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A Study on The Prevalence And Risk Factors Associated with Peripheral Vascular Disease In Type2 Diabetes Mellitus

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Abstract
Context: *Although Diabetic Peripheral Neuropathy and Peripheral Vascular Disease (PVD) both contribute to the development of diabetic foot, the risk of amputation raises steeply only if there is associated PVD . Hence the importance lies in identifying the risk factors responsible for the development of PVD in type 2 diabetes, and in active screening for PVD in all diabetic subjects.*
Aim Of The Study
1.To investigate the prevalence of PVD among type 2 diabetes patients.
2.To assess the risk factors associated with development of PVD.
3.To correlate the prevalence of cardiovascular risk factors and vascular complications of type 2 diabetes with abnormal ankle brachial index (ABI<1)
Settings And Design : *cross sectional observational analytical study*
Materials and Methods*:112 randomly chosen type 2 diabetic subjects attending GovernmentRajaji Hospital, Madurai, Diabetology department OP have formed the study sample.*
All patients underwent a fasting blood sugar,lipid profile,Urea,creatinine,urine albumin screening,dilated fundus examination,ECG,Echocardiogram and ABI estimation
Statistical Analysis: *Mean,standard deviation,correlation coefficient*
Results : *Prevalence of peripheral vascular disease is about 18% in the present study. About 50% of the PVD patients are totally asymptomatic . Central obesity, Uncontrolled hyperglycaemia, hypertension, high LDL cholesterol, high triglycerides, low-HDL cholesterol and smoking are the modifiable risk factors associated with development of PVD. Advancing age and male gender were found to be the non modifiable risk factors.*
Concordance rate for co-morbid CAD was very high (>50%) in PVD patients . Low ABI is associated with cardiovascular complications.
Conclusion: *ABI is a good indicator of underlying complications of diabetes mellitus, particularly PVD and CAD. ABI estimation is a non invasive cheap, bed-side, and rapid test with a high degree of validity and predictive power Hence, ABI estimation should be done for all diabetic patients annually.*
keywords: d*iabetes, peripheral vascular disease, ankle brachial index*

I. Introduction

Peripheral vascular disease (PVD) is one of the significant Macro vascular complication of type 2 diabetes mellitus. Peripheral vascular disease assumes importance, for prevention of morbidity and mortality related to diabetic foot. Further the importance of PVD assessment assumes importance in the light of a long duration of asymptomatic period in the natural course of the disease. The avenues for development of claudication symptoms of PVD in today's fast changing sedentary life style of the people are restricted, and hence the importance of active screening for the same with special emphasis on ankle – Brachial index gains importance for saving the limbs of Diabetic patients.

II. Materials And Methods

Study Group: 112 randomly chosen type 2 diabetic subjects attending Government Rajaji Hospital,Madurai, Diabetology department OP

Exclusion criteria:

1. Clinical evidence of thromboangitis obliterans.
2. Suspected arteritis subjects.
3. Patients suffering from hypercoagulable states including heamotologic diseases.
4. Hypothyroidism
5. Collagen vascular disorders
6. Valvular heart disease

III. Study Design

Cross sectional observational analytical study.
Ethical committee approval: obtained

Study protocol.

Patients were interviewed with special note on elicitation of history regarding symptoms of PVD.Duration of diabetes and hypertension, anthropometric measurements and the body-mass index , Waist-hip ratio and blood pressure was also recorded. An comprehensive physical examination was done and findings recorded. Special importance was given to foot examination. Peripheral neuropathy assessment was done using simmel-weiss monofilament testing and timed vibration sense perception recordings. Symptoms of peripheral neuropathy were also noted. Screening for coronary artery disease was done by resting ECG,ECHO and in equivocal cases with treadmill ECG Screening for Cerebrovascular disease was done with clinical carotid pulse,bruit examination and history of TIA and stroke All patients underwent a fasting blood sugar,lipid profile,Urea,creatinine,and urine albumin screening Dilated fundus examination was done by an ophthalmologist Method of peripheral vascular disease detection and assessment done by recording of ankle-brachial index Screening of diabetic nephropathy, retinopathy, coronary and cerebrovascular disease were also done.

IV. Statistical Analysis

The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using Epidemiological Information Package (EPI 2002).
Using this software, range, frequencies, percentages, means, standard deviations, chi square and 'p' values were calculated. Kruskul Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

V. Results

Prevalence Of Peripheral Vascular Disease

The total number of cases studied were 112. The prevalence of peripheral vascular Disease, as screened by Doppler ankle Brachial systolic pressure index was 17.9% (n = 20)

Age Distribution of PVD

The age of patients studied ranged from 31 years to 80 years with a mean age of 58.8 years + / - 10.5 S.D. fairly depicting the age group of type 2 diabetic subjects.

Age and severity of PVD

Severity of PVD	Age in years	
	Mean	S.D.
Mild	44.8	7
Moderate	63.7	5.1
Severe	67	8.1
'p'	0.0021 Significant	

The mean age of the group with PVD is 58.9 years + / - 11.3 S.D. The progressive rise in prevalence of PVD with advancing age was statistically significant with a P value of 0.0148

Sex Distribution

Males constituted 58% (n = 65) and females 42% (n = 47) of the study group, Prevalence of PVD was 20% among the males (n = 13) and 14.9% among the females (n = 7). But the male sex preponderance was not statistically significant (P = 0.6553).

Severity of PVD	Sex			
	Male		Female	
	Mean	SD	Mean	SD
Mild ABI 0.80 < 1	4	66.7	2	33.3
Moderate ABI 0.6 to 0.8	5	55.6	4	44.4
Severe	4	80	1	20

ABI < 0.6				
ABI Mean S.D.	0.67 0.18		0.75 0.14	
'p'	0.2495 Not Significant			

There was no correlation between sex and severity of progression of PVD, as indicated by mean ABI values comparison. (P = 0.249

Smoking

41.5% of male patients (N = 27) were smoking in the study group. The duration of smoking ranged from 5 - 35 pack years. There was no smoking in the female sub – set. Smokers had more than four fold increased risk of having PVD compared with non – smokers. ABI was less than 1 in 37.04% of the smokers (n = 10) and whereas it was 7.89% among the non – smoking males. (n = 3), which was statistically significant (P = 0.0098) There was a positive linear correlation between the duration of smoking (In pack - years) and risk of development of PVD

Relationship between Smoking among males (65)and PVD

Hypertension And Smoking

Smokers among Hypertensive Diabetic males had 58.3% prevalence of PVD (ABI < 1) compared to 14.3% among non – smoking Hypertensive Diabetic males (P=0.0164) Thus Smoking is an strong additional risk factor for peripheral vascular disease in hypertensive individuals. Similarly, in the PVD sub – group the mean ABI of Normotensive smokers was 0.85 +/- 0.12 S.D, while that of hypertensive smokers was 0.58 +/- 0.15 S.D. (P=0.0304) Thus, the presence of hypertension in a smoker, significantly increases the risk of peripheral vascular disease.

Association of Hypertension and Smoking with PVD

Among patients with Hypertension(33)	**PVD**			
	Present		**Absent**	
	No.	**%**	**No.**	**%**
Smokers (12)	7	58.3	5	41.7
Non smokers (21)	3	14.3	18	85.7
'p'	**0.0164 Significant**			

Dyslipidaemia And Pvd

Relationship between FPG, Dyslipidaemia and PVD.

Variable	**Value for Cases with PVD**				**'p'**
	Present		**Absent**		
	Mean	**SD**	**Mean**	**SD**	
F.P. Glucose	173.6	34.9	151.8	36.3	**0.006 Significant**
LDL	136.1	10.4	121.6	16.2	**0.0001 Significant**
HDL	30.5	4.7	34.7	6.1	**0.0009 Significant**
TGL	197.5	43.7	157.8	29.7	**0.0001 Significant**

Variable	**Cases**				**'p'**
	With PVD		**Without PVD**		
	No	**%**	**No**	**%**	
Smokers (27)	10	37.04	17	62.96	**0.0098**
Non Smokers (38)	3	7.89	35	92.11	

Symptomatic And Asymptomatic Pvd

Symptoms of PVD in the form of intermittent claudication, foot ulcers past and present, were present in 50% of the patients with PVD (ABI <1)

Symptoms of intermittent claudication and PVD.

Variables	Cases				'p'
	With PVD		Without PVD		
	No.	%	No.	%	
Symptoms					
Symptomatic (11)	10	90.9	1	9.1	**0.0001 Significant**
Asymptomatic 101)	10	9.9	91	90.1	

Relationship Between Other Quantitative Variables And Pvd

Variables	Cases				'p'
	With PVD		Without PVD		
	No.	%	No.	%	
CEVD					
Present (7)	**5**	**71.4**	**2**	**28.6**	**0.0019 Significant**
Absent (105)	**15**	**14.1**	**90**	**85.7**	
CAD					
Present (23)	**12**	**52.2**	**11**	**47.8**	**0.0001 Significant**
Absent (89)	**8**	**9**	**81**	**91.0**	
Nephropathy					
Present (8)	**6**	**75**	**2**	**25**	**0.0004 Significant**
Absent (104)	**14**	**13.5**	**90**	**86.5**	
Fundus					
Abnormal (26)	**11**	**42.5**	**15**	**57.7**	**0.0006 Significant**
Normal (86)	**9**	**10.5**	**77**	**89.5**	
Neuropathy					
Present (86)	**18**	**20.9**	**68**	**79.1**	**0.1524 Not Significant**
Absent (26)	**2**	**7.7**	**24**	**92.3**	

Variable	Value for Cases with PVD				'p'
	Present		Absent		
	Mean	SD	Mean	SD	
BMI	**25.33**	**1.67**	**24.64**	**2.37**	**0.0221 Significant**
WHR	**0.92**	**0.08**	**0.86**	**0.1**	**0.0014 Significant**
Duration of DM (in years)	**11.47**	**7.58**	**7.49**	**5.72**	**0.0304 Significant**
Duration HT (in years)	**10.83**	**7.79**	**5.87**	**4.75**	**0.0165 Significant**

Relationship Of Diabetic Complications And Pvd

VI. Discussion

Prevalence

Prevalence of peripheral vascular disease in this study was 17.9% which was comparable to the prevalence as described in other studies. Meijer etal in a meta analysis has presented age and gender adjusted

results of the prevalence of PVD ranging from 5.5% to 26.7% Thus, it is to be noted that PVD is a significant complication of type 2 diabetes

Symptomatic And Asymptomatic Pvd :

The symptoms of intermittent claudication is seen only in 50% 0f the patients affected with PVD in this study. It is comparable with other studies, where the prevalence of symptoms among PVD patients was only approximately 50% (2). This may be due to

i. Modern age sedentary life-style.
ii. Many elderly patients not walking far enough to experience symptoms of intermittent claudication.
iii. co-existing neuropathy masking pain sensation.

Since, many of the patients with PVD are asymptomatic it's vital for active screening with ABI in all type 2 Diabetic Subjects.

Sex distribution :

The prevalence of PVD was 20% among males and 14.9% among females in the study group. Diabetes seems to repeal the protective effect of female gender on PVD when compared to non diabetics as seen in other epidemiological studies (3). The higher prevalence among males could be partially due to smoking.

Aging and pvd :

As the age advances, the prevalence and risk of development of PVD increases and in this study, age adjusted prevalence rates, show a linearly progressive raising trend, and the highest prevalence was found among the geriatric age group.

Several epidemiological studies have shown a similar raising trend, proportionate to the advancing age (5, 30, 31). Thus it's to be noted that aging is an unmodifiable risk factor for PVD

Waist hip ratio and bmi :

Waist hip ratio and BMI were higher for the PVD sub set, indicating that intra abdominal adiposity in general has a important role in cardio-vascular diseases including PVD.

Hyperglycaemia and pvd :

As the duration of diabetes increased, the risk of PVD increased in the study group. Tight glycaemic control in general reduces peripheral arterial disease and risk of amputation.

Hypertension And Pvd

Hypertension associated with diabetes raised the risk of PVD, nearly three fold in the study subjects. Another interesting observation noted in the study group was that the duration of hypertension also significantly correlated with the risk of PVD.

Smoking and pvd :

In the study group, smokers had more than four fold increased risk of having PVD, compared to non-smokers. Thus smoking was found to be the single most important risk factor in comparison to other risk factors. A multivariate analysis by kannel, identified smoking as the strongest risk factor for development of PVD (16)

In this study, smoking in a diabetic hypertensive exponentially increased the risk of PVD. Smoking is the single most modifiable risk factor and hence smokers must be actively counselled for cessation of smoking.

Dyslipidaemia and pvd :

In the study group, LDL cholesterol and serum triglycerides was relatively higher for PVD subset and the HDL cholesterol was low. The cardiovascular health study and the Edinburg artery study reported higher prevalence of PVD in association with higher LDL, and lower HDL cholesterol in multiple logistic regression analysis (17, 18).

Thus, it's evident that even relatively mild increase in LDL – cholesterol, coupled with high serumtriglycerides and low HDL – cholesterol raises the risk of PVD. Hence, management of atherogenicdyslipidaemia is vital, and lipid levels to be maintained within optimal cut-off limits.

Cad and pvd :

Type 2 Diabetic patients are more prone to have silent CAD as well as PVD. Co-morbid coronary artery disease had a higher concordance rate (>50%) in the study group subjects affected with PVD. This indicates that an atherosclerotic disease in peripheral arteries should be considered as an indicator of generalized cardio-vascular disease and active secondary preventive measures to be started for prevention of further cardiovascular events. It is imperative to record the ABI – periodically in all Type 2 diabetics, since an ABI of <1 is an CAD equivalent. This assumes importance since many of the patients with ABI < 1 are asymptomatic.

Diabetic nephropathy and pvd :

In the present study group, PVD (ABI<1) was present in 75% of the diabetic nephropathy patients. Diabetic nephropathy was the single most important diabetic microvascular complication associated with development of PVD.

Association Of Pvd With Other Complications Of Diabetes

The prevalence of PVD was 42.5% among patients with diabetic retinopathy in the study group and this under scores the importance of screening for PVD among patients with diabetic retinopathy. Since due to poor visual acuity these patients are more prone for trauma to feet, while walking.

25% of patients with PVD had concomitant co-morbid cerebro vascular disease and this indicates that PVD patients also harbour significant generalized atherosclerosis in other vascular territories as well.

VII. Conclusion

1. Prevalence of peripheral vascular disease is about 18% in the present study. This has to be viewed seriously considering the huge type 2 diabetic population. Thus a significant proportion of type 2 diabetic subjects are affected by PVD, and hence due importance to be given for screening and prevention of PVD among type 2 diabetes patients.
2. About 50% of the PVD patients are totally asymptomatic and hence the need for active screening with estimation of ABI is to be done annually for all type 2 diabetes patients. This is important for prevention of lower extremity amputation.
3. Central obesity, Uncontrolled hyperglycemia, hypertension, high LDL cholesterol, high tri glycerides, low-HDL cholesterol and smoking are the modifiable risk factors associated with development of PVD. Advancing age and male gender were found to be the non modifiable risk factors for development of PVD.
4. Concordance rate for co-morbid CAD was very high (>50%) in PVD patients and hence active screening for CAD in all the PVD patients has to be done, even if there is no CAD symptoms.
5. PVD has to be given due importance, and ABI has to be estimated in all type 2 diabetic patients. Low ABI is associated with cardiovascular complications.

Thus, ABI is a good indicator of underlying complications of diabetes mellitus, particularly CAD. ABI estimation is a non invasive cheap, bed-side, and rapid test with a high degree of validity and predictive power and which does not need specially trained persons or costly equipments. Hence, ABI estimation should be done for all diabetic patients annually.

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