Comparison of Doppler and oscillometric methods of assessing ankle-brachial index in non-diabetic premenopausal women in Ghana

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Research Article

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Abstract

Introduction

Peripheral arterial disease (PAD) is a common cardiovascular disease less commonly diagnosed in female patients. PAD is objectively diagnosed using the ankle-brachial index (ABI), which can be measured using the ‘gold standard’ Doppler method or the oscillometric method. The agreement between these two methods is less investigated in sub-Saharan African population. Therefore, we compared the diagnostic characteristics of the oscillometric method of measuring ABI with the Doppler method in premenopausal female patients suspected of PAD in Ghana.

Method

ABI was measured in non-diabetic premenopausal women suspected of PAD using the Doppler method with a 8 MHz handheld Doppler (LifeDop 250, Summit Doppler) and an oscillometric device (Vasera 1500N, Fukuda Denshi) in 160 patients (320 legs). PAD was defined as ABI < 0.9 in at least one leg. Leg pains were assessed using the Edinburgh claudication questionnaire.

Results

Leg pain on exertion was present in 101 patients screened with similar mean ABIs in the right and left legs. The prevalence of PAD as screened by the Doppler method was 25.7% (18.9–33.4%) and that of the oscillometric method was 32.2% (24.9–40.3%). In comparison to the Doppler method, the accuracy of the oscillometric method was 88.2%, with sensitivity, specificity, positive and negative predictive values of 89.7%, 87.6%, 71.4% and 96.1%, respectively. The overall agreement between the Doppler and oscillometric methods was high [κ=0.78 (0.62–0.91), p < 0.001] and intraclass correlation of 0.89 (0.87–0.92, p < 0.001). In ROC curve analysis, the oscillometric method showed an area under curve of 0.925 compared to the Doppler method in the diagnosis of PAD.

Conclusion

In nondiabetic premenopausal women in our study, oscillometric ABI performed acceptably in the diagnosis of PAD when compared with Doppler ABI.

Introduction

Peripheral artery disease (PAD) is a progressive disorder characterized by stenosis and/or occlusion of large and medium-sized arteries, other than those that supply the heart (coronary artery disease) or the brain (cerebrovascular disease). The global population is in an epidemiological transition with the
burden of PAD shifting from high-income to low-middle-income countries (LMIC)\(^2\). It was estimated that the prevalence of PAD worldwide between the years 2000 and 2010 was 200 million, with the majority living in LMIC. The regional analysis also showed that about 14.2 million people are living with PAD in sub-Saharan Africa \(^2\). In LMIC, PAD is more common in women especially at a young age \(^2\), but is less represented in clinical studies \(^3\). PAD affects the lower extremities more commonly than the upper extremity vessels and may lead to recurrent fatigue, cramping sensation, or pain that is known as intermittent claudication, which is the most recognized symptomatic subset of lower extremity PAD \(^4\). PAD can affect walking and, in severe cases, can lead to tissue loss, infection, and amputation. In addition to morbidity directly caused by PAD, patients with PAD are at increased risk for cardiovascular disease (CVD) events, because atherosclerosis is a systemic disease that also causes coronary and cerebrovascular events \(^5,6\). Ankle-brachial index (ABI) is a simple, reproducible, non-invasive haemodynamic test used for screening patients suspected of atherothrombosis in the peripheral arteries of the lower extremities, commonly called peripheral artery disease (PAD) \(^5,7\). ABI less than 0.9 has been shown to have a high sensitivity and accuracy in detecting stenosis greater than 50% in peripheral arteries with digital subtraction angiography as a gold standard \(^8,9\).

The American Heart Association/American College of Cardiology recommend the use of the Doppler method for measuring ABI in suspected patients \(^1\). However, conventional Doppler ABI measurement is time-consuming, requires specific skills, and is therefore underused in resource-constraint clinical settings in sub-Saharan Africa \(^10\). To address this challenge, the use of automated oscillometric cuff-based equipment to measure ABI is gaining popularity. Compared to the Doppler method, the oscillometric method requires less training, a short duration of measurement, and is operator-independent \(^11,12\). The major setback of the utility of oscillometric devices is their accuracy, since earlier devices were considered less accurate \(^7,13,14\). However, current reports indicate acceptable accuracy of the oscillometric devices \(^10,15,16\). From our literature search, no study has assessed the accuracy of oscillometric devices in the sub-Sahara African population, especially in nondiabetic premenopausal women suspected of PAD. In this study, we assessed the reliability, validity, and diagnostic accuracy of an automated oscillometric ABI device compared with reference standard vascular laboratory Doppler ABI equipment in non-diabetic females suspected of PAD. We hypothesized that an automated oscillometric ABI device may perform similar to Doppler ABI in the diagnosis of PAD.

**Methods**

**Setting, design and patients**

The study was conducted at the Cardiovascular and metabolic research laboratory at the University of Ghana Medical School, Korle Bu, Accra, Ghana. Consecutive female patients, between 18–40 years, who were referred for vascular evaluation were included in the study. Patients with psychiatric or psychological disorders that made them unable to provide voluntary informed consent, major limb amputations, marked edema in one or both feet, inability to tolerate a supine position, upper extremity
vascular disease, and spasms or tremors of any kind were excluded from the study. The study protocol was approved by the College of Health Ethical and Protocol Review Committee of the University of Ghana. Each patient provided voluntary written consent before being included in the study. The clinical history of the participants was taken from their case notes, and leg symptoms were evaluated using the Edinburgh claudication questionnaire.

**ABI measurements**

ABI measurements were performed under standardised conditions in a quiet examination room in a supine position after 3 to 5 minutes of rest. Both oscillometric and Doppler measurements were obtained from patients in random order. All ABI measurements were performed in 3 replicates and the last two ABI measurements were averaged for analysis if they did not differ by 0.05. When the difference in ABI was greater than 0.05, the patient was allowed to rest for another 5 – 10 min and a new set of measurements performed.

Doppler systolic brachial blood pressures (BP) were measured with 8 MHz continuous wave Doppler (LifeDop, Summit Doppler) in both arms, after which the systolic ankle BPs of the dorsalis pedis and posterior tibial arteries were measured at the level of the malleoli. The ankle-brachial index was calculated for each leg by dividing the highest systolic ankle pressure by the highest brachial systolic pressure [13]. Study participants were categorized into those with PAD (ABI < 0.9) or normal (ABI < 0.9).

The oscillometric ankle and brachial systolic BPs were measured in all participants after a minimum of 5 min of rest in a supine position on an examination table in a room using a validated automated method (Vasera 1500N, Fukuda-Denshi, Tokyo). The Vasera BP cuffs were applied to both arms and ankles to simultaneously measure BP. ABI was calculated for each leg using the highest ankle pressure (HAP) method as the ratio of systolic ABI in the ankle divided by the highest of the systolic blood pressures in the arm. ABI > 0.9 was considered normal and PAD was defined as ABI ≤ 0.9 in at least one leg. The ABIs were measured in two sessions separated by > 30 mins intervals. When the equipment fails to measure ABI after two trials, it is considered as oscillometric error.

**Sample size estimation**

The minimum sample size for the study was calculated based on the assumption that the prevalence of PAD in our study population is 10% and the oscillometric method of measuring ABI would be able to correctly identify 90% of the patients as having PAD compared to the Doppler method (sensitivity of 0.9). Assuming a null hypothesis that the oscillometric method of measuring ABI has equal probabilities of correctly and incorrectly identifying PAD compared to the Doppler method (sensitivity of 50%), then at the power of 90% and a level of significance, the minimum sample size required for a two-tailed test would be 120 patients [17]. To make room for measurement errors due to device error and incompressible arteries, we recruited 175 patients into the study.

**Statistical Analysis**
The analyses were performed using the IBM SPSS ver 27 and R statistical package. Data are presented as mean ± standard deviation for continuous variables and counts and percentages for categorical variables. The comparison of variables between two groups was performed using an independent T-test and ANOVA for 3 or more variables. Correlational analyses were performed using the Pearson correlational test. The reproducibility of the oscillometric ABI was assessed using the correlation, coefficient, intraclass correlation and Bland-Altman plot. Agreement between oscillometric ABI and Doppler ABI in each limb was analyzed using Bland-Altman’s statistics. Sensitivity, specificity, positive and negative predictive values, positive and negative likelihood ratios, and diagnostic odds ratio of the oscillometric method were determined using the Doppler measurement as the reference standard. A receiver operating characteristic (ROC) curve was constructed, and the area under the curve (AUC) was computed for each limb. A p-value less than 0.05 was considered statistically significant.

Results

We excluded 15 participants from the analysis due to incompressible arteries (2 patients) and oscillometric device error (13 patients). When screened with the Edinburgh claudication questionnaire, 101 (63.1%) patients have exertional leg pains. Most of patients (71.3%) with exertional leg pain had intermittent claudication, while 25 (24.8%) patients had atypical claudication and 4 patients had rest pains.

Compared to those without exertional leg pains, patients with exertional leg pains were older, with high proportions of chronic kidney disease and PAD on the right side. There was no difference in their alcohol intake and previous smoking status, anthropometric indices, blood pressure indices, clinical histories such as hypertension, hypercholesterolemia, sickle cell disease, cardiovascular diseases and stroke among the two groups. Also, both right side and left side doppler ABIs were similar among the two groups. There was an association in the prevalence of PAD and exertional leg pain using doppler and oscillometric methods on the right side of the body, but not on the left side (Table 1).
Table 1
General characteristics of study participants based on leg pain on exertion.

<table>
<thead>
<tr>
<th></th>
<th>All participants (n = 160)</th>
<th>Leg Pain (n = 101)</th>
<th>No leg Pain (n = 59)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, yrs</td>
<td>31.4±8.6</td>
<td>32.9±9.3</td>
<td>28.7±6.5</td>
<td>0.025</td>
</tr>
<tr>
<td>Previous smoking, n (%)</td>
<td>12 (7.5)</td>
<td>5 (4.9)</td>
<td>7 (11.9)</td>
<td>0.109</td>
</tr>
<tr>
<td>Alcohol usage, n (%)</td>
<td>34 (21.3)</td>
<td>23 (22.8)</td>
<td>11 (18.6)</td>
<td>0.538</td>
</tr>
<tr>
<td>Body height, cm</td>
<td>165±7</td>
<td>165±6</td>
<td>166±8</td>
<td>0.578</td>
</tr>
<tr>
<td>Bodyweight, kg</td>
<td>70±15.4</td>
<td>69.6±13.6</td>
<td>70.5±18.6</td>
<td>0.823</td>
</tr>
<tr>
<td>BMI, kg/m²</td>
<td>25.8±5.6</td>
<td>25.8±5.1</td>
<td>25.7±6.6</td>
<td>0.96</td>
</tr>
<tr>
<td>Hip circumference, cm</td>
<td>102±13</td>
<td>102±14</td>
<td>101±13</td>
<td>0.808</td>
</tr>
<tr>
<td>Waist circumference, cm</td>
<td>85±14</td>
<td>85±14</td>
<td>85±13</td>
<td>0.97</td>
</tr>
<tr>
<td>Waist-hip ratio</td>
<td>0.83±0.07</td>
<td>0.83±0.08</td>
<td>0.84±0.07</td>
<td>0.648</td>
</tr>
<tr>
<td>Systolic BP, mmHg</td>
<td>123±24</td>
<td>122±29</td>
<td>125±12</td>
<td>0.371</td>
</tr>
<tr>
<td>Diastolic BP, mmHg</td>
<td>77±17</td>
<td>77±20</td>
<td>77±9</td>
<td>0.964</td>
</tr>
<tr>
<td>Pulse BP, mmHg</td>
<td>47±7</td>
<td>47±7</td>
<td>48±7</td>
<td>0.26</td>
</tr>
<tr>
<td>Mean BP, mmHg</td>
<td>95±12</td>
<td>96±13</td>
<td>93±11</td>
<td>0.41</td>
</tr>
<tr>
<td>Heart rate, beats/min</td>
<td>76±23</td>
<td>75±25</td>
<td>79±20</td>
<td>0.269</td>
</tr>
<tr>
<td>Clinical history, n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>64 (40)</td>
<td>46 (45.5)</td>
<td>18 (30.5)</td>
<td>0.061</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>33 (20.6)</td>
<td>25 (24.8)</td>
<td>8 (13.6)</td>
<td>0.091</td>
</tr>
<tr>
<td>Chronic kidney disease</td>
<td>32 (20)</td>
<td>26 (25.7)</td>
<td>6 (10.2)</td>
<td>0.017</td>
</tr>
<tr>
<td>Sickle cell disease</td>
<td>18 (11.2)</td>
<td>10 (9.9)</td>
<td>8 (13.6)</td>
<td>0.499</td>
</tr>
<tr>
<td>CVDs</td>
<td>57 (35.6)</td>
<td>39 (38.6)</td>
<td>18 (30.5)</td>
<td>0.302</td>
</tr>
<tr>
<td>Stroke</td>
<td>11 (6.9)</td>
<td>7 (6.9)</td>
<td>4 (6.8)</td>
<td>0.971</td>
</tr>
<tr>
<td>Doppler measurements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right ABI</td>
<td>0.97±0.13</td>
<td>0.96±0.13</td>
<td>0.98±0.11</td>
<td>0.546</td>
</tr>
<tr>
<td>Left ABI</td>
<td>0.98±0.12</td>
<td>0.98±0.13</td>
<td>0.96±0.09</td>
<td>0.385</td>
</tr>
</tbody>
</table>

BMI, body mass index; BP, blood pressure; CVDs, cardiovascular diseases; ABI, ankle-brachial index; PAD, peripheral artery disease.
<table>
<thead>
<tr>
<th></th>
<th>All participants (n = 160)</th>
<th>Leg Pain (n = 101)</th>
<th>No leg Pain (n = 59)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right PAD, n (%)</td>
<td>51 (31.9)</td>
<td>42 (41.6)</td>
<td>9 (15.3)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Left PAD, n (%)</td>
<td>58 (36.3)</td>
<td>41 (40.6)</td>
<td>17 (28.8)</td>
<td>0.135</td>
</tr>
</tbody>
</table>

Oscillometric measurements

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Right ABI</td>
<td>0.96±0.11</td>
<td>0.96±0.12</td>
<td>0.97±0.09</td>
<td>0.58</td>
</tr>
<tr>
<td>Left ABI</td>
<td>0.99±0.11</td>
<td>0.98±0.11</td>
<td>1±0.11</td>
<td>0.269</td>
</tr>
<tr>
<td>Right PAD, n (%)</td>
<td>53 (33.1)</td>
<td>38 (37.6)</td>
<td>15 (25.4)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Left PAD, n (%)</td>
<td>48 (30)</td>
<td>34 (33.7)</td>
<td>14 (23.7)</td>
<td>0.186</td>
</tr>
</tbody>
</table>

BMI, body mass index; BP, blood pressure; CVDs, cardiovascular diseases; ABI, ankle-brachial index; PAD, peripheral artery disease.

In correlational analyses, Doppler ABI was positively correlated with oscillometric ABI in right (r = 0.749, p < 0.001) and left (r = 0.787, p < 0.001) sides of the body (Fig. 1). This positive correlation was observed in patients with exertional leg pain and those without exertional leg pain (Fig. 2). When the lowest ABI in either the right or left side of the body was used in diagnosing PAD, the prevalence of PAD screened by the Doppler method was 25.7% (18.9–33.4%) and that of the oscillometric method was 32.2% (24.9–40.3%). Compared to the Doppler method, the accuracy of the oscillometric method was 88.2%, with sensitivity, specificity, positive and negative predictive values of 89.7%, 87.6%, 71.4%, and 96.1% respectively. The diagnostic odds ratio of the oscillometric method was 61.9, and 1.3 patients are required to correctly be assessed to diagnose PAD with the oscillometric method (Table 2). The overall agreement between the Doppler method and the oscillometric method is high [κ=0.78 (0.62–0.91), p < 0.001] and an intraclass correlation of 0.89 (0.87–0.92, p < 0.001).
Table 2
Diagnostic accuracy of the oscillometric method compared to the Doppler method.

<table>
<thead>
<tr>
<th>Decision statistics</th>
<th>Diagnostic parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>89.7 (75.8–97.1)</td>
</tr>
<tr>
<td>Specificity</td>
<td>87.6 (80.1–93.1)</td>
</tr>
<tr>
<td>Diagnostic accuracy</td>
<td>88.2 (81.9–92.8)</td>
</tr>
<tr>
<td>Positive predictive value</td>
<td>71.4 (56.7–83.4)</td>
</tr>
<tr>
<td>Negative predictive value</td>
<td>96.1 (90.4–98.9)</td>
</tr>
<tr>
<td>Diagnostic odds ratio</td>
<td>61.9 (19.1–200.6)</td>
</tr>
<tr>
<td>Number needed to diagnose</td>
<td>1.3 (1.1–1.8)</td>
</tr>
</tbody>
</table>

Data visualization by Bland-Altman graphs indicated that most ABIs fall within the upper and lower limits of agreement in the right and left legs (Fig. 3). The histogram-density plot indicates that the mean differences in measurements between Doppler and oscillometric methods fall mostly between −0.1 and +0.1 (Fig. 4). In ROC curve analysis, the oscillometric method showed an area under the curve of 0.925 compared to the doppler method in the diagnosis of PAD (Fig. 5).

Discussion

In this study, we investigated the agreement between Doppler and oscillometric methods to measure ABI in nondiabetic premenopausal female patients with or without exertional leg pain. The findings of this study indicate a good level of agreement between the Doppler and oscillometric methods in our study participants with sensitivity, specificity, diagnostic odds ratio and AUC of 89.7%, 87.6%, 61.9 and 0.93 respectively. To our knowledge, this is the first study from the sub-Saharan African population that has investigated the precision and reliability of oscillometric ABI, especially in the non-diabetic female population. The findings of this study are consistent with recent reported studies that investigated the accuracy of oscillometric devices. A binational study in Japanese and French patients reported the sensitivity, specificity and concordance of the oscillometric device in comparison to the Doppler method to be 89.1%, 94.4% and 0.8 respectively\(^1\). Similarly, Dutch patients, Hageman et al reported the sensitivity, specificity, DOR and AUC of the oscillometric device with ABI cutoff of 0.9 to be 73.7%, 96.7%, 82 and 0.96 respectively, in comparison with doppler ABI\(^16\). Systematic reviews reported high diagnostic accuracy of the oscillometric method compared to the doppler method. It was previously reported in a meta-analysis that oscillometric ABI is a reliable and practical alternative to conventional Doppler ABI, with sensitivity and specificity of 69% and 96%, respectively\(^12\). In a fairly recent systematic review, which utilised robust hierarchical summary receiver operator characteristics, reported the pooled diagnostic odds ratio for oscillometric ABI was reported to 32.5 with sensitivity of 65% and specificity of 96%, with
the time required to oscillometric ABI reduced by almost half when compared to Doppler ABI assessment.

The findings of this study show that the prevalence of low ABI was higher using the Doppler method compared to the oscillometric method (25.7% vs 32.2%). This is contrary to other studies conducted in Japan, the Netherlands and the United States which reported a high prevalence of low ABI with the Doppler method compared to the oscillometric method. Unlike these studies, our study participants were younger and had no diabetes. Chronological age and diabetes are known to stiffen the arteries, and this reduces the accuracy of the oscillometric BP measurement. This is because oscillometric devices measure BP from oscillations due to the “maximum buckling” of the specific artery under the cuff, which is nearly equal to the mean arterial pressure. Systolic and diastolic BP calculated from this mean, rather than measured directly, can be affected by stiffened arteries, as observed in older and diabetes patients. Therefore, in diabetes patients with a high proportion of stiffened arteries, ABI measurement has increased specificity, while sensitivity is compromised, compared to duplex Doppler ultrasound or digital subtract angiography in a meta-analysis. Excluding diabetes patients from our study population improved the sensitivity of the oscillometric method.

The findings of this study indicate that the diagnostic precision of the oscillometric method, with the Doppler method as standard, is similar in patients with and without leg pains. There is a paucity of data about the accuracy of oscillometric devices in patients with leg pain on exertion. Early studies reported that in patients with intermittent claudication, the use of an oscillometric device to measure brachial pressure only does not affect the computed ABI compared to brachial pressures measured by Doppler and auscultatory methods. However, the investigators did not measure ankle pressures with an oscillometric device. Another study compared the diagnostic accuracy of oscillometric and Doppler methods to angiography in patients with intermittent claudication when doppler ABI was performed by physicians with no training in the performance of doppler ABI. They found that the Doppler method has similar specificity to the oscillometric method, but lower sensitivity. However, they did not compare the oscillometric method, with the Doppler method as done in this study. In this study, we did not find any difference in mean values of oscillometric- and Doppler-ABIs between patients presenting with leg pain and those without leg pain. This is contrary to a meta-analysis of 27,945 patients from 7 studies that reported lower mean ABI in patients with leg pain.

A major influence in the measurement of oscillometric ABI on the methodology utilized by the device applied. In this study, we used a validated device with four cuffs that measured arm and ankle pressures simultaneously. This feature minimizes the potential error due to the random variation in blood pressure that occurs with sequential Doppler ABI measurements. The device measures ankle pressures in both the dorsalis pedis artery and the posterior tibial artery and automatically computes ABI using the high ankle pressure (HAP) method, avoiding sources of bias such as observer prejudice and calculation errors.
The ability to correctly identify PAD early in the course of the disease is an important barrier to the reduction of cardiovascular morbidity and mortality in patients with PAD. The standard for diagnosing PAD, which is duplex Doppler ultrasound, requires robust equipment and training that are not readily available at many health facilities in sub-Saharan Africa. These constraints may be solved by the utilization of ABI measurements, which is a simple, fast, reproducible and accurate alternative to duplex Doppler. Both the American 22 and European 1 guidelines for PAD diagnosis recommend measurement of ABI in these patients using the Doppler method. However, the doppler ABI method may be time-consuming and is operator dependent. The oscillometric ABI method, however, requires little training and can be performed within a relatively short time after adequate rest.10 Despite the advantages of oscillometric devices in assessing ABI, the main drawbacks to the implementation of these devices are the availability and affordability in sub-Saharan African countries. The Vasera 1500N, for instance, is currently available from suppliers in the European, Asian and American markets at a cost around US$20,000.23 This amount is far beyond the budget in many public and private healthcare systems in sub-Saharan Africa, which has the lowest healthcare expenditure per capita in the world.24 Public expenditure by governments in this region was reported to be approximately 6% of GDP or about $97 per capita in 2011, and this is mostly applied in dealing with infectious diseases and child and maternal health.24, 25 With low coverage of health insurance system, most of the population finance their healthcare from out-of-pocket.24 This condition may make it difficult to implement devices such as the Vasera 1500N in primary health settings in sub-Saharan Africa. Therefore, alternative devices at lower cost may be needed to implement oscillometric ABI measurements in this region.

The findings of this study can be interpreted in light of its limitations. First, the study was conducted in a single tertiary healthcare facility in Ghana and the results may not be generalised to other healthcare facilities. Additionally, only premenopausal women with suspicion of PAD were conveniently recruited into our study. This means that the findings of this study cannot be inferred to the general population and to men. Doppler ABI, which was used as the standard in this study, may also have some important limitations as compared to digital subtraction angiography, computed tomography angiography or Magnetic Resonance Angiography.6, 9 In this study, Doppler ABI was performed by an experienced technician and that may have reduced measurement errors. Additionally, ABI was calculated using the HAP method as recommended by the major guidelines.1, 22 Compared to the HAP method, the low ankle pressure (LAP) calculation has been shown to have higher sensitivity, accuracy and prediction in detecting PAD.26

Conclusion

The findings of this study have shown that in the non-diabetic premenopausal female population with suspicion of PAD, oscillometric measurement of ABI can be used to diagnose PAD with performance similar to the Doppler ABI. This makes the oscillometric suitable for screening PAD in resource-scarce settings like sub-Saharan Africa.
Abbreviations

PAD: peripheral artery disease, ABI: ankle-brachial index, BMI: body mass index, BP: blood pressure, LDL: Low-density lipoprotein, HDL: high-density lipoprotein.

Declarations

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Disclosure/Conflict of Interest Statement: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Credit author statement: Kwame Yeboah conceptualised the study, analysed the data, and drafted the manuscript. Jennifer A. Agyepong collected the data and made scientific contributions to the writing of the manuscript. Jared N. Oblitey revised the manuscript and made scientific contributions to the drafting of the manuscript. All authors approved the content of the manuscript.

Availability of data: Data supporting the conclusions of this paper are available and can be requested from the lead author (Dr. Kwame Yeboah).

References


10.1002/14651858.CD010680.pub2.


Figures
Figure 1

Scatterplot of the association between oscillometric ABI and Doppler ABI in the right (r=0.749, p<0.001) and left (r=0.787, p<0.001) sides of the body.

Figure 2

Scatterplot of the association between oscillometric ABI and Doppler ABI in the right and left sides of the body based on the presence or absence of leg pain on exertion.
Figure 3

Agreement between oscillometric method vs Doppler method in Bland-Altman's plot of the right side (A) and the left side (B) ABIs.

LoA: level of agreement
Figure 4

Density plot of the mean differences in Oscillomteric and Doppler ABIs showing >95% of the mean difference values between doppler ABI and oscillometric ABI fall within -0.1 to +0.1.
Figure 5

Receiver operator characteristic curve for oscillometric diagnosis of PAD as defined by doppler ABI ≤ 0.9 in the entire study participants.