



Prevalence and symptoms of peripheral artery disease in diabetic patients: In-hospital survey with modified Edinburgh Claudication Questionnaire

Ekpe EE¹, Onung S², Ubani BC², Morgan U³, Akpan AF¹, Umoren U², Ekuma IA²

¹Cardiothoracic Surgery Unit, Department of Surgery, University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria

²Endocrinology Unit, Department of Internal Medicine, University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria

³Department of Family Medicine, University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria

Abstract

Context: Between 2000 and 2010 the prevalence of peripheral artery disease (PAD) increased by 23% worldwide due to a growing and aging global population, an increased number of patients with diabetes, and smoking. Furthermore, symptomatic PAD is associated with a 29% rate of silent myocardial infarction. Therefore, primary prevention of PAD, and its morbidity and mortality call for increased researches. This study aims to determine the prevalence of PAD and its symptoms among diabetic patients attending the University of Uyo Teaching Hospital, Uyo (UUTH) Materials and Methods: The study utilized a cross-sectional study design utilizing modified Edinburgh Claudication Questionnaire on all consenting diabetic patients who meet the inclusion criteria. Patients with incomplete data were excluded.

Results: There were 99 diabetic patients studied and analyzed with M:F = 1:1.4 and mean age 56.2 ± 9.9 years. Using the PAD diagnostic criteria in ECQ, the prevalence of PAD was 51.5%. Fifty-one percent had been diabetic for more than 10 years, 44% for 1-10 years, and 5% for less than one year. Sixty-one percent had ever been treated with insulin injection, 41% were currently on insulin therapy, while 69% were on oral hypoglycaemic drugs and 10% were on combined therapy. The mean HbA1c was 7.8%. Forty-four percent, 27% and 29% of the patients were overweight, obese and normo-body weight respectively. Twenty-eight percent of the patients were hypertensive for more than 10 years and 14% for 1-9 years, therefore making hypertension co-morbidity in 42%. Only 2% of the patients were smokers. The symptomatology study was analysis of the responses of the study participants to the Edinburgh Claudication Questionnaire instrument. Leg pain or discomfort that starts on walking and aggravated uphill, and disappears after about 10 minutes of resting or similar characteristic pain in the calf or buttock was noted.

Conclusion: The prevalence of PAD in diabetic patients in UUTH is 51%. Further research will reveal the pattern, severity and risk factors.

Keywords: Peripheral artery disease, Edinburgh claudication questionnaire, ankle brachial index, Duplex Doppler ultrasound scan

Corresponding Author:

Professor Eyo Effiong Ekpe

Cardiothoracic Surgery Unit, Department of Surgery, University of Uyo Teaching Hospital, Uyo, Akwa Ibom State, Nigeria.

eyoekpe@uniuyo.edu.ng | ORCID ID: 0000-0002-5882-9896

DOI: 10.61386/imj.v19i3.1185

Introduction

The cardiovascular complications of arteriosclerosis are the main causes of morbidity and mortality in the Western world.¹ This histopathological lesion is characterized by its slow progression and systemic nature, which is manifested by various vascular syndromes that

often appear simultaneously and depend on the vascular territory affected (ischemic heart disease, ischaemic cerebrovascular disease and peripheral arterial disease). The natural history of atherosclerosis includes an asymptomatic first phase of lengthy duration, followed by a clinical phase that is often sudden and fatal as a consequence of vascular stenosis or acute thrombosis associated with the atheroma plaque. Treatment of this condition is mainly based on prevention, or, at least, control of progression before the development of severe cardiovascular complications.² To provide adequate multifactorial therapeutic interventions, scales assessing vascular risk, such as the Framingham cardiovascular risk equation, have been established to allow overall evaluation of specific patients.³ A complementary approach is noninvasive direct assessment of the arteriosclerotic lesion in the target organ, which allows identification of patients at a high risk for future development of a cardiovascular complication.⁴ Along this line, there is growing interest in the detection of peripheral arterial disease (PAD) of the lower limbs using a simple noninvasive technique, known as the ankle-brachial index (ABI). This is calculated by dividing the systolic blood pressure in the ankle by the systolic pressure in the arm to determine the arterial pressure (AP) ratio.^{5,6} As compared to angiography, an ABI value of <0.9 has a sensitivity of 95% and a specificity $>95\%$ for detecting stenosis of at least 50% of the arterial lumen.^{5,6} Moreover, it is an inexpensive, accurate, reproducible procedure that does not require specialized personnel. Because of its diagnostic precision and widespread availability, the ABI is the method of choice for diagnosing PAD, which in most patients is not manifested by symptoms, and should be routinely used when assessing patients at a risk of developing atherothrombotic disease.⁶ In addition to its use in the diagnosis of symptomatic PAD, the greatest value of ABI lies in its function as an independent predictive marker of cardiovascular death in patients with asymptomatic PAD.⁷ The main clinical impact of this technique is obvious: it allows the detection of high-risk patients in the primary care setting who would benefit from a more intensive multifactorial therapeutic approach. To date, numerous studies have been published on the

prevalence of PAD and the prognostic value of the ABI in the general population.⁸⁻¹² Nevertheless, there is little data on the prevalence of low ABI values in selected, at-risk patients with no known atherothrombotic event, who may be the population that could most benefit from the application of this index. Epidemiological survey of PAD has also been carried out with good precision using the Edinburgh Claudication Questionnaire which is a well validated research instrument.¹³

Based on these considerations, we proposed to conduct an epidemiological study of the prevalence of peripheral artery disease in diabetic patients; a population of at-risk patients with no known arterial disease, seen in family medicine department and internal medicine department. The aim of this study is to determine the prevalence and symptoms of PAD

Materials and Methods

Study area: This study was conducted in the general outpatient and the medical outpatient departments of University of Uyo Teaching Hospital (UUTH). UUTH is a 500 bedded tertiary hospital in Akwa Ibom State which provides general and specialized medical and surgical services to its patients who reside in Akwa Ibom State and neighbouring states. The family medicine clinic runs five days (Monday to Friday) every week except on public holidays. The endocrinology clinic of Internal Medicine department runs two days every week.

Study design: This study used descriptive a cross-sectional study design. The study utilized an international well validated instrument called Edinburgh Claudication Questionnaire (ECQ). This instrument was adapted for the study by making it into four sections: section A for bio-data of respondent, section B for disease characteristics, section C for claudication and section D for assessment of the presence of peripheral artery disease.

Inclusion criteria

1. All consenting adult previously diagnosed diabetic patients
2. All consenting adult newly diagnosed diabetic patients

Exclusion criteria

1. All non-consenting patients

2. All acutely ill patients
3. All non-diabetic patients

Sample size determination

The following simple formula was used for calculating the adequate sample size in this prevalence study.¹⁴

$$n = Z^2 P(1-P) / d^2$$

Where n is the sample size, Z is the statistic corresponding to level of confidence, P is prevalence from a previous study or expected prevalence (that can be obtained from same studies or a pilot study conducted by the researchers), and d is precision (corresponding to effect size). The level of confidence usually aimed for is 95% as confidence interval (CI).

Therefore, the sample size will be $n = Z^2 P(1-P) / d^2$

(from a similar study in Nigeria, P is 40%.¹⁵)

$$n = 1.96^2 \times 0.4(1-0.4) / 0.05^2$$

$$n = 369$$

Since the study population was less than 10,000, the sample size was adjusted by the use of the finite population correction formula as follows; Adjusted sample size = $(n / (1 + (n/N)))$, where n = initial sample size calculated, and N = population size. And with 10% attrition, the final sample size was 82. However, 99 participants were studied and analyzed.

Data collection

Data collection took place in the GOPD on Monday to Friday, and in MOPD on Monday and Tuesday of every week till the sample size is obtained. The sampling technique utilized in the study was consecutive sampling of all consenting diabetic patients who met the inclusion criteria. Data was collected through interviewer administered questionnaire after preliminary information were extracted from the patient's case note.

The administration of the questionnaire lasted between five and ten minutes for each patient, and was not allowed to interfere with patient's care. The duration of data collection was three months.

Data Analysis

Data was cleaned and transferred into a spreadsheet and analyze using STATA version 12. The categorical variables were expressed as frequencies and proportions and continuous variables summarized using means and the appropriate measures of dispersion. Results were presented in tables and charts.

Ethical consideration

Ethical approval was obtained from Ethical Review Committee of University of Uyo Teaching Hospital. Written informed consent was obtained from the respondents. Participation was voluntary and the respondents were at liberty to discontinue at any stage of the research without any consequences. There was a strict adherence to confidentiality as the questionnaires were de-identified and data security was assured. No intentional harm was done to the participants and no patient was expected to incur additional financial expenditure because of participation in the study.

Results

There were more females than males (59:40) in the study with age range of 24 to 69 years, with mean

Table 1: Socio-demographic characteristics of diabetic patients of respondents

Variable	Frequency	Percent
Sex		
Males	40	40.4
Females	59	59.6
Age group (in years)		
Less than 30	1	1
31-40	6	6
41-50	21	21
51-60	38	39
61-70	26	26
Greater than 70	7	7
Mean age (SD)	56.2 ± 9.9	
Marital status		
Single	4	4.0
Married	81	81.8
Separated	1	1.0
Widowed	13	13.1
Occupation		
Unemployed	3	3.0
Business	21	21.2
Civil service	15	15.2
Pensioners	21	21.2
Others	39	39.4
Highest education level		
No formal education	1	1.0
Primary education	14	14.1
Secondary education	18	18.2
Tertiary education	66	66.7

age of 56 (± 9.9) years, and about 82% of them were married, 13% were widow and the remaining 5% were either single or separated. About 21% of the patients were pensioners, about 21% were self-employed, 15% were civil servants, 39% were engaged in petty trading, subsistence farming, or other menial jobs, and three percent were unemployed. More than 66% of the respondent had tertiary level of education, 18% had secondary level of education, while 14% had primary level of education. One percent had no formal education.

Only about 29% of the diabetic patients studied had normal body weight-for-height (BMI), 43.4% were overweight and 27% were obese. About 60.6% of the respondents had ever been treated with insulin injection, 41.4% were currently on insulin injection, and about 69.7% were on oral glucose-lowering drug(s). About 42.4% of the patients were suffering from associated systemic hypertension. And only about half of the patients were satisfied with their blood sugar control.

Table 2: Clinical characteristics of diabetic patients

Variable	Frequency	Percent
BMI Category (n=99)		
Normal BMI	29	29.3
Overweight	43	43.4
Obese	27	27.3
Treatment on insulin before		
Yes	60	60.6
No	39	39.4
Currently on insulin		
Yes	41	41.4
No	58	58.6
Currently on DM tabs		
Yes	69	69.7
No	30	30.3
Satisfied with glycaemic control		
Yes	50	50.5
No	49	49.5
Mean (SD) of last HbA1c	7.8% (± 1.9)	
Systemic hypertension		
Yes	42	42.4
No	57	57.6

Table 3: Tobacco use amongst the respondents

Variables	Frequency	Percent
Take snuff or cigarettes		
Yes	2	2.0
No	97	98.0
If yes, how long (in years)		
<1	1	1.0
>24	1	1.0

Ninety-eight percent of the diabetic were not exposed to tobacco use, while one percent each had smoked cigarettes for less than one year and more

than 24 years respectively.

About 68.7% of diabetics studied reported ever experiencing leg pain or discomfort, including while standing or sitting while about 51.5% experience such pain only during walking and pain disappears in after about 10 minutes of resting, thereby conforming to the pattern of pain of PAD. The same number of patients reported calf or buttock pain. Using the instrument of ECQ, PAD was positive in 51.5% of our diabetic patient cohort.

Table 4: Symptoms of peripheral artery disease in diabetic patients

Variable	Frequency	Percent
Leg pain or discomfort		
Yes	68	68.7
No	31	31.3
Pain on calf or buttock		
Yes	68	68.7
No	31	31.3
Pain start on standing or sitting		
Yes	68	68.7
No	31	31.3
Pain walking uphill		
Yes	51	51.5
No	48	48.5
Pain disappear after 10 minutes of resting		
Yes	51	51.5
No	48	48.5
IVC Present		
Yes	51	51.5
No	48	48.5
IVC Absent		
Yes	48	48.5
No	51	51.5
PAD Pos		
Yes	51	51.5
No	48	48.5
PAD Neg		
Yes	48	48.5
No	51	51.5

The symptomatology study was based on Edinburgh Claudication Questionnaire instrument. Leg pain or discomfort that starts on walking and aggravated uphill and disappears after about 10 minutes of resting or similar characteristic pain in the calf or buttock was noted.

Discussion

There were more female diabetic patients than males (M:F= 1:1.5) in the present study with age range of 24 to 76 years and mean of 56.2 $\pm$ 9.9 years. These were consistent with findings of related studies by other researchers.¹⁶⁻²⁰ Studies have also shown that in developing world, the population of diabetics with PAD is characterized by younger age because of ignorance, poverty, poor social facilities

and need for out-of-pocket payment for health care, which jointly propagate late presentation and sub-optimal management of diseases.^{21,22}

Most of the respondents were married and this portends good social support. Again, 79% had regular source of income as civil servant, pensioners or business people and also about 85% had good educational attainment, connoting good intellectual capability to understand health educational instructions on care of diabetes mellitus. Sixty-two percent of the studied patients were overweight or obese, 60% had ever been treated with insulin injection and 80% were receiving oral tablet for the treatment of diabetes. The prevalence of PAD among diabetics in this study was 51.5%. A previous study had found prevalence of PAD in general population to be 7.6% with certain risk factors which include male sex, older age, inability to perform physical activity, smoking, hypertension, diabetes, previous CVS disease, hypercholesterolaemia, hypertriglyceridaemia, obesity and physical inactivity.²³ Krishna, et al found a prevalence of 26.1% in elderly population with similar risk factors.²⁴ While the review of Soyoye et al, gave prevalence of ~9% to 55% with the upper extreme among diabetic patients.²⁵

A related study utilized the Edinburgh Claudication Questionnaire without Ankle Brachial Index measurement.²⁶ The current study used a modification of ECQ whereby certain details of leg pain were sought. In addition to asking about the presence of leg pain or discomfort, relationship of onset of pain with exercise was sought, radiation to buttock, and aggravating and relieving factors were also sought. Based on their responses, a respondent was determined to have or not intravascular claudication and therefore peripheral artery disease. The symptomatology study was based on Edinburgh Claudication Questionnaire instrument. Leg pain or discomfort that starts on walking and aggravated uphill and disappears after about 10 minutes of resting or similar characteristic pain in the calf or buttock was noted and not affected by diabetic neuropathy. Meta-analysis has shown that one simple claudication question can be used for screening for PAD.²⁶ and physical examination of the lower limb arterial pulses with Doppler and ABI with diagnostic cut-off ≤ 0.9 .^{27,28}

Conclusion

The prevalence of PAD among diabetic patients in the University of Uyo Teaching Hospital, Nigeria is 51%. Further studies are required to reveal the pattern, severity and risk factors of PAD in diabetics.

References

1. Viles-González JF, Fuster V, Badimón JJ. Atherothrombosis: a widespread disease with unpredictable and life-threatening consequences. *Eur Heart J*. 2004;25:1197-207.
2. Velasco JA, Cosín J, Maroto JM, Muñiz J, Casanovas JA, Plaza I, et al. Guías de práctica clínica de la Sociedad Española de Cardiología en prevención cardiovascular y rehabilitación cardíaca. *Rev Esp Cardiol*. 2000;53:1095-120.
3. Marrugat J, Solanas P, D'Agostino R, Sullivan L, Ordovás J, Cerdón F, et al. Estimación del riesgo coronario en España mediante la ecuación de Framingham calibrada. *Rev Esp Cardiol*. 2003;56:253-61.
4. Pearson TA. New tools for coronary risk assessment: what are their advantages and limitations? *Circulation*. 2002;105:886-92.
5. Belch JJ, Topol EJ, Agnelli G, Bertrand M, Califf RM, Clement DL, et al. Critical issues in peripheral arterial disease detection and management: a call to action. *Arch Intern Med*. 2003;163:884-92.
6. Hiatt WR. Medical treatment of peripheral arterial disease and claudication. *N Engl J Med*. 2001;344:1608-21.
7. Doobay AV, Anand SS. Sensitivity and specificity of the ankle brachial index to predict future cardiovascular outcomes: a systematic review. *Arterioscler Thromb Vasc Biol*. 2005;25:1463-9.
8. Hirsch AT, Criqui MH, Treat-Jacobson D, Regensteiner JG, Creager MA, Olin JW, et al. Peripheral arterial disease detection, awareness, and treatment in primary care. *JAMA*. 2001;286:1317-24.
9. Curb JD, Masaki K, Rodríguez BL, Abbott RD, Burchfiel CM, Chen R, et al. Peripheral artery disease and cardiovascular risk factors in the elderly. The Honolulu Heart Program. *Arterioscler Thromb Vasc Biol*.

- 1996;16:1495-500.
10. Meijer WT, Hoes AW, Rutgers D, Bots ML, Hofman A, Grobbee DE. Peripheral arterial disease in the elderly: The Rotterdam Study. *ArteriosclerThrombVasc Biol.* 1998;18:185-92.
11. Hooi JD, Stoffers HE, Kester AD, Rinkens PE, Kaiser V, van Ree JW, et al. Risk factors and cardiovascular diseases associated with asymptomatic peripheral arterial occlusive disease. The Limburg PAOD Study. *Peripheral Arterial Occlusive Disease.Scand J Prim Health Care.* 1998;16:177-82.
12. Wattanakit K, Folsom AR, Selvin E, Weatherley BD, Pankow JS, Brancati FL, et al. Risk factors for peripheral arterial disease incidence in persons with diabetes: the Atherosclerosis Risk in Communities (ARIC) Study. *Atherosclerosis.* 2005;180:389-97.
13. Leng GC, Fowkes FG. The Edinburgh Claudication Questionnaire: an improved version of the WHO/Rose Questionnaire for use in epidemiological surveys. *J Clin Epidemiol.* 1992;45:1101-9.
14. Daniel WW, editor. 7th ed. New York: John Wiley & Sons; 1999. Biostatistics: a foundation for analysis in the health sciences
15. Ogbera AO, Adeleye O, Solagberu B, Azenabor A. Screening for peripheral neuropathy and peripheral arterial disease in persons with diabetes mellitus in a Nigerian University Teaching Hospital. *BMC Res Notes* (2015) 8:533 DOI 10.1186/s13104-015-1423-2
16. Ikem R, Ikem I, Adebayo O, Soyoye D. An assessment of peripheral vascular disease in patients with diabetic foot ulcer. *Foot (Edinb)* 2010;20:114–117.
17. Arora E, Maiya AG, Devasia T, Bhat R, Kamath G. Prevalence of peripheral arterial disease among type 2 diabetes mellitus in coastal Karnataka. *Diabetes Metab Syndr.* 2019;13:1251–1253.
18. Akalu Y, Birhan A. Peripheral Arterial Disease and Its Associated Factors among Type 2 Diabetes Mellitus Patients at Debre Tabor General Hospital, Northwest Ethiopia. *J Diabetes Res.* 2020;2020:9419413
19. Soyoye DO, Ikem RT, Kolawole BA, Oluwadiya KS, Bolarinwa RA, Adebayo OJ. Prevalence and Correlates of Peripheral Arterial Disease in Nigerians with Type 2 Diabetes. *Adv Med.* 2016;2016:3529419.
20. Hiatt WR, Goldstone J, Smith SC, et al. Atherosclerotic peripheral vascular disease symposium II: nomenclature for vascular diseases. *Circulation* 2008; 118: 2826–2829.
21. Ekpe EE, Akpan MU. Poorly treated broncho-pneumonia with progression to empyema thoracis in Nigerian children. *TAF Preventive Medicine Bulletin* 2010;9(3):181-186
22. Ekpe EE, Umanah IN, Ikpe MC. Neglected soft tissue chest wall tumours in Nigeria; a call for expansion of national health insurance scheme. *International Journal of Tropical Surgery* 2012; 6: 55-59
23. Alzamoram T, Fore R, Baena-Diezmpera G, Toran P, Sombes M. PAD Study: Prevalence & risk factors in general population. *BMC Public Health* 2010;10:32.
24. Krishna MN, Geevarb Z, Mohananc PP, Venugopald K, Devikae S. Prevalence of peripheral artery disease and risk factors in the elderly: A community based cross-sectional study from northern Kerala. *India Indian Heart Journal* 2018;70; 808–815.
25. Soyoye DO, Abiodun OO, Ikem RT, Kolawole BA, Akintomide AO. Diabetes and peripheral artery disease: A review. *World J Diabetes.* 2021 Jun 15; 12(6): 827–838.
26. Kieback AG, Espinola-Klein C, Lamina C, Moebus S, Tiller D, Lorbeer R, et al. One simple claudication question as first step in Peripheral Arterial Disease (PAD) screening: A meta-analysis of the association with reduced Ankle Brachial Index (ABI) in 27,945 subjects. *PLoS ONE* 209;14(11): e0224608. <https://doi.org/10.1371/journal.pone.0224608>
27. Armstrong DWJ, Tobin C, Matangi MF. The accuracy of the physical examination for the detection of lower extremity peripheral arterial disease. *Can J Cardiol* 2010;26(10):e346-e350.
28. Okello S, Millard A, Owori R, Asimwe SB, Siedner MJ, Rwebembera J, et al. Prevalence of lower extremity peripheral artery disease among adult diabetes patients in Southwestern Uganda. *BMC Cardiovascular Disorders* 2014, 14:75 <http://www.biomedcentral.com/1471-2261/14/75>.