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Predictive value of the Edinburgh claudication questionnaire in diagnosing peripheral arterial disease among Nigerian adults

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Abstract

Background: Although Peripheral arterial disease (PAD) is a strong predictor of adverse cardiovascular events, it is frequently unrecognized and under diagnosed. When the diagnosis is considered, it is often made by eliciting the presence of intermittent claudication using the Edinburgh Claudication Questionnaire (ECQ) whereas the Ankle Brachial Index (ABI) is a simpler and more objective means of making the diagnosis with a sensitivity and specificity of > 90%.

Objective : To determine the predictive values of Edinburgh Claudication Questionnaire in the diagnosis of PAD among adult patients in Sagamu, south western Nigeria.

Methods: A cross-sectional study of 400 patients aged ≥ 50 years attending the General Out- Patients Clinic of Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria was carried out. ECQ was administered on all the subjects to determine the presence of intermittent claudication (IC) and their ABI were also measured. A value of ABI d" 0.9 was taken as diagnostic of PAD. The prevalence of PAD, the sensitivity, specificity, positive and negative predictive values of ECQ against ABI were evaluated.

Results: Using ECQ 25 (6.3%) of the patients had PAD while 99 (24.8%) had PAD when ABI was used. Among these 99 patients, 17 (17.2%) had symptoms consistent with IC based on ECQ. The presence of IC was significantly associated with ABI values d"0.9 (p = 0.000).The sensitivity of ECQ was 17.2% while the specificity was 99% with a positive predictive value of 85% and a negative predictive value of 77.7%.

Conclusion: The ECQ is not a useful tool for the screening of PAD given its low sensitivity. Its use would result in missing a large number of patients with asymptomatic PAD who would have benefitted from interventions.

Keywords: *Intermittent Claudication, Peripheral arterial disease, Ankle brachial index, Edinburgh Claudication Questionnaire, sensitivity, specificity.*

Résumé

Contexte: Bien que la maladie artérielle périphérique (MAP) soit un prédicteur puissant des événements cardiovasculaires indésirables, elle est souvent méconnue et sous-diagnostiquée. Lorsque le diagnostic est pris en considération, on le fait souvent en provoquant la présence d'une claudication intermittente en utilisant l'Edinburgh Claudication Questionnaire (ECQ), alors que l'index Brachial de la cheville (ABI)est un moyen plus simple et plus objectif de faire le diagnostic avec une sensibilité et une spécificité de > 90%.

Objectif: Déterminer les valeurs prédictives d'Edinburgh Claudication Questionnaire dans le diagnostic de MAP chez des patients adultes à Sagamu, sud-ouest du Nigeria.

Méthodes: Une étude transversale de 400 patients âgés de e" 50 ans fréquentant la Clinique Générale pour Patients Non-Hospitalisés de l'Hôpital d'Enseignement Universitaire OlabisiOnabanjo, Sagamu, Nigéria, a été réalisée. ECQ a été administré sur tous les sujets pour déterminer la présence de claudication intermittente (IC) et leur ABI ont également été mesurés. Une valeur d'ABI d" 0,9 a été prise comme diagnostic de MAP. On a évalué la prévalence de la MAP, la sensibilité, la spécificité, les valeurs prédictives positives et négatives de l'ECQ par rapport à ABI.

Résultats: En utilisant l'ECQ, 25 (6,3%) des patients avaient MAPcependant 99 (24,8%) avaient MAP quand ABI a été utilisé. Parmi ces 99 patients, 17 (17,2%) avaient des symptômes compatibles avec l'IC basée sur l'ECQ. La présence de l'IC était significativement associée aux valeurs d'ABI d"0,9 (p = 0,000).La sensibilité de l'ECQ était de 17,2% alors que la spécificité était de 99% avec une valeur prédictive positive de 85% et une valeur prédictive négative de 77,7%.

Conclusion: L'ECQ n'est pas un outil utile pour le dépistage du MAPétant donné sa faible sensibilité. Son utilisation entraînerait la disparition d'un grand nombre de patients atteints de MAP asymptomatique qui auraient bénéficié d'interventions.

Mots-clés: *Claudication intermittente, Maladie artérielle périphérique, Index brachialde la cheville, Edinburgh Claudication Questionnaire, sensibilité, spécificité.*

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Introduction

Peripheral arterial disease (PAD) is frequently associated with increased cardiovascular morbidity and mortality because the underlying pathological process, atherosclerosis, is a systemic one. Atherosclerosis, if present in the peripheral vessels, is also likely to be present in the coronary and cerebral vasculature [1]. Therefore, individuals with PAD have a high chance of suffering angina, acute myocardial infarction, transient ischaemic attack and stroke [2]. PAD is thus considered an independent biomarker of cardiovascular disease [3]. The gold standard in the diagnosis of PAD is the Ankle Brachial Index (ABI), which is the ratio of Doppler recorded systolic arterial blood pressure at the ankle, usually dorsalis pedis artery, to brachial systolic blood pressure [4,5]. Values of ABI $\leq$ 0.9 predicts the diagnosis of PAD in both symptomatic as well as asymptomatic patients with a sensitivity and specificity of > 90% for detecting angiographically confirmed PAD [4-6]. However, despite the simplicity of this procedure, ABI is not widely used by clinicians because of poor awareness that a low ABI is a marker of cardiovascular risk, the misconception that it is a specialist test for use only by vascular surgeons and physicians and the lack of familiarity with the procedure [7]. As a result of this, the diagnosis of PAD tends to be made based on the presence of intermittent claudication (IC) which is the classical symptom of PAD.

Intermittent claudication is defined as exertional calf pain that is relieved within 10 minutes of resting and is usually assessed by the Edinburgh Claudication Questionnaire (ECQ), which is an improved version of WHO/Rose Claudication Questionnaire [8]. Compared with the diagnosis of PAD made by clinical examination, ECQ had been shown to be 91.3% sensitive and 99.3% specific in detecting IC in the general population [8,9] . Given that the diagnosis of PAD is often made based on the presence of IC, this study was conducted to look at the predictability of ECQ as a screening tool for the diagnosis of PAD compared with ABI as a gold standard in a general practice setting.

Materials and methods

The study formed part of a cross-sectional study on the profile of ABI of adult patients attending the General Out-Patient clinic of Olabisi Onabanjo University Teaching hospital (OOUTH), Sagamu, south west of Nigeria and was carried out on consecutive working days from January to May 2011. The target population was adult patients attending the clinic and aged $\geq$ 50 years. The study population was determined using the sample size calculation for prevalence studies [10]. This gave a sample size of 376 which was approximated to 400. The recruitment was done by systematic random sampling in which every fourth patient was selected. Excluded from the study were those with respiratory distress and clinical features suggestive of deep vein thrombosis, to prevent embolism which may occur while measuring ABI. The presence of IC among the patients was determined using ECQ as shown in Table 1.

The ABI of the participants were measured using *Accoson®* sphygmomanometer with appropriate cuff and hand-held 10-MHz Doppler device with vascular probe (*Huntleigh Healthcare Mini Dopplex Model No 0900*). Each patient was allowed to rest for 10 minutes in the supine position on the examination couch. The brachial systolic pressure was measured by applying the cuff of the sphygmomanometer on the upper arm of the patient with the lower edge approximately 1 inch above the antecubital fossa. The brachial artery was localized by palpation and conductivity gel applied over it. The tip of the probe of Doppler device was placed on the gel at 45-60 degree angle until clear arterial pulse sounds were heard. The cuff was inflated

Table 1: The Edinburgh Claudication Questionnaire for detecting intermittent claudication [8].

If a patient describes pain or discomfort in the legs when they walk, ask **Question**	**Interpretation**
Does the pain ever begin when you are standing still or sitting?	No = IC
Do you get pain if you walk uphill or hurry?Yes = IC	
Do you get pain if you walk at an ordinary pace on the level?	No = mild IC Yes = moderate/severe IC
What happen if you stand still?	Pain goes away = IC
Does pain disappear within 10 minutes or less when you stand still	Yes = IC
Where do you get the pain or discomfort?	IC is present if patient indicates pain in the calf irrespective of whether pain is indicated in any other part of the body

progressively up to 20 mmHg above the level of flow signal disappearance and then deflated slowly to detect the pressure of flow signal reappearance. The corresponding cuff pressure is the systolic pressure. This procedure was repeated in the other arm. The ankle systolic pressure was measured by applying the cuff on the patient's leg just above the medial malleolus. The dorsalis pedis pulse was palpated and the gel applied. The tip of the Doppler probe was applied to the gel and the systolic pressure measured following the same step described for the arm. The systolic pressure from the posterior tibial artery was similarly measured. The same procedure was repeated for the other leg. The ABI was calculated for each leg by dividing the higher of the systolic blood pressure in the ankle by the higher systolic blood pressure in the arm [4]. The diagnosis of PAD was made if the ABI in either of the leg was d" 0.9.Normal ABI was taken as >0.9 while ABI of > 1.3 indicated incompressibility of the artery as a result of calcification [4]. Due to poor correlation between calcification and severity of atherosclerosis, the ABI is generally unreliable in this situation (i.e.>1.3) and was excluded from the analysis.

The data were analyzed using Statistical Package for Social Sciences (SPSS) version 16 and descriptive statistics was used to present the results. The Chi-square test was used to determine the association between categorical variables with the level of significance set at $p< 0.05$.

The study was approved by the Health Research and Ethical Committee of the Olabisi Onabanjo University Teaching Hospital, Sagamu. Informed written consent was obtained from each of the participants.

Results

Table 2 shows the demographic data and results of investigation with ECQ and ABI. The mean age was 62.5 ± 9.29 years and there were 244 (36%) males and 256 (64%) females. The prevalence of PAD using both ABI and ECQ were also shown. With the value of ABI of ≤0.9 for the diagnosis of PAD, 99 (24.8%) had PAD while with ECQ only 25 (6.2%) were diagnosed as having PAD. 13 (3.3%) of the patients had arterial calcification and so could not have a successful ABI. Table 3 is a cross-tabulation of ABI and IC showing that of the 99 patients who were found to have PAD using ABI, only 17 (17.2%) had IC while the majority (82.8%) did not have. The presence of IC was significantly associated with ABI values ≤0.9 ($p = 0.000$). The sensitivity, specificity, positive and negative predictive values of ECQ in the diagnosis of PAD are shown in Table 4.

Table 2: Demographic data and results of ankle brachial index and Edinburgh Claudication Questionnaire in all patients

Parameters	Frequency n=400	%
Age group (yrs)		
50-59	162	40.5
60-69	146	36.5
≥70	92	23.0
Gender		
Male	244	36
Female	256	64
ABI		
PAD present	99	24.8
PAD absent	288	72.0
Arterial calcification	13	3.3
ECQ		
PAD present	25	6.2
PAD absent	375	93.8

Table 3: Cross-tabulation of Ankle brachial index and Intermittent Claudication

ABI	IC		Total	Chi-square
	Yes	No		
High ABI	5 (38.5%)	8 (61.5%)	13	0.000
Low ABI	17 (17.2%)	82 (82.8%)	99	
Normal ABI	3 (1.0%)	285 (99.0%)	288	

Table 4: Predictive values of Edinburgh Claudication Questionnaire for Peripheral arterial disease

ECQ	Low ABI (PAD present)	Normal ABI (PAD absent)
IC present	17 (true positive)	3 (false positive)
IC absent	82 (false negative)	285 (true negative)

Sensitivity (17.1%), Specificity (99%), Positive predictive value (85%), Negative predictive value (77.7%).

Discussion

Reports on the prevalence of PAD varied depending on the methods used and the population studied. It had been found to be between 1.6%-6.4% based on Rose Questionnaire/ECQ and 8%-52.5% based on ABI [11-14]. In this study, similar prevalence of PAD was found as the use of ABI and ECQ gave a prevalence of 24.8% and 6.3% respectively. While the asymptomatic nature of PAD had been shown in many studies mainly in high risk group such as the cigarette smokers and diabetics[1,2,12] , the finding from this study showed that even among unselected group of patients in general practice, PAD is largely asymptomatic as only 17 (17.2%) of the 99 patients with low ABI reported intermittent claudication. Similarly, Bernstein *et al.* found out that 20% of patients referred by primary care physicians for evaluation of lower extremity pain have asymptomatic PAD irrespective of the cardiovascular risk status [15]. The ECQ showed a low sensitivity of 17.2% and a high specificity of 99% with a positive predictive value of 85% and a negative predictive value of 77.7% for an ABI of **d"**0.9 for PAD. Even among high risk patients the sensitivity and specificity of ECQ range between 25% - 28.6% and 90.0%-99.4% respectively [9,16] . The implication of this is that ECQ is not a very reliable screening tool for PAD given its low sensitivity. This is due to the fact that ECQ evaluates PAD symptoms and so cannot be expected to detect asymptomatic disease, which represents a large proportion of the total PAD burden [17] .However, its high positive and negative predictive values make it a good diagnostic tool for PAD.

Many studies have shown that using the presence of IC as screening for PAD, would result in missing large number of patients who would have benefitted from early interventions to prevent adverse effects of atherosclerosis [6,7,9]. It has also been shown that a history of IC, underestimated the presence of PAD by a factor of two to five and screening for PAD on the basis of finding a complaint of IC will miss up to 90% of high risk patients with the disease [7]. While the previous studies were done on high risk groups such as diabetic patients in which the presence of peripheral neuropathy may mask IC, the present study was carried out on an undifferentiated group of patients frequently encountered in general practice. Yet the results are similar, implying that even among patients considered as low risk, ECQ is not a very useful screening tool for PAD. In this group of patients other causes of leg pain such as neurological, musculoskeletal and venous pathology may exist or coexist with leg pain from PAD, confounding the diagnosis of PAD by ECQ. Additionally, IC may be atypical in its presentation with potential of ECQ missing the diagnosis of PAD [16,18]. These may limit the ability of ECQ to detect PAD to an appreciable extent.

A limitation of this study is that more than half of the study population (59.5%) were aged 60 years and above. This group of patients may be less active thereby not generating enough exertion to provoke calf pain and may even take the pain as part of normal ageing process [18].

Conclusion

The prevalence of PAD using ABI was 24.8% while it was 6.3% based on ECQ. This means that just about a quarter of patients with PAD have symptoms of IC. While the ECQ was demonstrated to have high positive and negative predictive values, its low sensitivity renders it a poor screening tool for screening for PAD even among patients considered as low risk. It is suggested that primary care physicians should be familiar with the procedure for ABI assessment in order to detect PAD early and institute appropriate strategies to prevent adverse cardiovascular events.

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