Original Research Article

Prevalence of peripheral vascular disease in high risk population using non-invasive techniques

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ABSTRACT

Background: The term peripheral arterial disease (PAD) generally refers to a disorder that obtained the blood supply to lower or upper extremities. It is frequently associated with cerebral and coronary atherosclerosis.
Methods: 200 patients coming to OPD and IPD in age group of 20-65 years with risk factors of HT, DM known CAD, known PAD, smokings were worked up.
Results: Steep increase in prevalence of clinical PAD was found in 50 years or above, males predominated only slightly 32% than females 27.7% in clinical PAD. Every one patient was either hypertensive or diabetic, one-third had both Diabetes and hypertension, one third was dyslipidemic, and one fifth had CAD. CAD was more prevalent in patients with clinical PAD 40% than without PAD 11.4%. Elevated triglyceride levels >150 mg/dl was more in patients clinical PAD 33.3% than without PAD 14.2%. Elevated total cholesterol levels >200 mg/dl was more in patients with clinical PAD 26.6% than without PAD 20%. 80% of patients with clinical PAD had ABI <0.9, and out of patients with no clinical PAD 16% had abnormal PAD. Grading of ABI according to severity showed grater no of patients with ABI <0.8 and less in clinical PAD group.
Conclusions: PAD was more prevalent with increasing age, diabetes mellitus, hypertension, smoking and dislipidema.

Keywords: Ankle brachial index, CAD, Diabetes mellitus, Hypertension, Peripherial arterial disease, Smoking

INTRODUCTION

The term peripheral arterial disease (PAD) generally refers to a disorder that obtained the blood supply to lower or uper extremities. It is frequently associated with cerebral and coronary atherosclerosis. While studying diabetic patients with cardiovascular diseases Warren S et al found that peripheral arterial disease in diabetic patients is similar to that found in control subjects but it begins at an early age, advances more rapidly and is more common.[1]

PAD is frequently associated with cerebral and coronary atherosclerosis. Moreover symptoms of PAD jeopardize the quality of life and independence of many patients.[2]

Aim of the study was to group the population according to different risk factors, to find out the prevalence of peripheral arterial disease in population with different risk factors, to compare and find the significance of various risk factors in patients with and without clinically diagnosed PAD, to find out ankle brachial index of each patient, to group patients according to ABI levels.

METHODS

The patients included in the study were those coming to OPD's and wards of Department of Medicine, Sri Guru Ram Das Institute of Medical Sciences, Amritsar, Punjab, India. 200 patients were included in age group of 20 – 65 years. Before commencing the study permission was

sought from ethical committee and Head of Department of all concerned departments. Nature and purpose of study was discussed with them.

All the patients were thoroughly explained the purpose of study and informed consent obtained from them. Cases were worked up. Performa with detailed history and systemic examination with particular reference to vascular system of limbs were filled.

Inclusion criteria

- All cases were chosen between 20 - 65 year of age with one or more of the following risk factors.
- Diabetes mellitus type 1 and 2
- Hypertension
- Known coronary artery disease
- Known PAD
- Dyslipidemia
- Smoking
- Previous cerebro vascular accident.

Patients were included and grouped according to the following

- Diabetes confirmed by H/o Oral Hypoglycemic Agents or WHO criteria for DM (Fasting Blood Glucose $\geq$ 126mg/dl or Random or PP Blood Glucose $\geq$ 200mg/dl repeated twice)
- HT confirmed by JNC-7 criteria.
- Known cardiac disease (CAD) by history and examination and diagnostic tests.
- History of smoking or symptoms of PVD-Intermittent Claudication, rest pain, atypical symptoms, impaired functional capacity of limbs.
- History of any CVA.

This was followed by complete physical examination with special attention to palpation of pulses, skin changes, temperature of limbs and bruits.

Routine investigations

- Hb
- TLC
- Platelets
- Blood urea
- Urine complete examination
- Lipid profile
- Electrocardiogram
- Echocardiography, stress tests
- ABI

It was done according to the standard protocol. ABI measurement were taken in supine position after patient was given rest for five minutes in supine position using a bi-directional Doppler machine, a hand held 8 MHz probe and standard mercury sphygmomanometer.

Systolic blood pressure (SBP) was measured in following order right brachial artery (RBA), right dorsalis pedis (RDP), right posterior tibial artery (RPTA), left dorsalis pedis (LDP), right posterior tibial artery (LPTA) and left brachial artery (LBA).

BP cuff of different sizes were used to accommodate different patients. The ratio of higher systolic BP between DPA and PTA to of SBP in two brachial arteries and lower of 2 ABI values for legs were used to define a low ABI.

Values were grouped in 5 categories

- 0.96 : General (normal)
- 0.81-0.95 : Mild
- 0.51-0.81 : Moderate
- 0.31-0.51 : Moderate to severe
- 0.30 or less : Severe.

(Technique in non-invasive diagnostic protocol and procedure. Guidelines Manual RJ, Diagle BA, RVT According to Medical Systems 1994 PBG).

The prevalence of PAD was evaluated in subjects using conventional symptomatic criteria and abnormal lower examination and correlated by standard method. Ankle Brachial index is expressed in percentage. Then the data was analysed and grouped according to presence of absence of risk factors in patients with and without clinically diagnosed PAD.

Statistically the data was grouped and chi square test was applied to find out the prevalence and then the results of each were calculated.

RESULTS

Table 1: Grouping of patients according to risk factors.

Risk factor	Number	Percentage
Diabetes	100	50 %
Hypertension	100	50 %
Diabetes + hypertension	60	30 %
Known CAD	40	20 %
Dyslipidemia	60	30 %
Cerebro vascular disease	4	2 %
Smoker	4	2 %

Out of 200 patients included in the study

- 100 were diabetic
- 100 were hypertensive
- 60 had co existing diabetes and hypertension
- 60 patients were dyslipidemic
- 40 patients had CAD, 4 had CVD and 4 were smokers.

Table 2: Agewise grouping of the patients according to presence of absence of clinically diagnosed peripheral arterial disease and prevalence.

Age (years)	Patients with PAD	Patients without PAD	Total	Prevalence/ 1000
20-25	0 (0%)	1 (100%)	1	0/1000
25-30	0 (0%)	1 (100%)	1	0/1000
30-35	0 (0%)	2 (100%)	2	0/1000
35-40	0 (0%)	3 (100%)	3	0/1000
40-45	1 (16.68%)	5 (83.33%)	6	166/1000
45-50	1 (14.28%)	6 (85.71%)	7	142/1000
50-55	9 (20.45%)	35 (79.54%)	44	204/1000
55-60	18 (30%)	42 (70.0%)	60	300/1000
60-65	31 (40.78%)	45 (59.2%)	76	407/1000

In patients with clinically diagnosed PAD only one patient was in age group of 40-45, one was in age group of 45-50, nine patients were in age group of 50-55, eighteen patients in age group of 55-60 and thirty one patients were in age group of 60-65.

Thus showing that the symptomatic PAD increases with increasing age, the risk factors were more in the patients with old age. There was a steep rise in patients with risk factor after the age of 50 years.

Out of total 106 male patients 34 patients had clinically diagnosed PAD and 72 were without clinically diagnosed PAD showing prevalence of 370/1000 in males with risk factors (Table 3).

Table 3: Grouping of the patients according to sex with and without clinically diagnosed PAD.

Sex	No of patients with PAD	No of patients without PAD	Total	
Female	26 (27.7%)	68 (72.3%)	94	277/1000
Male	34 (32.07%)	72 (69.9%)	106	370/1000
	60	140	200	

Chi Square (x^2) = 9.66; df = 1; P <0.01 (significant)

Out of total 94 female patients 26 patients had clinically diagnosed PAD and 68 were without clinically diagnosed PAD showing prevalence of 277/1000 in males with risk factors. This showed statistically significant higher male prevalence.

Out of total 60 with clinically diagnosed PAD 24 patients had features suggestive of CAD (40%).

Out of total 140 patients without clinically diagnosed PAD. 16 patients had features suggestive of CAD (11.4%).

This clearly showed that features of CAD are more in patients with clinically diagnosed PAD.

Table 4: Grouping of the patients according to evidence of CAD with and without clinically diagnosed PAD.

ECG/echo/stress tests	No of patients with PAD	No of Patients without PAD	Total
Features suggestive CAD	24 (40%)	16 (11.4%)	40
Features not suggestive of CAD	36 (60%)	124 (88.6%)	160
	60	140	200

Chi square (X^2) = 10.3; df = 1; P <0.05 (Significant)

Table 5: Grouping of the patients with and without clinically diagnosed PAD according to triglycerides levels.

Triglyceride level	No of patients with PAD	No of patients without PAD	Total
>150 mg/dl	20 (33.3%)	20 (14.2%)	40
<150 mg/dl	40 (66.6%)	120 (85.7%)	160
	60	140	200

Chi Square (χ^2) = 4.51; df = 1; P <0.01 (Significant)

Out of total 60 with clinically diagnosed PAD 20 patients had triglycerides levels greater than 150 mg/dl (33.3%).

Out of total 140 patients without clinically diagnosed PAD. 20 Patients had triglycerides levels greater than 150 mg/dl (14.2%).

This clearly showed that prevalence of patients with elevated triglycerides levels were more in patients with clinically diagnosed PAD.

Table 6: Grouping of the patients with and without clinically diagnosed PAD according to total cholesterol levels.

Total cholesterol level	No of patients with PAD	No of patients without PAD	Total
>200 mg/dl	16 (26.6%)	28 (20%)	44
<200 mg/dl	44 (73.4%)	112 (80%)	156
	60	140	200

Chi square (X^2) = 0.525; df = 1; P >0.05 (insignificant).

Out of total 60 with clinically diagnosed PAD 16 patients had cholesterol levels greater than 200 mg/dl (26.6%). Out of total 140 patients without clinically diagnosed PAD. 28 patients had cholesterol levels greater than 200 mg/dl (11.4%).

Though this clearly showed that total cholesterol levels were more in patients with clinically diagnosed PAD than the patients without clinically diagnosed PAD, but it was statically insignificant.

Out of total 60 with clinically diagnosed PAD 8 patients had carotid bruit (13.2%). Out of total 140 patients without clinically diagnosed PAD. No patient had carotid bruit. This clearly showed that carotid bruit was present in patients with clinically diagnosed PAD.

Table 7: Grouping of the patients with and without clinically diagnosed PAD according to presence or absence of carotid bruit.

Bruit	Patients with clinically diagnosed PAD	Patients without clinically diagnosed PAD	Number
Carotid bruit present	8 (13.2%)	0	8
Cartoid bruit absent	52 (86.8%)	140 (100%)	192
	60	140	

Chi square (χ^2) = 9.52; P <0.01 (Significant).

Table 8: Grouping of the patients with and without clinically diagnosed PAD according to AB index.

AB Index	ABI > 0.9	ABI 0.81-0.9	ABI 0.51-0.81	ABI 0.31-0.5	Total
Patients with clinically diagnosed PAD	12 (20%)	16 (26.6%)	18 (30%)	14 (23.4%)	60
Patients without clinically diagnosed clinically	124 (88.57%)	12 (8.57%)	4 (2.85%)	0 (0%)	140
	136	24	22	0	200

Table 9: Grouping of the patients with and without clinically diagnosed PAD according to AB index.

ABI	Normal ABI > 0.9	Abnormal ABI < 0.9	Total
Patients with PAD clinically diagnosed	12 (20%)	48 (80%)	60
Patients without PAD clinically diagnosed	124 (88.5%)	16 (11.5%)	140
	136	64	200

Chi square (χ^2) = 45.01; df = 1;P <0.01.

Out of 60 patients with clinically diagnosed PAD.

- 12 (20%) had ABI > 0.9
- 16 (26.6%) had ABI 0.81-0.9
- 18 (30%) had ABI 0.51-0.80
- 14 (23.4%) had ABI 0.31-0.5

Whereas out of 140 patients without clinically diagnosed PAD.

- 124 (88.57%) had ABI > 0.9
- 12 (8.57%) had ABI 0.81-0.9
- 4 (2.88%) had ABI 0.51-0.80
- 0 (0%) had ABI 0.31-0.5

Out of total 60 with clinically diagnosed PAD 48 patients had abnormal ankle brachial index (80.0%). Out of total 140 patients without clinically diagnosed PAD. 16 patients had abnormal ankle brachial index (11.5%). This clearly showed that ankle brachial index is a significant parameter to diagnose PAD.

DISCUSSION

The present study was conducted to study the presence of PAD in the high risk population group and to study the role of Ankle Brachial Index as a diagnostic measure for PAD. Patients in the age group of 20-65 years of age were taken with the presence of one or more risk factors.

Patients and attendants were explained and convinced for participating in the study.

The true prevalence of PAD is greater than expected as majority of the patients are asymptomatic and usually present with ischemic ulcer with or gangrene or for amputation of limb. The prevalence of PAD varies depending on the population studied and the diagnostic method used and whether symptoms are included to derive estimates.

PAD is present in 4% of the population greater than 40 years and older and 15-20% in 65 years or greater. In the present study of comprising of 200 patients, 60 patients had clinically evident PAD. Showing the prevalence of 30/100 high risk population.

Data derived from various studies (including Edinburgh Artery Study, Framingham Heart Study and Cardiovascular Health Study) showed 2-3 fold risk of developing PAD in smokers 2-4 fold risk in diabetic patients. Abnormalities of lipid metabolism also increase in the prevalence of PAD.

Wouter TM, Armo WH et al while conducting the famous Rotterdam study observed that age sex specific presence of PAD in elderly patients aged 50 years and above was 19.1% with DM and 5.5% with hypertension forming major chunk of the patients.[3]

Binaghi et al showed that predominance of hypertension in patients with PAOD is 21.6% is second only in hypercholesterolemia (59.1%).[4] In our study all the patients had either one or more risk factors present.

Two hundred patients with risk factors were studied. The distribution of the risk factors were also varied; 50 % of the population was either diabetic of hypertensive 100 patients each 60 patients (30%) had both diabetes and hypertension. 60 patients (30%) were dyslipidemic. 40 patients (20%) had evidence of CAD. And only 4 (2 %) patients were smokers and had Cerebro vascular disease.

This showed that most common risk factor was diabetes and hypertension, dyslipidemis, CAD was next. The low number of smokers in this area was due to majority of sikh population studied.

In our study the age wise distribution showed a step rise in the patients with risk factors as well as with clinically diagnosed PAD with increasing age showing the prevalence of clinically diagnosed PAD was (300/1000) in 55-60 years and (407/1000) in 60-65 years of age where as low prevalence (166/1000) in 40-45 years and (142/1000) in 45-50 years. This data was consistent with most studies.

Makin A in their study on sex prevalence, 512 patients were studied which comprised of equal male and female with hypertension showed increased prevalence of PAD in males than females. However after menopause the prevalence is same.[5] PAD is more common in males in females before menopause and after that the prevalence is the same in both.

Kennedy M et al in cardiovascular health study reported a prevalence rate of 12% CAD in patients who had clinically evident PAD which worsened with age.[6] Sarah H et al in Edinburgh artery study showed 17 % of men and women having PAD in 55-75 years of age. During follow up about 1/3 died and half of the deaths were due to CAD.[7] Leng GC et al observed (relative risk of CAD was 1.38) in 5 years follow up of PAD patients in the age group of 55-74 years.[8]

Buyzere CD et al concluded that PAD of lower limbs is associated with high cardiovascular morbidity and mortality. Intermittent claudication is an important predictor of cardiovascular deaths increasing it by three fold and increasing all-cause mortality by fivefold.[9]

In the study 60 patients had clinically diagnosed PAD out of which 24 patients (40%) also had features suggestive of CAD whereas out of 140 patients without clinically evident PAD 16 patients (11.4%) had CAD. This already showed that PAD patients have more prevalence of CAD (P value <0.05 chi square =10.3). Anomalies of lipid metabolism are also associated with increased prevalence of PAD.

Elevation in total/LDL cholesterol increased the risk of developing PAD in some studies but not in all. Hypertriglyceridemia independently predicts the risk of PAD. Binaghi et al noted the predominance of hypercholesterolemia was (59.1%) in PAOD and hypertension is (21.6%).[4]

In this study two parameters total cholesterol and triglycerides levels were taken. Fasting samples of all the patients were taken. The patients were grouped in those with elevated (>200mg/dl) total cholesterol and triglycerides (>150mg/dl) levels vs normal levels (<200 mg/dl) total cholesterol an (<150 mg/dl) for triglycerides.

In this study out of 60 patients who had clinically diagnosed PAD 20 patients (33.3%) had elevated triglyceride levels (>150 mg/dl) as compared to 40 patients (66.6%) with levels (<150 mg/dl) whereas 20 patients (14.2%) out of 140 patients without PAD had elevated triglyceride levels (>150 mg/dl).

This showed a significant co-relation between elevated triglycerides level and PAD (p <0.01 chi square = 4.51). Apart from these studies all other studies failed to confirm an association between lower extremity arterial disease and elevated total cholesterol levels.

This can be explained by the fact any patient studied was either hypertensive or diabetic and all of them are prone to have dyslipidemia which is an independent risk factor

for PAD. An ABI of 0.9 or less is considered abnormal. It is 90-95% sensitive and 95-100% specific for angiographically verified PAD.

ABI is also used to gauge the severity of PAD. Patients with symptoms of intermittent claudication often has ABI ranging from 0.5-0.8 and in patients with critical limb ischemia ABI is (0.5 and less). Newman AB et al evaluated the relationship between ankle brachial index and cardiovascular mortality and morbidity showed ABI 0.9 or less is as important predictor.[10] In this study measurement of ABI was done in every patient and grading of the patients including to ABI levels were done.

Out of 60 patients with clinically diagnosed PAD

- 12 (88.57%) had ABI >0.9
- 16 (26.6%) had ABI 0.81-0.9
- 18 (30%) had ABI 0.51-0.80
- 14 (23.4%) had ABI 0.31-0.5

Whereas out of 140 patients without clinically diagnosed PAD

- 124 (88.57%) had ABI >0.9
- 12 (8.57%) had ABI 0.81-0.9
- 4 (2.88%) had ABI 0.51-0.80
- 0 (0%) had ABI 0.31-0.5

This clearly showed that ABI levels are an important indicator of severity in patients with PAD. Also out of 60 patients with clinically diagnosed PAD 12 patients (20%) had normal ABI >0.9, 48 patients (80%) had abnormal ABI <0.9. But out of 140 patients without clinically diagnosed PAD 124 patients (88.5%) had normal ABI >0.9 and 16 patients (11.5%) had abnormal ABI<0.9. This showed a statistically significance diagnostic value of ABI in detecting PAD. Thus ABI is a simple, non-invasive, easy, specific and highly sensitive method of diagnosing peripheral disease and it should be performed regularly in all patients with risk factors.

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