Research Article

Pattern of peripheral arterial disease and serum lipid profile in patients with diabetes mellitus

Hiren P Pandya, Prashant M Bhansali

Department of Medicine, AMC MET Medical College, Ahmedabad, Gujarat, India.
Correspondence to: Hiren P Pandya, E-mail: drhirenpandya@yahoo.com

Received December 3, 2014. Accepted February 25, 2015

Abstract

Background: Diabetes mellitus is rapidly rising. Majority of patients with diabetes mellitus also have dyslipidemia [diabetic dyslipidemia (DD)]. DD has been found to be associated with increased risk of peripheral arterial disease (PAD).

Objective: To use ankle-brachial index (ABI) to evaluate the prevalence of PAD and to identify the associated risk factors and their level of control in patients with diabetes mellitus.

Materials and Methods: This cross-sectional study was carried out in tertiary-care teaching hospital of Gujarat. People attending diabetes clinics were screened for PAD by measuring their ABI. In addition, their medical records were reviewed for PAD risk factors, including age, smoking, blood pressure, glycated hemoglobin, and lipid profile. Association between serum lipid profile and PAD was analyzed.

Result: Total 50 patients were enrolled in this observational study. Of these, 16 were (32%) women and 34 (68%) were men aged 25–72 years. Of total 50 patients, 19 (38%) had positive history of smoking and 1 (2%) had history of alcohol consumption. More than two-thirds of the participants had HbA1c >10%. On analysis of PAD, 41 patients were found to have ABI > 1, and their total cholesterol, triglyceride, and low-density lipoprotein (LDL) were noted to be higher than those for patients having ABI < 1, which was statistically significant ($P < 0.05$).

Conclusion: The study showed that PAD is highly prevalent among people with diabetes mellitus. Increased level of total cholesterol, triglyceride, and LDL was positively associated with the development of PAD.

KEY WORDS: Ankle-brachial index, diabetes mellitus, LDL peripheral arterial disease, total cholesterol, triglyceride

Introduction

Lifestyle diseases are constantly rising in India due to rapid urbanization with decreased physical activity. Type 2 diabetes mellitus is rapidly becoming one of the most important causes of mortality in both developing and developed countries and significantly affects the economy.[1]

Access this article online	
Website: http://www.ijmsph.com	Quick Response Code:
DOI: 10.5455/ijmsph.2015.03122014217	

Cardiovascular (CV) deaths are the most common cause of mortality in diabetes mellitus and India is one of the leading countries with one of the highest number of patients with diabetes mellitus. Patients with diabetes mellitus who have been identified with peripheral arterial disease (PAD) are more prone to the sudden ischemia of arterial thrombosis.[2]

Diabetes mellitus is associated with high risk of cardiovascular diseases and PAD when compared to those without diabetes mellitus. Hence, physicians should aggressively manage all CV risk factors in people with diabetes mellitus.[3]

Dyslipidemia is one of the most important risk factor for PAD that co-occurs with type 2 diabetes mellitus in more than 70% patients and the typical pattern of dyslipidemia is known as diabetic dyslipidemia. PAD is a common complication of both type 1 and type 2 diabetes mellitus. PAD occurs earlier in individuals with diabetes mellitus than in those without it, which is often more severe and diffuse.[4]

This was carried out at tertiary-care teaching hospital of Gujarat to evaluate the pattern of PAD in individuals with diabetes mellitus and its relation with lipid profile.

Materials and Methods

In this study, patients were randomly selected from different wards and the outpatient department of the Shree Krishna Hospital, Karamsad, Gujarat, India. Patients admitted for control of diabetes mellitus, freshly diagnosed diabetes mellitus, and those with known diabetes mellitus admitted with other diseases or complications such as ischemic heart disease, tuberculosis, or diabetic foot were analyzed for demographic profile, lipid profile, glycemic parameter, and ankle-brachial index (ABI).

All the patients were studied by taking detailed history and physical examination. Patients were also examined for evidence of hypercholesterolemia. The findings were reordered in a prepared pro forma to avoid any omission. Fifty cases were studied from February 1990 to November 2000. Only patients willing to participate were included in the study.

Blood samples collected were analyzed for serum cholesterol, serum triglycerides, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C; indirect), very low density lipoprotein cholesterol (VLDL-C), total cholesterol (TC)/HDL, LDL/HDL, HbA1c, and ABI.

Noninvasive Evaluation for PAD: Ankle-Brachial Index

ABI is noninvasive measurement for the detection of PAD and the determination of disease severity. The ABI is defined, as noted previously, as the ratio of the systolic blood pressure in the ankle divided by the systolic blood pressure at the arm.

The tools to perform the ABI measurement include a handheld 5–10 MHz Doppler probe and a blood pressure cuff. The ABI is measured by placing the patient in a supine position for 5 min. Systolic blood pressure is measured in both arms, and the higher value is used as the denominator of the ABI. Systolic blood pressure is then measured in the dorsalis pedis and posterior tibial arteries by placing the cuff just above the ankle. The higher value is the numerator of the ABI in each limb.[5]

An ABI value of >1.0 suggests poorly compressible arteries at the ankle level due to the presence of medial arterial calcification. ABI was performed as a screening procedure in all enrolled patients. There may be errors in the evaluation of the individual patient and that the reliability of any diagnostic test is dependent on the prior probability of disease (Bayes' theorem).[6]

Results

Of 50 patients, 16 were (32%) women and 34 (68%) were men aged from 25 to 72 years. Of the total patients, 17 (34%) were >60 years, 16 (32%) were between 50 and 60 years, 9 (18%) were between 40 and 50 years, 6 (12%) were between 30 and 40 years, and only 2 (4%) were between 20 and 30 years of age.

Of the 50 patients enrolled, 39 (78%) were on oral hypoglycemic drugs, 7 (14%) were on insulin, and 4 (8%) were on insulin and oral hypoglycemic agents. Of these patients, 34 (68%) were regularly taking drugs whereas 16 (32%) were on irregular treatment. Majority of the patients had a BMI of less than 25 kg/m^2 and 16 (32%) had a BMI of more than 25 kg/m^2.

Positive family history of diabetes mellitus was found in 7 (14%) and that of hypertension in 11 (22%) patients with diabetes mellitus whereas 36 (72%) patients had negative family history. Majority of the patients (31, 62%) had no history of smoking or alcohol consumption, 19 (38%) had positive history of smoking, and 1 (2%) had history of alcohol consumption.

Laboratory results showed a mean fasting blood sugar of 174 mg/dL and postprandial blood sugar of 264 mg/dL. More than two-thirds (33, 66%) of the participants had HbA1c of >10% and the rest 17 (34%) had HbA1c of <10%.

PAD was defined as presence of at least two of the following factors: ABI < 1, absence of both dorsalis pedis and posterior tibial pulses at palpation in one or both legs, and intermittent claudication.

On analysis of ABI among patients with diabetes mellitus, of 50 patients, 9 (18%) were found not to have PAD (ABI < 1) and their lipid profile was within normal range, whereas 41 (82%) were found to have ABI of >1, and on comparative analysis of lipid profile, their TC, triglyceride, and LDL were significantly higher than those of patients having ABI of <1 ($P < 0.05$) [Tables 1 and 2].

Discussion

PAD is a common CV complication in patients with diabetes mellitus. In contrast to PAD in individuals without diabetes mellitus, it is more prevalent and, because of the distal territory of vessel involvement and its association with peripheral neuropathy, it is more commonly asymptomatic.[6]

Common clinical findings as absence of peripheral pulses and presence of claudication are inadequate diagnostic indicators in diabetes mellitus. But it can be detected at early stage by ABI analysis. The true prevalence of PAD in people with diabetes mellitus is difficult to determine, as the majority of patients is asymptomatic or does not report their symptoms, and pain perception may be attenuated by the presence of peripheral neuropathy.[6]

In the United Kingdom Prospective Diabetes Study (UKPDS), 1.2% of nearly 5000 individuals with newly diagnosed type 2 diabetes mellitus had PAD at the time of diagnosis. Prevalence increased to 12.5% by 18 years of duration of diabetes mellitus.[7]

Compared with an assessment of pulses or a medical history, the ABI has been found to be more accurate. It has been validated against angiographically confirmed disease and found to be 95% sensitive and almost 100% specific.[8]

Table 1: Lipid profile for ABI* < 1

N = 9	Cholesterol	Triglyceride	HDL	VLDL	LDL	TC/HDL	LDL/HDL
Mean (mg/dL)	167.76	139.44	36.11	43.11	88.33	4.68	2.9
SD	33.71	86.05	4.85	47.76	37.98	0.93	0.95
SE	11.23	28.68	1.16	15.92	12.66	0.31	0.32

ABI, ankle-brachial pulse index; HDL, high-density lipoprotein; VLDL, very low density lipoprotein; LDL, low-density lipoprotein; TC, total cholesterol.

Table 2: Lipid profile for ABI* > 1

N = 41	Cholesterol	Triglyceride	HDL	VLDL	LDL	TC/HDL	LDL/HDL
Mean (mg/dL)	188.49*	187.44*	38.98	44.68	109.12*	5.11	3.01
SD	61.25	140.89	12.5	37.15	56.93	1.87	1.87
SE	9.57	22.01	1.95	5.8	8.86	0.29	0.29
T	2.54	2.55	1.13	0.28	2.7	1	0.25
P	<0.05	<0.05	>0.05	>0.05	<0.05	>0.05	>0.05
Inference	S	S	NS	NS	S	NS	NS

ABI, ankle-brachial pulse index; NS, not significant; HDL, high-density lipoprotein; VLDL, very low density lipoprotein; LDL, low-density lipoprotein; TC, total cholesterol.
*S, significant.

In studies using only the ABI as screening technique for PAD, prevalence of PAD in patients with diabetes mellitus ranges from 20% to 30%,[9] whereas in our study 41% patients were having PAD.

Dyslipidemia is closely associated with diabetes mellitus, and typical pattern of dyslipidemia in individuals with diabetes mellitus is commonly referred to as diabetic dyslipidemia. Even in this study we have observed that ABI was higher in patients with diabetes mellitus having higher serum triglyceride, TC, or LDL. This is mostly due to the insulin resistance because of which the hormone-sensitive lipase in adipose tissue is not inhibited postprandial, leading to high levels of free fatty acid and subsequently high triglycerides.[10]

Several studies have shown high serum triglycerides associated with insulin resistance.[11] Thus, as evidenced in this study, it is important to address both insulin resistance and high triglycerides.

Conclusion

The study concluded that there is high prevalence of PAD among people with diabetes mellitus, which shows positive association with modifiable risk factors such as increased triglyceride, total cholesterol, and LDL-C with management of diabetes mellitus.

References

1. Murray CJ, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: Global Burden of Disease Study. Lancet 1997;349(9064):1498–504.
2. Morrish NJ, Wang SL, Stevens LK, Fuller JH, Keen H. Mortality and causes of death in the WHO Multinational Study of Vascular Disease in Diabetes. Diabetologia 2001;44(Suppl 2):S14–21.
3. Harper W, Clement M, Goldenberg R, Hanna A, Main A, Retnakaran R, et al. Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada: pharmacologic management of type 2 diabetes. Can J Diabetes 2013;37 (Suppl 1):S61–8.
4. Vinik A, Flemmer M. Diabetes and macrovascular disease. J Diabetes Complications 2002;16:235–45.
5. Strandness DE Jr, Bell JW. Peripheral vascular disease: diagnosis and evaluation using a mercury strain gauge. Ann Surg 1965;161(Suppl 4):1–35.
6. Clark N. Peripheral arterial disease in people with diabetes. Diabetes Care 2003;26(12):3333–3341.
7. Adler AI, Stevens RJ, Neil A, Stratton IM, Boulton AJ, Holman RR. UKPDS 59: hyperglycemia and other potentially modifiable risk factors for peripheral vascular disease in type 2 diabetes. Diabetes Care 2002;25:894–9.
8. Bernstein EF, Fronek A. Current status of non-invasive tests in the diagnosis of peripheral arterial disease. Surg Clin North Am 1982;62:473–87.
9. Marso S, Hiatt R. Peripheral arterial disease in patients with diabetes. J Am Coll Cardiol 2006;47:921–9.
10. Selby JV, Peng T, Karter AJ, Alexander M, Sidney S, Lian J, et al. High rates of co-occurrence of hypertension, elevated low-density lipoprotein cholesterol, and diabetes mellitus in a large managed care population. Am J Manag Care 2004; 10(2 Pt 2):163–70.
11. Mooradian AD. Dyslipidemia in type 2 diabetes mellitus. Nat Clin Pract Endocrinol Metab 2009;5:150–9.

How to cite this article: Pandya HP, Bhansali PM. Pattern of peripheral arterial disease and serum lipid profile in patients with diabetes mellitus. Int J Med Sci Public Health 2015;4:1046-1048

Source of Support: Nil, **Conflict of Interest:** None declared.