

Original Article

Identifying relationship of lipid profile with hypertension among diabetic patients

Muhammad Ahmad Alamgir¹, Irum Alamgir², Shafique Aqil³, Masroor Ali Qazi³, Ali Imran³ Javeria Aslam¹ & Humanyun Hassan¹

¹Department of Medicine, Civil Hospital, Bahawalpur.

²Quaid-e-Azam Medical College, Bahawalpur

³Department of medicine, BVH/Quaid-e-Azam Medical College, Bahawalpur

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Corresponding Author Email:

alamgir916@yahoo.com

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Abstract

Background: Relevant literature suggests that hypertension (HTN) is commonly linked with lipid abnormalities among diabetics so management of dyslipidaemia may reduce the cardiovascular complications significantly. The study was aimed to evaluate whether dyslipidaemia was associated with HTN among type 2 diabetics.

Methodology: This hospital-based, observational, retrospective and comparative study was carried out from January 2018 to June 2018 in the medical outdoor department of Bahawal Victoria Hospital (BVH), Bahawalpur. The study sample was comprised of 50 normotensive diabetic patients as control (group A) and 50 diabetic subjects with HTN were labeled as group B. Comparative values of lipids were primarily observed between the two groups. Quantitative demographic data, blood pressure (BP) recordings, laboratory values of lipid and serum sugar levels were presented as percentage, mean and standard deviation accordingly. To determine statistical assessment, Statistical Package for the Social Sciences (SPSS) version 15 was used and Student t-test was applied to compare the means of two groups for lipoproteins with significance level at 5%.

Results: Analytic results of this study showed that hypertensive subjects (group B) had hyperlipidemia along with uncontrolled hyperglycemia as well. Among them, high-density lipoprotein cholesterol (HDL- C) was 32.73 ± 4.47 mg/dl while in normotensive control (group A) it was 39 ± 2.94 mg/dl. Same with the total cholesterol (TC) and triglycerides (TG), both lipoproteins were observed in greater concentrations among hypertensive patients as 194.68 ± 31.75 mg/dl and 196.05 ± 78.45 mg/dl respectively, compared to control (179.07 ± 38.61 mg/dl and 165.75 ± 48.80 mg/dl respectively). Hyperlipidaemia was defined according to guidelines for diabetic patients provided by the National Cholesterol Education Program /American Diabetes Association (NCEP/ADA).

Conclusion: It can be concluded from the study results that diabetics having HTN have more susceptibility towards hyperlipidemia when compared to the normotensive diabetic.

Keywords

Diabetes Mellitus, Hypertension, High-Density Lipoprotein Cholesterol, Total Cholesterol, Triglycerides



Introduction

Recently American Diabetic Association has estimated that 425 million people are living with diabetes globally and it is the leading cause of death due to non-communicable diseases every year¹. Diabetes claimed 1.6 million deaths in the year 2016, majority were attributable to cardiovascular complications and registered in underdeveloped countries².

A national survey revealed that over 27.4 million individual in Pakistan are suffering from type 2 diabetes and there is an overall 52.6% prevalence of high BP in the country while obesity and dyslipidaemia were most significantly associated risk factors³. In fact, the prevalence of diabetes (38.3%) and HTN (32.9%) is relatively increased in south Punjab region of Pakistan, obviously owing to ignorance, poverty, and reduced health care facilities⁴. Contemporarily, diabetes and HTN so commonly coexist in general population that logically it is termed as “co-morbidities”.

About half of diabetics have BP over 160/95 mmHg, while most authorities encourage level close to 130 mmHg for such individuals^{5&6}. There is cumulative evidence that diabetes substantially escalates the risk of cardiovascular complications and the normal glycemia along with optimal BP control failed to reduce the risk of macro-vascular events⁷. Some large epidemiological trials have a rational explanation in this regards and elaborated that HTN is associated with dyslipidaemia, frequently resulting with reduced life expectancy^{8,9&10}. Diabetic patients commonly have HTN, obesity and dyslipidemia with 2-4 folds more risk of atherosclerotic cardiovascular disease(ASCVD)^{9,10&11}. The literature shows that among diabetics, development of atherosclerosis and HTN is accelerated due to insulin resistance, associated

with derangement in lipoproteins components of TC values, TGs and HDL-C levels^{12&13}. "For timely prevention of ASCVD, customarily all hypertensive patients and diabetics should have their lipids measured", says 2013 American College of Cardiology/American Heart Association (ACC/AHA) Guidelines¹⁴.

United States organizations recommend that among individuals above the age of 20 years, screening of lipids should begin if cardiovascular risk factors like HTN exists¹⁵. For prevention of devastating consequences in hypertensive population, evidence-based research had a logical analysis that timely preferential treatment with lipid-lowering drugs had 36% reductions in the primary endpoints of nonfatal and fatal cardiovascular diseases and stroke along with reductions of secondary endpoints of all coronary events^{16&17}.

Hypertensive patients having diabetic dyslipidaemia are virtually harboring biological time bomb. Modern medicine has scientific evidence that preventive strategy of dyslipidaemia is tremendously rewarding^{8&10}. Although a lot of work had been carried out on lipids, their values may differ on basis of geographical and ethnic variations⁸. This paper seeks to assess the link of hypertensive diabetics with lipids in the south Punjab population and to compare their levels already determined by NCEP/ADA.

Methodology

In this retrospective and comparative study, medical and biochemical data were obtained from January 2018 to June 2018 in the medical outdoor department of BVH, Bahawalpur. Almost 50 normotensive diabetics as a control along with 50 diabetic patients with HTN were enrolled for study and were

labeled as group A and B respectively. As set per Declaration of Helsinki, an ethical protocol was followed. Formal consent was obtained followed by history and general physical examination. Exclusion criteria were subjects with secondary causes of dyslipidemia ex. hypothyroidism, nephrotic syndrome and pregnancy. Patients with a history of smoking, taking steroids, oral contraceptive pills or lipid-lowering drugs, were also excluded from the study.

By reviewing the patient's medical documents, anthropometric and socio-demographic records were obtained. Particularly HTN and use of drugs was noted. Systolic blood pressure and diastolic blood pressure was measured by using two readings in sitting position and the average was recorded. HTN was defined as SBP of 140 mm Hg or more, or DBP of 90 mm Hg or more. Body mass index (BMI) was calculated as normal (18.5-24.9 kg/m²), overweight (25-29.0 kg/m²) and obese if BMI ≥ 30 kg/m.

For a definition of diabetic dyslipidaemia, the National Cholesterol Education Program ATP III criterion was used. For diabetic patients with cardiovascular risk factors, high-risk lipid values were defined as TC ≥ 190 mg/dl, TG ≥ 150 mg/dl and HDL-C ≤ 40 mg/dl for males and ≤ 50 mg/dl for females¹⁸. The higher the HDL-C, beneficial it is. Fasting

lipid samples were centrifuged and their values were interpreted by ELIZA (Rendox Labs). Lipid parameters like TC, TG, and HDL-C were tabulated and computer software SPSS version 15 was used for analysis of collected data. Precipitation method was used for determination of HDL-C and for blood glucose level, the enzymatic color test was done on a spectrophotometer. All data were presented as frequency percentage for discrete measures and means ± SD for continuous measures. Student t-test was applied for statistical assessment of lipoprotein concentrations; the significance level chosen was $P < 0.05$.

Results

This study demonstrates distinctive demographic and metabolic features among type 2 diabetics and comparative status as shown in Table I. Among patients of group A, the mean glycemic level was 210.57 ± 101.6 mg% while the SBP was 135.71 ± 21.29 , DBP was 80.21 ± 13.38 mm/hg and the BMI was 26.01 ± 3.92 . In group B, results highlighted that the participants had SBP of 155 ± 25.72 mm/Hg (P -value = 0.0001), and diastolic was 90.6 ± 17.60 mm/Hg (P value = 0.0023) while the glycemic level was 246.64 ± 105.06 mg%, with statistical significance.

Table I: Data framework among subjects studied.

Variables	Normotensive (Group A)	HTN (Group B)	P value
SBP (mm/hg)	135.71 ± 21.29	155 ± 25.72	0.0001*
DBP (mm/hg)	80.21 ± 13.38	90 ± 17.60	0.0023*
Blood Glucose (mg/dl)	210.57 ± 101.6	246.64 ± 105.06	0.0841
BMI (Normal <25)	26.01 ± 3.92	29.21 ± 5.58	0.0013*

*Significant

HTN= Hypertension; SBP=Systolic Blood Pressure; DBP= Diastolic Blood Pressure; BMI=Body Mass Index

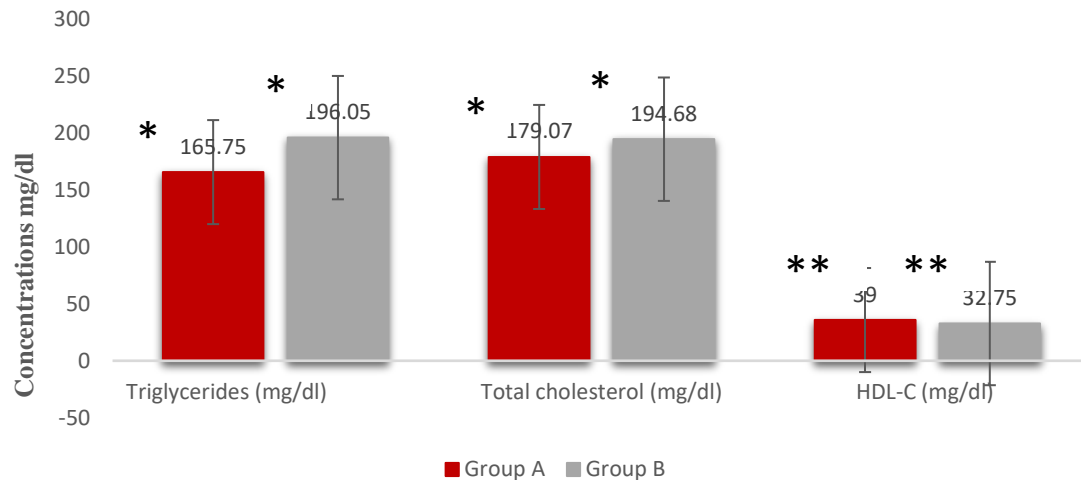


Figure I: Correlation of lipoprotein values according to groups

*Significant

** Highly Significant

HDL-C=High Density Lipoprotein Cholesterol; Group A= Normotensive; Group B= Hypertensive

As far as data of lipid profile is concerned, and it is worth pointing out that their concentrations were elevated in hypertensive subjects (group B). The concentrations of TG in this group was 196.95 ± 78.45 mg/dl (P-value=0.0226), the TC was 194.68 ± 31.75 mg/dl (P-value =0.0296) and HDL-C was 32.75 ± 4.47 mg/dl (P-value=0.0027) correspondingly, all values being significant. In the normotensive group A, the above mentioned lipoprotein concentrations of TGs, TC and HDL-C were 165.73 ± 48.80 , 179.07 ± 38.61 and 39 ± 2.94 mg/dl respectively. Figure I shows a bar chart presentation of lipoproteins values among both groups. Collectively hyperlipidaemia was seen in group B, as compared to normotensive control.

Discussion

Coexistence of dyslipidemia and HTN has been coined as lipitension and it is a well-known risk factor for the development of macrovascular complications among diabetics¹⁹. The evidence-based trials have shown that HTN was related to rising levels of lipids among diabetics and leads to a substantially increased prevalence of atherosclerotic cardiovascular diseases^{18&19}. The present study was aimed to investigate this paradigm. Since the uncontrolled hyperglycemia among our group B subjects is concerned, it is high time to consider reports of landmark Framingham epidemiological trial²⁰. They concluded that in diabetic individuals cardiovascular

risk factors and hypertension were observed with impaired glucose regulation and this relation was independent of other traditional cardiovascular risk factors²⁰. In these perspectives, Y Heianza and colleagues also reported similar observations after a 5-year follow-up study and presented multivariate-adjusted odds ratios with adjusted models²¹. They found that a high concentration of fasting plasma glucose was associated with more risk of developing hypertension (OR 1.35–1.39), after adjusting for age and gender²¹. The findings of a Pakistani study have shown the analogous effect. In his cross-sectional analytical study records of 2199 subjects, poor glycemic control was significantly

associated with hypertension and hypertriglyceridemia as well²².

In the current study, the condition hyperlipidaemia is defined by considering the cut off values provided by NCEP/ADA. The results shown in figure 1 are similar to the results reported by ES Idogun. Respectively comparing their lipid values of hypertensive subjects with the current study figures (Figure 1), both had higher plasma levels of TGs (178.3 ± 6.3 vs. 202.83 ± 31.8 mg/dl), and TC (232 ± 40 vs. 190.75 ± 14.4 mg/dl) while their HDL-C (32.86 mg/dl vs. 31.75 ± 3.8 mg/dl) was also in high-risk category²³.

As mentioned earlier, our study results (table I) concluded that the lipid values among the hypertensive subjects were high and these observations were in accordance with the findings of raised TC (212 ± 46 mg/dl), and TG (175.22 mg/dl) reported by Habib in his study²⁴. When compared with NCEP guidelines their above levels were reported to be raised, while HDL levels had no significant difference. Recently Aziz conducted 9000 patients' cohort in the USA and demonstrated unique significant correlations, associations and regression models between serum lipids results. He found that their values were higher among hypertensive patients (p value < 0.001)²⁵. It was evident from that the correlations between serum lipids with SBP and DBP (respectively) along with p -values were positively significant. Also, HDL-C was lower in hypertensive subjects (p -value < 0.001) with high-risk category²⁵. A *high-risk HDL* cholesterol level is described as one that is below 40 mg/dl as higher the HDL-C, beneficial it is. They narrated that for the first time in medical research, with the development of regression models, had analyzed the

contribution of high lipid levels to the development of increased blood pressure²⁵.

Another author Alam worked on small sample size but also reported a significantly increased level of serum total cholesterol ($P < 0.001$) in hypertensive type II diabetics as compared to normotensive diabetics²⁶. Though TG concentrations were also high in the former group as compared to later, it was not statistically significant. Serum HDL-C level was more in normotensive type II diabetes mellitus and it was in the low-risk category. Since coexistence of HTN and dyslipidemia (lipitension) is concerned, literature also verifies that atherogenic hyperlipidaemia exists among hypertensive patients and hyperlipidemia increases with increasing age, with the risk of cardiovascular diseases more prevalent in women than in men^{27&28}. Therefore in developing world real challenge exist in managing this risk factor.

For the same purpose of comparing the results of lipid profile (Table I), other researchers in Albania had observed that total cholesterol (195.83 ± 6.43) in the diabetic group of the participants with HTN were higher than the levels of those without HTN, the differences were not statistically significant. Although the group of the patients with HTN had statistically significant higher level of TG (207.48 ± 18.4 , $p = 0.001$) and lower level of HDL-C (41.05 ± 1.41 , $p = 0.04$) as well and both were in the high-risk category²⁹.

Nonreciprocal results were obtained by Pakistani authors³⁰. Comparing the mean values of lipoproteins among participants without HTN and those with poorly controlled blood pressure respectively, serum TC (181.08 ± 32.05 and 185.33 ± 35.55 mg/dl), TG (172.57 ± 80.53 and 183.19 ± 74.34 mg/dl), HDL-C (40.54 ± 12.36) were not significant³⁰. HTN did not worsen diabetic

dyslipidaemia. A possible explanation is that geographical locations, ethnicity and gender may alter the prevalence of CVD risk factors like hypertension and hyperlipidaemia may also be related to different socioeconomic status, lifestyles and smoking.

The above mentioned studies have made innovative and dynamic thinking that HTN and dyslipidemia commonly coexist. The study had a few limitations like multiplicative cardiovascular risk factors were not included because it was relying on further reanalysis of laboratory data.

Conclusion

The results confirmed potential interrelationship between HTN and hyperlipidaemia among diabetics. Health care providers should advise regular screening of lipids among the high-risk population and public education program is needed for lifestyle changes such as smoking cessation, heart-healthy diet along with more physical activity.

Conflicts of Interest

None.

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