia, 50% had hypertriglyceridaemia 24% had high LDL and 32% had low HDL. Disturbances in levels of plasma lipoproteins are known to occur in hypertension either as a primary defect, or secondarily as a result of antihypertensive treatment. In primary hypertension, the typical pattern consists of an elevation in levels of TG and VLDL and decrease in levels of HDL. The LDL is usually normal or at a slightly increased level.[9] For the purpose of comparison two studies are worth mentioning. First study was done by Yonga et al [10] on cardiovascular risk factor profile of 60 patients with mild to moderate hypertension. In this study the most prevalent cardiovascular risk factors were LVH (31.7%), obesity (28.3%)

Hyper-cholesterolaemia (28.3%) and diabetes (20%). In another study by Govalda[11] on 891 hypertensive patients gave the following results. Family history of high blood pressure was present in 53%, sedentary life style 52%, elevated blood cholesterol 37%, smoking 35%, obesity 33%, LVH 16% and diabetes mellitus in 11.7%. Both these studies, and our own data strongly suggest that hypertension is frequently associated with other cardiovascular risk factors. Results of our study are similar to those of Yonga and Govalda except that the prevalence of diabetes was much higher. Although some of these associated conditions may be caused by hypertension itself (e.g. LVH) [12] or its treatment (e.g. hyperuricaemia), or may be entirely unrelated (e.g. smoking) yet probably there is also a common genetic predisposition causing hypertension, diabetes, hyperlipidaemia, obesity and hyperuricaemia.[13] One such predisposition may be insulin resistance state[14] which can at least theoretically explain hypertension,[15] hyperlipidaemia,[16] obesity, and impaired glucose tolerance. The constellation of these factors has been given the name of syndrome X.[17] Other factors may also be involved. Whatever the explanation may be, it is important that every newly diagnosed hypertensive patient should be screened for such factors. Unless "multiple risk factors intervention strategy" is adopted the full benefit of treatment cannot be appreciated.

Conclusion

Hypertension is the most common cardiovascular risk factor. Other cardiovascular risk factors like diabetes mellitus, obesity, hypercholesterolaemia, smoking and physical inactivity are usually associated with hypertension. Association of these risk factors increases the chance for cardiovascular complication. Every newly diagnosed hypertensive patient should be screened for these risk factors. Since the objective of the treatment of hypertension is to reduce cardiovascular complications, treatment of the other conditions must be aimed to improve the individual cardiovascular risk.

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