Research Article

Prevalence of Peripheral Arterial Disease in Ages 40 or Above in the UAE

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Abstract

Background: Peripheral arterial disease (PAD) is a common cause of atherosclerotic occlusive disease of arteries in the lower extremities. Less information is available for the prevalence of PAD among adults in the United Arab Emirates (UAE), despite the high prevalence of risk factors associated with PAD in the gulf region. The purposes of this study were to assess the prevalence of PAD in ages 40 and above in the UAE, and to assess the prevalence of risk factors. **Methods:** A cross-sectional study was conducted in various clinical settings in the United Arab Emirates amongst 203 adults aged 40 and above. Participants filled out a questionnaire that included: socio-demography, risk factors, Edinburgh Claudication Questionnaire. The Ankle Brachial Index (ABI) of the participants was assessed and used to confirm the probability of having PAD. Height, weight, and body mass index were also measured. The chi-square test and multiple logistic regression were used in the analysis. **Results:** The present study showed that the prevalence of PAD among the studied participants was (22.7%). The highest frequency of PAD was found among 60 years old and above participants (45.5%). The prevalence of PAD was higher amongst females compared to males (30.9%vs 18.5%). There was a significant association between PAD and: duration of smoking, being overweight or obese and having hypertension (P<0.001) and diabetes (P<0.002). Multiple logistic analysis showed that hypertension and diabetes were significant predictors of PAD among the studied participants. **Conclusion:** This study concludes that PAD increases with age. Significant associations were found between PAD and age, gender, smoking duration, being overweight, obesity, and having hypertension and diabetes. Hypertension and diabetes were significant predictors of peripheral arterial disease among the studied participants. A population-based study needs to be conducted to confirm the importance of utilization of the ABI in routine clinical examinations.

Keywords: Ankle-Brachial Index; Peripheral Arterial Disease; Hypertension; Diabetes; Hypercholesterolemia

Introduction

Peripheral Arterial Disease (PAD) is the narrowing of the arteries most commonly affecting those in the legs leading to pain or discomfort after rest [1]. Peripheral Arterial Disease is by far the most common cause of atherosclerotic occlusive disease of arteries in the lower extremities. It has been associated with an increased risk of lower limb amputation and is an indication of atherothrombosis [2]. PAD is manifested by myocardial infarction, stroke, and death in cardiovascular, cerebrovascular, and renovascular patients due to atherothrombosis. Risk factors for PAD include; tobacco use, age, gender, hypertension, diabetes, hypercholesterolemia, and obesity [3].

Objectives

- To assess the prevalence of PAD in ages 40 and above in UAE

- To assess the prevalence of risk factors Smoking, Diabetes, Hypercholesterolemia, and Hypertension in patients with PAD

- To find an association between PAD and other factors (age, gender, ethnicity)

Materials and Methods

Study Design: This study was a cross-sectional design study conducted in Thumbay Clinic Umm Al Quwain, Thumbay University Hospital in Ajman, Thumbay Hospital in Dubai, Thumbay Hospital in Fujairah and Thumbay Medical & Dental Speciality Centre Sharjah.

Population: Individuals who attended the outpatient clinic at Thumbay Clinic Umm Al Quwain, Thumbay University Hospital in Ajman, Thumbay Hospital in Dubai, Thumbay Hospital in Fujairah and Thumbay Medical & Dental Speciality Centre Sharjah.

Inclusion Criteria: The study included residents of the UAE ages 40 years and above, of both genders, any nationality, and participants who consented before enrollment in the study.

Exclusion Criteria: The study excluded individuals below the age of 40, refused consent and had a known history of cardiovascular disease.

Sample Size Calculation: The following equation was used $n=pqz2/d2$ to estimate the sample size, the prevalence of 5.9% in reference to the United States Preventive Services Task Force (USPSTF) recommendation study [4].

Study settings: Thumbay Hospitals, Thumbay Healthcare Center, and Thumbay Clinics across UAE.

Study Instrument & Validation Procedure: The research team developed a questionnaire that includes information about social demography and some risk factors. The questionnaire was validated by two physicians working at Thumbay University Hospital. In addition, the Ankle Brachial Index was followed by its standard guidelines and used along with the Edinburgh Claudication Questionnaire to confirm the probability of having PAD.

Ethical issues

- The study was approved by Gulf Medical University's Institutional Review Board. Participants were enrolled after a thorough explanation of the objectives and getting their signed and informed consent. Patients were informed of their right to refuse participation.

- The Ankle Brachial Pressures were taken in the privacy of a separate room in the clinical setting.

- We assured the participant that the study was anonymous, the information provided was analyzed by the group, and there will be no link between the person and the results. Confidentiality of the information is respected, and only the research team, community medicine department faculties, statisticians, and ethics committee members may have access to the data.

Methodology

A cross sectional study was conducted in various branches of Thumbay Hospitals and Clinics across the United Arab Emirates from November - December 2021. All adults above the age of 40 attending the outpatient clinics during the duration of the study were invited to participate. A total of 203 participants aged 40 years and above were included. Participants younger than 40 years, or with a known vascular disease were excluded from the study. A self-administered, validated questionnaire was used as a tool to collect data. The questionnaire included socio-demography, risk factors, Edinburgh Claudication Questionnaire, and the Ankle Brachial Index (ABI) of the patient, all used to confirm the probability of having PAD.

Initially 3 anthropometric measurements were taken (height, weight, and body mass index). To calculate the ABI, the highest systolic pressure of the upper extremity was divided by the highest systolic pressure of the lower extremity. Then systolic blood pressures of the upper extremities were taken with an aneroid sphygmomanometer. Measurements of the lower extremity systolic pressures were taken with a hand held doppler and an aneroid sphygmomanometer. Peripheral arterial disease was defined as an ankle brachial index lower than 0.9.

Details of data storage

Data will be stored for a minimum of 3 years in the Community Department as per Gulf Medical University.

Data analysis

Data was entered in an Excel sheet and IBM SPSS version 27 was used to analyse the data. Data was then presented in tables, figures, and text format. In addition, Chi-square was used to assess the association between the prevalence of PAD, and selected factors. Finally, logistic regression analysis was used to assess predictors of PAD.

Results

The study included 203 participants, 66.5% were male (n=135) and 33.5 % were female (n=68). In regard to the age of participants, 63.5% (n=129) of participants were ages 40-50, 25.6% (n=52) were ages 51-60 and 10.8% (n=22) were over the age of 60.
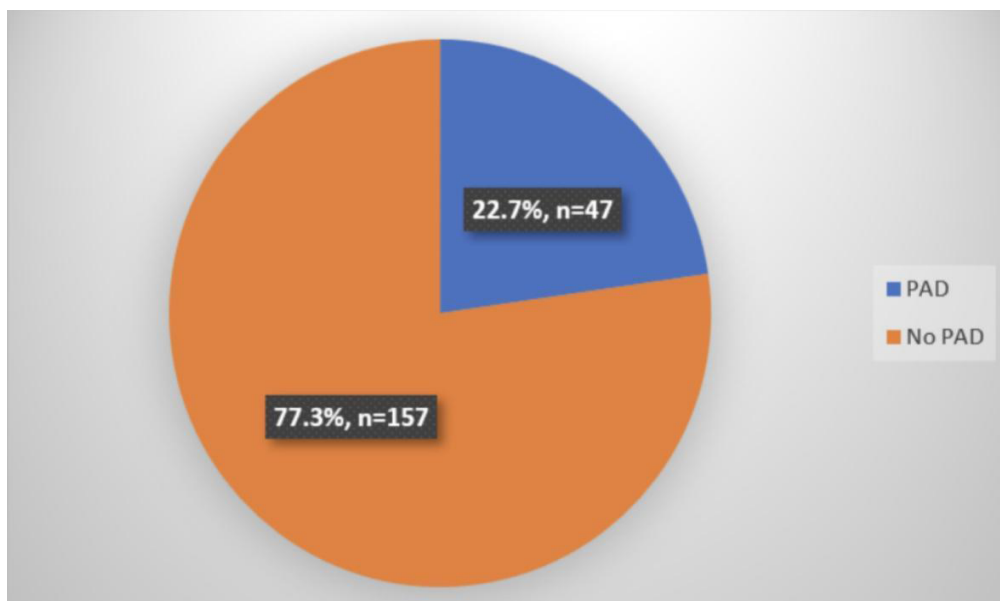
Figure 1: Prevalence of Peripheral Arterial Disease Among Participants

Out of the 203 participants, PAD was measured in 22.7% (n=47) individuals and 77.3% (n=157) did not have PAD.

Table 1: Association between sociodemographic and Peripheral artery disease (PAD)

Variable	Subcategories	PAD		No PAD		Total	P
		Frequency	%	Frequency	%		
Age	40-50 years	20	15.5	109	84.5	129	0.002
	51-60 years	16	30.8	36	69.2	52	
	Above 60 years	10	45.5	12	54.5	22	
Gender	Male	25	18.5	110	81.5	135	0.047
	Female	21	30.9	47	69.1	68	
Ethnicity	Non-Arab	23	18.7	100	81.3	123	0.095
	Arab	23	28.7	57	71.3	80	
Living situation	Family/relatives	6	28.6	15	71.4	21	0.465
	Friends/Dormitory	3	13.0	20	87.0	23	
	Alone	3	15.0	17	85.0	20	
	Married (with spouse)	34	24.5	105	75.5	139	

* P-values were calculated using Chi-square test. P< 0.05 indicates statistical significance.

The percentage of participants ages 40-50 years who had PAD was 15.5%(n=20). The percentage of participants ages 51-60 years old who had PAD was 30.8%(n=16), and the percentage of participants above 60 years was 45.5%(n=10). The percentage of male and female participants who had PAD was 18.5%(n=25) and 30.9%(n=21) respectively.

Among the Arab participants 28.7%(n=23) had PAD and Non-Arab participants 18.7%(n=23) had PAD.

There was a significant association between age and PAD, Gender and PAD (P<0.05). There was no significant association between Ethnicity and PAD(P>0.05).

Table 2 : Association between lifestyle, Habits, BMI and Peripheral Artery Disease

Variables	Subcategories	PAD		No PAD		Total	P
		Frequency	%	Frequency	%		
Smoking	Yes	13	27.1	35	72.9	48	0.402
	No	33	21.3	122	78.7	155	
Smoking Duration	25 years or less	3	8.1	34	91.9	37	0.001
	25 years or more	16	43.2	21	56.8	37	
Exercise	3 times a week or less	37	23.3	122	76.7	159	0.693
	More than 3 times a week	9	20.5	35	79.5	44	
Diet	Non-Mediterranean	7	26.9	19	73.1	26	0.578
	Mediterranean	39	22.0	138	78.0	177	
BMI	Normal	8	27.6	21	72.4	29	0.017
	Overweight	15	14.6	88	85.4	103	
	Obese	23	32.4	48	67.6	71	

* P-values were calculated using Chi-square test. P< 0.05 indicates statistical significance.

With respect to individuals with PAD and smoking habit, 27.1% (n=13) smokers had PAD and 21.3% (n=33) non-smokers had PAD. The percentage of participants who smoked for 25 years or less and had PAD was 8.1% (n=3) and those who smoked for more than 25 years and had PAD was 43.2%(n=16).

With regards to individuals with PAD and frequency of exercise, 37% (n=23.3) exercised less than 3 times a week and 20.5% (n=9) exercised more than 3 times a week.

With respect to individuals with PAD and their Diet, 26.9% (n=7) of participants with PAD followed a non-Mediterranean diet and 22% (n=39) followed a Mediterranean diet.

There was a significant association between Smoking duration and PAD (P<0.05). There was no significant association between Smoking and PAD, Exercise and PAD, Diet and PAD (P>0.05). There was a significant association between obesity and PAD (P<0.05).

Table 3 : Association between Hypertension, Hypercholesterolemia, Diabetes and Peripheral Artery Disease

Variables	Subcategories	PAD		No PAD		Total	P
		Frequency	%	Frequency	%		
Hypertension	Yes	26	35.6	47	64.4	73	0.001
	No	20	15.4	110	84.6	140	
Hypercholesterolemia	Yes	22	35.3	40	64.5	62	0.004
	No	24	17	117	83.0	141	
Diabetes	Yes	16	41.0	23	59.0	39	0.002
	No	30	18.3	134	81.7	164	

* P-values were calculated using Chi-square test. P< 0.05 indicates statistical significance.

Among the participants with Hypertension, the percentage of those who had PAD was 35.6%(n=26). There was a significant association between hypertension and PAD (P<0.001).

Among the participants with Hypercholesterolemia, the percentage of those who had PAD was 35.5% (n=22). There was a significant association between hypercholesterolemia and PAD (P<0.004).

The percentage of participants with Diabetes and had PAD is 41% (n=16). There was a significant association between Diabetes and PAD (P<0.002).

Variables		No	COR* (95%CI)	P value	AOD** (95%CI)	P-value
Age (year)	40-50	129	1		1	
	51-60	52	2.422 (1.135-5.167)	0.022	2.916 (0.394-21.599)	0.295
	>60	22	3.468 (1.201-10.019)	0.022	0.723 (0.071-7.404)	0.785
Gender	Male	135	1	0.49	1	0.424
	Female	68	1.966 (1.003-3.854)		0.429 (0.054-3.413)	
Smoking	Yes	48	1.373 (0.653-2.889)	0.403		
	No	155	1			
Smoking Duration	25 years or less	37	1	0.002	1	0.843
	More than 25	37	8.635 (2.244-33.234)		1.240 (0.147-10.446)	
Hypertension	Yes	73	2.233 (1.077-4.636)	0.031	29.042 (3.080-273.841)	0.003
	No	130	1		1	
Hypercholesterolemia	Yes	62	2.681 (1.357-5.297)	0.005	1.155 (0.187-7.127)	0.877
	No	141	1		1	
Diabetes	Yes	39	3.107(1.466-6.584)	0.003	8.691 (1.106-68.276)	0.040
	No	164	1		1	
COD: Crude Odds Ratio; **AOD:** Adjusted Odds Ratio						

Table 4: Logistic Regression Analysis for Predicators of Peripheral Artery Diseases (PAD)

Multiple logistic analysis shows that hypertension and diabetes were significant predictors of PAD among the studied participants.

Discussion

Prevalence of PAD

The present study showed that the prevalence of PAD among the studied participants was 22.7%, as shown in (Figure 1). Epidemiological studies have shown that approximately 7.1 million people in the United States have PAD [5].

A study conducted in Saudi Arabia conducted among 261 patients at a tertiary center in Jeddah during the period from July 2012 to September 2017, found that PAD was reported to affect about 12% of the population in Saudi Arabia [6].

Similarly, another cross-sectional study conducted at a General Hospital in Huambo, South Angola, on 115 participants with a median age of 52.5 found that the prevalence of PAD was 42.6%, which is also high compared to other population-based studies [7]. It is worth mentioning that the high prevalence in this study can be a result of the setting in which the research was conducted. Patients already visiting a hospital are more likely to have aggregate risk factors, making them at more risk of having Peripheral Arterial Disease.

Factors Related to PAD

Age

In this study, there was a significant association between age and Peripheral Arterial Disease (P<0.002) (Table 1). The results showed that the age group above 60 years old had the highest frequency of PAD, 45.5%, among the studied population. PAD increases with age, which is why the results showed that those in the younger age groups, 40-50 years and 51-60 years, had the lowest frequency with 15.5% and 30.8% respectively.

This finding agrees with a study conducted in India and included a total sample of 1180 of both women and men ages 60-79 years. The results showed a steady increase in the prevalence with increased age. The youngest age group of 60-64 years showed a 21.2% prevalence while the oldest age group of 75-79 showed a 38.29% prevalence [8].

Gender

The results of this study showed a significant association between gender and Peripheral Arterial Disease (P<0.047) (Table 1). The prevalence of PAD was higher amongst females in comparison to males (30.9% vs. 18.5%), a finding that disagrees with most literature studies. A retrospective study in Jeddah, Saudi Arabia, showed that the majority of PAD patients were males [6]. In agreement with our finding, few studies showed that females had a higher prevalence of PAD. This can be attributed to the older age and its associated risk factors among the studied females, which cannot be excluded.

Smoking

In this study, no significant association was found between smoking and Peripheral Arterial Disease (Table 2). This finding disagrees with several studies which reported that smoking elevates the risk of PAD by at least seven-fold, and plays an essential role in the pathophysiology of the disease [9]. It should be noted that the prevalence of PAD was slightly higher among smokers compared to non-smokers (27.1% vs. 21.3%) (Table 2). This is in line with a study done by Mayo Clinic, reporting that approximately 90% of patients with PAD have a history of smoking [10]. The Framingham study reported that intermittent claudication (IC) was twice as high in smokers than in non-smokers [11].

The current data showed a significant association between the duration of smoking and PAD (Table 2). Participants who had a longer duration of smoking (>25 years) were at a higher risk compared with those who smoked for a shorter duration (< 25 years) (43.2% vs. 8.1%) (Table 2). A study done in Korea using 2517 participants above the age of 50, showed that cumulative smoking exposure and the duration of smoking were significantly associated with PAD [12].

Exercise

In this study, no significant association between exercise and Peripheral Arterial Disease was found. However, participants who exercised less frequently had a slightly higher prevalence of PAD (23.3% vs. 20.5%) (Table 2). Nonetheless, other studies showed that exercise is clinically significant in improving the symptoms of PAD.

Randomized trials reported that exercise rehabilitation in PAD patients improved their daily activity levels and patients' perceived health-related quality of life [13].

Diet

The current data shows no significant association between diet and Peripheral Arterial Disease (Table 2). Participants who did not follow the Mediterranean Diet had a higher risk for PAD compared to those following the Mediterranean Diet (26.9% vs. 22.0%) (Table 2). The results agree with other studies that adhering to the Mediterranean Diet is inversely proportional to developing PAD. A randomized control trial reported that those following a Mediterranean diet pattern were at lesser risk of developing Peripheral Arterial Disease [14].

Hypertension

In this study, results showed a significant association between PAD and hypertension (P<0.001) (Table 3). The study's results showed that those with hypertension had a higher prevalence of PAD than those without hypertension (35.6% vs. 15.4%) (Table 3). Hypertension is a risk factor for PAD (Table 4) , and as they get older, an increased number of hypertensive patients reported intermittent claudication. [19].

In a study conducted in Jeddah, Saudi Arabia, published in June 2018, a total of 240 patients were recruited, 55.8% of the participants were male, and 52.9% were native Saudis. The study concluded that the most common associated risk factors were hypertension, 34.2% of cases [6].

The mechanism of how hypertension causes PAD is complex. Endothelial dysfunction, platelet activation, and increasing oxidative stress, all are factors contributing to atherosclerosis and PAD [15].

Diabetes

Our results showed a significant association between PAD and diabetes (P<0.002) (Table 3). Participants with diabetes had a higher prevalence of Peripheral Arterial Disease compared to non-diabetic participants (41.0% vs. 18.3%) (Table 3). Diabetes was also a significant predictor of peripheral arterial disease (Table 4). Diabetes mellitus-associated hyperglycemia results in alteration of the vascular repair mechanisms, alteration of the ROS generation, changes in platelet activity, and coagulation pathway. Diabetes also increases an individual's risk for PAD by four folds. Furthermore, about 20% of patients with PAD reported to have diabetes in a study conducted in Jeddah, Saudi Arabia, in June 2018 [6].

Hypercholesterolemia

This study's results showed a significant association between high cholesterol and PAD (P<0.004) (Table 3). Participants with hypercholesterolemia had a higher prevalence of PAD than those with normal cholesterol levels (35.5% vs. 17.0%) (Table 3).

A study conducted to determine whether high Low-Density Lipoprotein-Cholesterol is related to the risk of peripheral arterial disease in the general population revealed a stepwise increase in the risk of PAD with higher low-density lipoprotein cholesterol levels. The study results displayed a hazard ratio of 1.25 (1.06-1.47) for PAD in individuals with low-density lipoprotein cholesterol levels above the 95th percentile versus below the 50th percentile [16].

Obesity

The percentage of participants with normal BMI and had PAD is 27.6% (n=8). As for overweight and obese participants, 14.6% (n=15) and 32.4% (n=23) had PAD respectively. In this study's results, there was a significant association between obesity and PAD (P<0.017) (Table 2). Current data showed that obese patients had a higher prevalence of Peripheral Arterial Disease compared to those with normal BMI levels (32.4% vs. 27.6%) (Table 2).

A study conducted at Johns Hopkins University School of Medicine in Baltimore, with 14000 participants, showed that obese people were 1.5 times at more risk for developing PAD [17]. Another study performed on 11,477 adults aged 40 from two nearby communities during 2011-2013 in Shanghai, China, showed that obesity is a risk factor for PAD even after controlling other cofactors such as hypertension, dyslipidemia, and diabetes [18].

Limitations

- **Sample size:** the sample size included 203 individuals. It was originally aimed to reach a sample size of 371 however, it was not plausible to reach this sample size due to the pandemic.

- **Selection Bias:** Participants who volunteered and selected themselves participated in this study.

Conclusion

This study provides prevalence estimates of Peripheral Arterial Disease for people above 40 years old, revealing that it affects 23% of them. PAD prevalence increases with age. No statistically significant difference was found among ethnicity. Significant associations were found between hypertension and PAD, diabetes and PAD, and hypercholesterolemia and PAD. In addition, a significant association was seen between the duration of smoking and Peripheral Arterial Disease. In conclusion, hypertension and diabetes are predictors of PAD among the study participants.

Recommendation

- The utilization of Ankle Brachial Index in routine clinical examinations by health care   providers.

- The education of UAE citizens on the risk factors and symptoms of PAD

- For the repetition of the study as a population-based study.

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