Original Article

Significance of Type 2 Diabetes Mellitus in the Development of Peripheral Arterial Disease

Muhammad Ishaq*
Ghulam Jillani Khan**
Sibgha Zulfiqar***

**Assistant Professor, Department of Physiology, Bannu Medical College, Bannu*
***Associate Professor, Department of Physiology, Khyber Medical College, Peshawar*
****Professor/ Head, Department of Physiology, Sheikh Zayed, Federal Post-graduate Medical Institute,& Principal SZMC, Lahore*

Abstract

Objective: **To determine risk factors for peripheral arterial disease among patients with diabetic mellitus.**

Study Design: **Quasi experimental Study**

Place and Duration: **The study was conducted at the Department of Physiology, Sheikh Zayed Federal Post-graduate Medical Institute, Lahore from November 2008 to December 2010 .**

Materials and Methods: **A total of 150 patients, (age ≥40) with type 2 diabetes mellitus, were selected from the Diabetic Clinic, Cardiology Unit and Biochemistry Department of the Institute. The subjects were equally divided into uncomplicated (n=75) and complicated (n=75) groups. The blood samples of each subject were collected for various blood lipid parameters. The blood pressure of each patient (arm and ankle) was recorded with the help of an sphygmomanometer and a hand held Doppler to calculate his ABI (ankle brachial index).**

Results: **The total and LDL cholesterol in the complicated group were higher than in the uncomplicated group but the triglycerides and HDL cholesterol was in the reverse order. Among these, only the total cholesterol level was statistically significant (P<0.05). It was revealed that the HDL cholesterols level was inversely correlated with PAD.**

Conclusion: **The study confirms that aged and overweight complicated type 2 diabetic patients with low HDL cholesterol level are more vulnerable to develop peripheral arterial disease.**

Keywords: **ABI, Lipids, PAD, Type 2 Diabetes Mellitus**

Address for Correspondence

Dr. Muhammad Ishaq
Assistant Professor, Department of Physiology, Bannu Medical College, Bannu

Introduction

Diabetes mellitus is among the most prevalent diseases in the world, with a rapid increase in Asian populations in recent years.[1] In addition to cardiovascular disease, diabetes also predisposes to a variety of cancers.[2] The results of a survey, conducted in 199 countries and territories (1980 to 2008), concluded that glycemia and diabetes are rising globally. The survey estimated that the number of people with diabetes increased from 153 million in 1980 to 347 million in 2008. The researches claim that they recorded almost no change in mean FPG (fasting plasma glucose) in East and Southeast Asia, and Central and Eastern Europe.[3] It's an established fact that the cholesterol levels boost high in diabetes culminating in enormous health problems, including PAD (peripheral arterial disease) not only for the patient himself in particular but entire community in general. PAD, a major cause of disability, loss of work, and lifestyle changes in the United States, is defined as obstruction of blood flow into an arterial tree excluding the intracranial or coronary circulations. PAD is mostly silent in its early stages, but when lesion obstruction exceeds 50%, it may cause intermittent claudication with ambulation.[4] The disease is also designated as PVD (peripheral vascular disease), PAOD (peripheral artery occlusive disease) or with many other names. It is generally believed that raised triglycerides and cholesterol in the form of LDL (low density lipoproteins) and VLDL (very low density lipoproteins) are unfavorable but cholesterol in the form of HDL (high density lipoproteins) is favorable for health. Type 2 diabetes is associated with a cluster of interrelated plasma lipid and lipoprotein abnormalities, including reduced HDL, a predominance of small dense LDL particles, and elevated triglycerides.[5] About 30 years ago, the Framingham Heart Study established that individuals with diabetes have a two to three times higher risk of cardiovascular events than nondiabetic people.[6] Therefore the main purpose of the study was to identify the group of type 2 diabetes mellitus

(uncompleted or completed) more at risk to develop PAD in the population of Lahore, Pakistan.

Materials and Methods

The study was conducted at the Department of Physiology, Sheikh Zayed Federal Post-graduate Medical Institute, Lahore from 2008 to 2010 . A total of 150 subjects with age ≥40 were selected from the Diabetic Clinic, Cardiology Unit and Biochemistry Department of the Institute. The subjects were equally divided into uncomplicated (males = 32%, females = 68%) and complicated (males = 29%, females = 71%) type 2 diabetes mellitus groups. Patients on insulin therapy, with sever systemic disease or having a major surgery in the past 3 months were not included in the study. After approval from the Ethical Committee, each patient was briefed about the procedure and, after his consent, his blood samples were collected for various blood lipid parameters. The blood pressure of each patient (arm and ankle) was recorded with the help of an ordinary sphygmomanometer and a hand held Doppler to calculate his ABI (ankle brachial index). A criterion for the diagnosis of PAD was an ABI < 0.9 and may indicate varying degrees of atherosclerosis in the lower extremity arteries[7]. The weight of each subject was recorded bare footed and in light clothes to determine his BMI (body mass index). The BMI was calculated according to the formula; BMI = Body Weight in Kilograms / Square of Body Height in Meters. A patient suffered even from microalbuminuria (>200 µg/dl) was considered as a complicated case of diabetes mellitus. The data was analyzed on SPSS version 16.0 for statistical analysis.

Results

The results of the lipid profiles of the participants of the study are summarized in table I, which shows the comparison of mean values of one group with the corresponding mean values of the other to determine statistical significance between them.

Table I: Comparison of the lipid profiles of the participants of the two groups. The figure designated by * indicates significant P value (P<0.5).

Lipid Profile	Uncomplicated (Mean±SD)	Complicated (Mean±SD)	P Value
Triglycerides (mg/dl)	188±100.0	179.0±100.0	0.570
Total Cholesterol (mg/dl)	179.0±53.0	201.0±51.0	0.012
LDL Cholesterol (mg/dl)	107.0±42.0	119.0±41.0	0.099
HDL Cholesterol (mg/dl)	43.0±15.0	42.0±12.0	0.819

The total and LDL cholesterols in the complicated group were higher than in the uncomplicated group but the triglycerides and the HDL cholesterol was in the reverse order. The difference between the groups was not significant statistically (P>0.05) regarding all parameters except total cholesterol levels which showed a statistically significant difference (P<0.05). These findings signify that the patients with complicated type 2 diabetes mellitus at par with the patients of the uncomplicated type 2 diabetes mellitus are more prone to develop diabetic related anomalies.

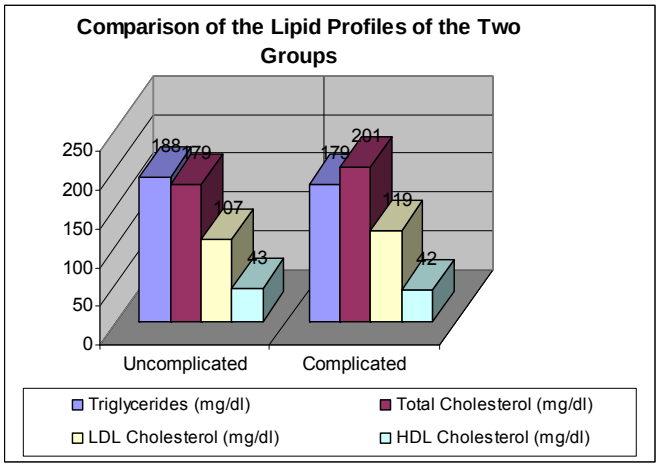

Figure1. Comparison of the lipid profiles of the participants of the study (table I) in graphic form to visualize the data.

In another event of the study, the triglycerides, total cholesterol and LDL cholesterol did not show any correlation but the HDL cholesterol showed a statistically significant inverse correlation with PAD. It was shown that age and body mass index were also clinically correlated with PAD but this was not significant statistically. These facts reveal that aged persons suffering from complicated type 2 diabetes and with low HDL cholesterol are at a greater risk to develop PAD.

Discussion

Peripheral Arterial Disease (PAD) is a highly prevalent atherosclerotic syndrome that affects approximately 8-12 million individual in the USA and is associated with significant morbidity and mortality.[8-12] Enough evidence is present to believe that diabetes mellitus accelerates atherosclerosis resulting in PAD of the distal limbs. Gangrene of the lower extremities, as a result of advanced vascular disease, is about 100 times more common in diabetics than normal population.[13] Therefore, the main focus of this study, too, was on the PAD of lower limbs in response to type 2 diabetes mellitus. In this disease plaque builds up in the arteries causing diminished blood supply to various body's

organs. Plaque is made up of fat, cholesterol, calcium, fibrous tissue, and other substances in the blood. There are many factors which increase the likelihood of PAD but diabetes mellitus, probably in this regard, top the list. The current study compares the uncomplicated and complicated type 2 diabetes mellitus patients to identify the group more vulnerable to develop PAD. The current study shows high levels of total and LDL cholesterols, and low levels of triglycerides and HDL cholesterol in the complicated group. However, among the lipid parameters, it was only the total cholesterol which showed a statistically significant difference. In our opinion the statistically insignificant lipid parameters do not mean a favorable provision for the complicated group, rather it is wise to presume that these raised factors, too, sound the alarm of danger for these individuals. We recorded low levels of triglycerides in the complicated group but we were unable to find any reasonable explanation for this finding. However, this fact may be worrisome for these persons because low levels of triglycerides might be associated with increased cancer risk.[14]

We determine correlation of age, BMI and lipid parameters with ABI to find out any association between them. It was only the HDL cholesterol which exhibited strong inverse correlation with worse ABI. With the type 2 diabetic patients' point of view, this is a worsened condition for them because in a study it was reveled that lower HDL cholesterol levels are associated with worse ankle brachial index.[15]

Conclusion

This study reveals that aged and overweight complicated type 2 diabetic patients with low HDL cholesterol are more vulnerable to develop peripheral arterial disease.

References

1. Chan JC, Malik V, Jia W, et al. Diabetes in Asia: epidemiology, risk factors, and pathophysiology. JAMA 2009;301: 2129-2140
2. Jee SH, Ohrr H, Sull JW, et al. Fasting serum glucose level and cancer risk in Korean men and women. JAMA 2005;293: 194-202
3. Danaei G, Finucane MM, Lu Y, et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. Lancet 2011;378(9785): 31–40.
4. Garcia LA. Epidemiology and pathophysiology of lower extremity peripheral arterial disease. J Endovasc Ther 2006;13: II3-9
5. American Diabetes Association. Management of dyslipidemia in adults with diabetes (Position Statement). Diabetes Care 2003;26 (Suppl.1): S83-S86
6. Kannel WB, McGee DL. Diabetes and cardiovascular risk factors: the Framingham Study. Circulation 1979;59: 8-13
7. Lim PS, Chen TT, Yang SM, Chin SW, et al. Prevalence and clinical correlates of peripheral arterial disease in hemodialysis patients. Acta Nephrologica 2006;20(1): 113-120
8. Criqui MH, Fponek A, Barrett-Conner E, Klauber MR, Gabriel S. The prevalence of peripheral arterial disease in a defined population. Circulation 1985;71: 510-15
9. Criqui MH, Denberg JO, Langar RD, Fronek A. The epidemiology of peripheral arterial disease; importance of identifying the population at risk. Vasc Med 1997;2: 221-26
10. Meijer WT, Hoes AW, Rutgers D, Bots ML, Hofman A. Peripheral arterial disease in the elderly: the Rotterdam Study. Arterioscler Thromb Vasc Biol 1998; 18: 18
11. Fowkes FG, Housley E, Cawood EH, Macintyre CC, Ruck CV. Edinburgh artery prevalence of asymptomatic and symptomatic peripheral arterial disease in the general population. Epidemiol 1991; 20: 384-92
12. Halperin JL. Evaluation of patient with peripheral vascular disease. Thrombosis Research 2002;106: 303-11
13. Maitra A and Abbas AK. The endocrine system. In Kumar, Abbas and Fausto (Eds). Robbins and Cotran, Pathologic Basis of Disease (7th Edn). The Curtis Center, 170 Independence Mall, W 300 E, Philadelphia, Pensylvania. 2004:1155-1226
14. Yang X, Ronald CW, So WY, et al. Low triglyceride and nonuse of statins is associated with cancer in type 2 diabetes mellitus. Cancer 2011;117: 862–71
15. Mauer K, Exaire EJ, Stoner JA, Guthery LD, et al. Reduced High-Density Lipoprotein Level is Linked to Worse Ankle Brachial Index and Peak Oxygen Uptake in Postmenopausal Women with Peripheral Arterial Disease. Angiology 2010; 61(7): 698–704