Lipid Profile in Uncomplicated Non-Diabetic Hypertensives

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Abstract

Background- Many risk factors have been reported to be higher among hypertensive than normotensive subjects. This study was an effort to determine the prevalence and types of dyslipidemia among the hypertensive population.

Methods- This case-control study was performed on 1500 participants over 30 years of age between 1998 and 2001. The case group consisted of uncomplicated non-diabetic hypertensive patients, and the control group was composed of normotensive individuals. First a questionnaire containing demographic details, drug intake and smoking status was completed. Then physical examination, including systolic and diastolic blood pressure (SBP, DBP) and body mass index (BMI), was performed. Fasting blood sample was drawn for sugar (FBS), total cholesterol (TC), triglyceride (TG) and low and high density lipoprotein cholesterol (LDL-C and HDL-C). Data were analysed in SPSS V11 /Win by using t-test and Chi-square test.

Results- Mean age in the case and control groups was 51.03±18.7 and 50.84±19.3, respectively. TC and LDL-C levels were higher in the hypertensive population, and this just reached statistical significance. There were no significant differences in HDL-C and TG levels. LDL-C was also significantly higher in the female hypertensives as compared to the males and also in comparison with the controls. TG and HDL-C levels were not significantly different in either sex in the two groups. The overall prevalence of dyslipidemia was more than 75 percent in the case and nearly 70 percent in the control group. Hypercholesterolemia and high LDL-C were more prevalent in the case compared to the control group.

Conclusion- These results indicate that hypercholesterolemia and high LDL-C are the more common variety of dyslipidemia in uncomplicated hypertension and that we must consider primary and secondary prevention with life style modification and drug therapy in hypertensive patients ***(Iranian Heart Journal 2005; 6 (3): 64-69).***

Key words: lipid profile ■ hypertension ■ cholesterol ■ triglycerides

Hypertension is one of the most important modifiable risk factors for cardiovascular disease.[1] Available data from several Eastern Mediterranean countries indicate that hypertension is emerging as a considerable challenge to public health and an important cause of morbidity and mortality.[2] Other risk factors have been reported to be higher among hypertensive than normotensive subjects.[3]

Essential hypertension is being increasingly recognized as part of a complex multi-faceted disorder, which may include other abnormalities including dyslipidemia, central

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obesity, glucose intolerance and hyperinsulinemia, all of which may increase the risk of coronary heart disease.[4-6]

A few studies in Western populations have established the relationship between hyperlipidemia and hypertension.[7] Most studies on hypertension and dyslipidemia in Iran have focused only on their prevalence[8,9] or other coronary risk factors.[10] This study sought to determine the prevalence and types of dyslipidemia among the hypertensive population at Isfahan Cardiovascular Research Center.

Methods

This case-control study was conducted on 1500 participants over 30 years of age (600 stable, uncomplicated, non-diabetic hypertensives as the case group and 900 controls) who referred to Isfahan Cardiovascular Research Center between 1998 and 2001. The control group consisted of normotensive individuals that presented for various reasons other than major medical illnesses, which alter the lipid profile. At first, questionnaires consisting of such parameters as age, sex, height and weight, duration of hypertension, systolic and diastolic blood pressure (SBP, DBP) at the time of study, details of smoking habits and medication were filled out.

Trained physicians recorded BP according to the World Health Organization's (WHO) standard criteria.[11] BP was measured in the sitting position after a 10-minute rest, and the mean of three readings from the right arm was utilized in the analysis.

Individuals who were finally selected had a complete biochemical profile including fasting blood glucose, renal profile, serum electrolytes, urinalysis and ECG. Patients with any history of diabetes, renal impairment, drug intake (e.g. thiazides or beta-blockers, which are known to alter the lipid profile) or any evidence of target organ damage as defined in JNC VII were excluded from our analysis.[12] Patients either untreated at the time of assessment or using drugs not usually affecting the lipid profile were included in the study.

Blood samples were drawn after 12-14 hours of fasting. All the blood samples were analyzed in the central laboratory of Isfahan Cardiovascular Research Center, which is under the external quality control of St. Rafael University, Leuven, Belgium. Sera were separated and total cholesterol (TC) and triglyceride (TG) were assessed by an Elan 2000 autoanalyzer. Low-density lipoprotein cholesterol (LDL-C) was calculated by Friedwald formula in those with TG <400mg/dL.[13] High-density lipoprotein cholesterol (HDL-C) was determined by an enzymatic calorimetric method.

Hypercholesterolemia was defined as TC >240 mg/dL or intake of TC-lowering drugs. Hypertriglyceridemia was defined as fasting TG concentration >200 mg/dL or being on a TG-lowering treatment, and LDL-C level >160 mg/dL was abnormal.[14] Low HDL-C level was considered at lower than 40 mg/dL in men and 50 mg/dL in women.[15]

Hypertension was defined according to the JNC VII and WHO's guideline criteria: a systolic BP (SBP)>140 mmHg or a diastolic BP (DBP) >90mmHg or being on treatment.[11-12] Stage I (mild hypertension) was defined as a SBP between 140-159 mmHg or a DBP between 90-99mmHg. Stage II and III were defined as a SBP between 160-179 mmHg or a DBP between 100-109 mmHg, and a SBP ≥180 mmHg or a DBP ≥110 mmHg, respectively.[16]

Statistical Analysis

Data were analysed by means of SPSS V11/Win by using t-test for continuous data and Chi-square test for nominal data. P-value less than 0.05 was regarded as significant.

Results

There was no difference in the demographic data in both case and control groups (Table I). A higher proportion of the males in both the

hypertensive and control groups were smokers as compared to the females. The overall picture indicated that TC and LDL-C levels were higher in the hypertensive population, and this just reached statistical significance ($p<0.05$). There were no significant differences in HDL-C and TG levels (Table II).

Table I: General characteristics of hypertensives and controls

	Hypertensives	Controls	P.Value
Mean age	51.03±18.7	50.84±19.3	NS
Sex (Male)	475 (76.1 %)	676 (74.9 %)	NS
Obesity (BMI≥30)	260 (43.3 %)	381 (42.3 %)	NS
Males	235 (39.2 %)	345 (38.3 %)	NS
Females	337 (56.1 %)	494 (54.9 %)	NS
Smoking	101 (16.8 %)	145 (16.1 %)	NS
Males	133 (22.2 %)	193 (21.4 %)	NS
Females	3 (0.5 %)	3 (0.3 %)	NS

NS: not significant

Table. II: Mean lipid levels in hypertensives and controls by sex

Lipid profile	Hypertensives Mean±SD	Controls Mean±SD	P.Value
Total Cholesterol (mg/dl)			
Males	219.2±32.9	211.1±36.8	<0.05
Females	227.1±45.7	219.2±89.8	<0.05
All	221.8±36.5	213.1±47.6	<0.05
HDL Cholesterol (mg/dl)			
Males	45.3±12.8	46.2±13.2	NS
Females	49.1±13.2	49.8±12.3	NS
All	46.2±11.1	47.3±10.4	NS
LDL Cholesterol (mg/dl)			
Males	133.7±41.4	125.6±52.1	<0.05
Females	141.6±38.8	129.2±43.3	<0.05
All	135.6±42.0	127.7±47.9	<0.05
Triglyceride (mg/dl)			
Males	204.1±99.8	202.9±105.3	NS
Females	184.8±101.8	181.9±93.3	NS
All	197.9±101.2	195.6±107.7	NS

NS: not significant

Mean TC, HDL-C, LDL-C and TG levels were slightly higher in the female hypertensives as compared to the males, which was statistically significant ($p<0.05$). In comparison with the controls, the mean TC and LDL-C was significantly higher in the females and males of the case group ($p<0.05$). LDL-C was also significantly higher in females in the hypertensive group as compared to the males and also in comparison with the controls. TG and HDL-C levels were not significantly different in either sex in the two groups (Table II).

According to Table III, the overall prevalence of dyslipidemia was more than 75 percent in the case and nearly 70 percent in the control group. The most common abnormality was low HDL-C and hypertriglyceridemia, whereas these abnormalities were not statistically significant between the two groups. Hypercholesterolemia and high LDL-C were more prevalent in the case compared to the control groups ($p<0.05$).

With increasing severity of hypertension there was a steady and significant rise in the proportion of patients having high TC, LDL-C and low HDL levels. Triglycerides also showed a rising trend with more severe hypertension, but this was not significant (Table IV).

Table III. Prevalence of dyslipidemia in hypertensives and controls

Type	Hypertensives n(%)	Controls n(%)	P.Value
Hypercholesterolemia	181 (30.2)	238 (26.5)	<0.05
Low HDL Cholesterol	281 (46.8)	417 (46.3)	NS
High LDL Cholesterol	164 (27.3)	174 (19.3)	<0.05
Hypertriglyceridemia	239 (39.8)	344 (38.2)	NS
Normal lipid profile	146 (24.3)	291 (32.2)	<0.05

NS: not significant

Table IV. Level of hypertension and lipid profile

		Dyslipidemia			
Level of HTN	N (%)	Elevated Cholesterol N (%)	Elevated LDL-C N (%)	Low HDL-C N (%)	Elevated Triglyceride N (%)
Stage 1	478 (79.7)	130 (27.2)	115 (24.0)	204 (42.6)	183 (38.2)
Stage 2	91 (15.2)	40 (43.9)	36 (39.2)	50 (54.3)	35 (38.3)
Stage 3	31 (5.1)	16 (51.6)	15 (49.8)	24 (79.0)	13 (41.9)
Total		P< 0.05	P< 0.05	P< 0.05	P=NS

Discussion

This study attempted a comprehensive survey of lipid levels in uncomplicated essential hypertension. It was found that, overall, there was a significantly higher TC and LDL-C in the hypertensive population, although TG and HDL-C were not statistically different in the two groups in either sex. The females had higher levels of TC, HDL-C and LDL-C than the males; TG level was higher in the males than in the females in either group. The most significant abnormality was a much higher prevalence of hypercholesterolemia and high LDL-C in hypertensives. This was found in both the sexes. The TC and LDL-C levels showed a rising trend, and HDL-C levels tended to be lower with increasing severity of hypertension.

A study carried out on 3182 Indian hypertensive patients detected high TC and low HDL-C but no disturbance in LDL-C.[17] This study is in line with our study concerning TC. Nevertheless, contrary to our study, low HDL-C was more prevalent. Differences in diet, especially the common use of hydrogenated solid oil in everyday cooking in our society can raise LDL-C.[18] Modernization of life and inactivity in the whole population cause low HDL-C in our city, thus low HDL-C in both groups without significant differences was not far from expectation.[19]

Hypertension and hyperlipidemia occur together more often than it is expected by chance. There is some evidence that hyperlipidemia itself may predispose to hypertension and that lipid-lowering interventions may have a beneficial effect on blood pressure, or at least on vascular reactivity.[20] Hypertension and hyperlipidemia have a more than additive effect on cardiovascular risk, and it is important to consider them both along with other risk factors before embarking on drug therapy.[20] It has been found repeatedly in epidemiological studies that hypertension is often associated with lipid abnormalities as well as with type 2 diabetes, insulin resistance and obesity.[20, 21] Hypertension and dyslipidemia can occur together in the absence of diabetes, but insulin resistance may still be the underlying link. In a study in Tecumseh, Michigan, elevated TC, TG and insulin levels and low HDL-C levels were found in young subjects with borderline and white-coat hypertension.[22] The relationship between blood pressure and these metabolic risk factors was linear, as we witnessed it in our study.

It has been shown in other studies that evidence of a relationship between serum lipids and blood pressure can be found even after adjusting for confounding variables such as age and body mass index. A review of seven studies including over 41,000 subjects showed that significant correlations existed between blood pressure and high TC, LDL-C and TG.[23] This study is in line with our study, but TG in our study was not different in the two groups. One explanation is the exclusion of obese patients from our study.

The term familial dyslipidemic hypertension (FDH) was used by the late Roger Williams to describe some cohorts of patients in Utah. This suggested an association between hypertension and a syndrome of mixed lipid abnormalities, probably familial combined hyperlipidemia or dyslipidemia as a low HDL-C level was the most common abnormality.[24]

The pathophysiology leading to the typical dyslipidemia of the metabolic syndrome is quite well understood, but whether dyslipidemia more commonly precedes, follows or occurs simultaneously with the development of hypertension remains unclear.[20] Increased release of free fatty acids from adipose tissue, particularly from visceral fat into the portal veins, stimulates the production of triglyceride- rich lipoproteins in the liver with the release of more and larger VLDL particles. This in turn has effects on other lipoprotein particles, resulting in reduced levels of HDL-C.[5] Hyperinsulinemia may result in hypertension because insulin

can increase the sympathetic drive, promote sodium retention, alter membrane ion transport and stimulate vascular hypertrophy.[5] An alternative scenario, suggested by Julius and others, is that the hemodynamic changes in hypertension are the forerunners of insulin resistance.[25] As we did not measure insulin or resistance to it, we recommend that another study be performed to clarify this issue.

Whatever the precise mechanism of the underlying pathophysiology, it is generally thought to be a combination of genetic and environmental factors. Changes in the environment of modern society have allowed the expression of genetic susceptibility in populations with physical inactivity and weight gain.[26]

Our study indicates that dyslipidemia in a form as manifested by abnormal cholesterol fractions are not uncommon in hypertensives. Furthermore, blood sampling for measuring the lipid profiles of hypertensives is an essential part of managing them. We must encourage a change in the life style of hypertensives; a healthy diet and more physical activity will result in a healthier community.

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