The Role of Ankle Brachial Index in Patient with Peripheral Arterial Disease; Diagnostic and Prognostic Tool

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Abstracts: *Objectives:* Peripheral arterial disease is an independent risk factor for developing major cardiovascular events, and even death; this makes its diagnosis important in early detection and prevention of these events. Ankle brachial index is a non-invasive, simple, bedside screening, diagnostic and even prognostic tool, patients with ABI less than 0.9 were found to have PAD, and at risk of cardiovascular events. *Methods:* A descriptive cross-sectional study of 338 patients was conducted during the period October 2021 to December 2022. They were referred to vascular and endovascular surgery unit at Ghazi Al-Hariri multispecialty teaching hospital/ Medical city teaching, they were presented with intermittent claudication and other PAD symptoms. Peripheral endovascular angioplasty was done; all were subjected to Ankle brachial index measurement. *Results:* The study involves 338 patients, among them males were 242 (72%), females were 96 (28%). Age ranged from 25-92 years old, with an age average of 61 years. A total of 203 (60%) were presented with classical lower limb claudication, 100 (30%) patients with atypical symptoms and only 35 (10%) patients with critical limb ischemia. A total of 216 (64%) patients with ABI between 0.4-0.9; 100 (29%) patients with ABI greater than 0.9; 19 (6%) patients with ABI less than 0.4, and only 3(1%) patients with ABI more than 1.4. *Conclusion:* Ankle brachial index is a useful, cost effective, simple non-invasive diagnostic tool in patients with peripheral arterial disease.

Keywords: Peripheral Arterial Disease, Ankle Brachial Index.

1. INTRODUCTION

Peripheral arterial disease (PAD) is a disease where there is limited blood flow in the peripheral limbs due to narrowing or obstruction in its vessels. [1] PAD is an atherosclerotic occlusive disorder affecting systemic vessels apart of coronary arteries. PAD affecting lower extremities is an independent risk factor for systemic major cardiovascular events and even cardiovascular deaths. [2, 3]

The risk factors causing PAD are those of cardiovascular disorders including old age, cigarette smoking, hypertension, diabetes mellitus, and hypercholesteremia. [4]

Depending on the degree of obstruction of the affected vessel, clinical presentations vary from atypical symptoms or intermittent claudication to ultimate critical ischemia (rest pain, ulceration and gangrene), which, if not treated properly, can lead to amputation. Almost two thirds of patients with PAD are asymptomatic or having mild symptoms - atypical clinical presentation, such as tingling, numbness of the affected limb, atypical pain and decreased mobility due to co- morbidities, these atypical symptoms may render the patient without proper clinical diagnosis. [5]

The diagnosis of PAD is often to be difficult, especially in those with atypical symptoms. [6]

Clinical history, physical examination, and investigating tools are all aid in the diagnosis of PAD. Doppler ultrasonography, conventional angiogram, and CT/MR angiograms are the investigating tools used to confirm diagnosis of PAD, but they are costly and invasive especially for angiogram as well. So, we have to have a cost-effective non-invasive, bedside investigating tool of great help in diagnosing PAD. And this can be fulfilled by using Ankle brachial index (ABI). Besides the diagnostic role, ABI has a prognostic role, identifying patients with very high cardio- vascular risk, independently of the presence or absence of symptoms. [7]

Normal cut-off value for ABI adopted by most studies and by the accepted guidelines of cardiology societies is 0.9. An abnormal ankle-brachial index below 0.9 is a powerful independent marker of cardiovascular risk. Also, there is an inverse correlation between ABI value, non-fatal cardiac events (myocardial infarction, stroke and heart failure exacerbation) and mortality (cardiovascular and global), the relation being nonlinear, patients with very low ABI (<0.4) having an additional risk significantly higher. Table (1). Also, a decrease in ABI was found as an independent prognostic factor for these patients. [8, 9]

Table (1): Interpretation of ABI.

ABI value	Interpretation	Recommendations
Greater than 1.4	Calcification/vessel hardening	Refer to vascular specialist
1-1.4	Normal	None
0.9-1	acceptable	None
0.4-0.9	Moderate arterial disease	Refer to vascular specialist
Less than 0.4	Severe arterial disease	Refer to vascular specialist

2. PATIENTS AND METHODS

A descriptive cross-sectional study including 338 patients presented with PAD during the period October, 2021 to December 2022. Cases were collected from vascular and endovascular surgery unit at Ghazi Al-Hariri multispecialty teaching hospital/ Medical city teaching complex. Their clinical presentations were classical lower limb claudication, atypical symptoms of tingling sensation of feet, and discomfort, to rest leg pain, discoloration and foot gangrene. Those patients were managed by limb peripheral endovascular angioplasty. The diagnosis was carried out by lower limb Doppler ultrasonography, or CT angiography. All were investigated by measuring the ankle brachial index. ABI is measured using handheld (5-10 MHz) Doppler probe, and blood pressure cuff. Figure (1). The systolic blood pressure in the brachial artery at each elbow is measured, taking the highest reading as denominator and the systolic pressure in the posterior tibial and the dorsalis pedis arteries at each ankle, again the highest reading as nominator. The calculation of the ABI is done using this formula:

ABI = Highest systolic blood pressure of two ankles/ highest systolic blood pressure of both arms.

All analyses were performed using SPSS statistical software (version 26)

Figure 1: how to measure ankle brachial index using handheld duplex ultrasound and blood pressure cuff.

3. RESULTS

The study involves 338 patients, among them males were 242 (72%); females were 96 (28%). As shown in figure (2). Age was ranging from 25-92 years old, with an age average of 61 years. As shown in figure (3), 37% were between 60-70 years old, 29% between 50-60 years old. A total of 203 (60%) were presented with classical lower limb claudication, 100 (30%) patients with atypical symptoms and only 35 (10%) patients with critical limb

ischemia, as shown in figure (4). Regarding ABI, a total of 216 (64%) patients with ABI between 0.4-0.9, 100 (29%) patients with ABI greater than 0.9, 19 (6%) patients with ABI less than 0.4, and only 3(1%) patients with ABI more than 1.4; as shown in figure (5).
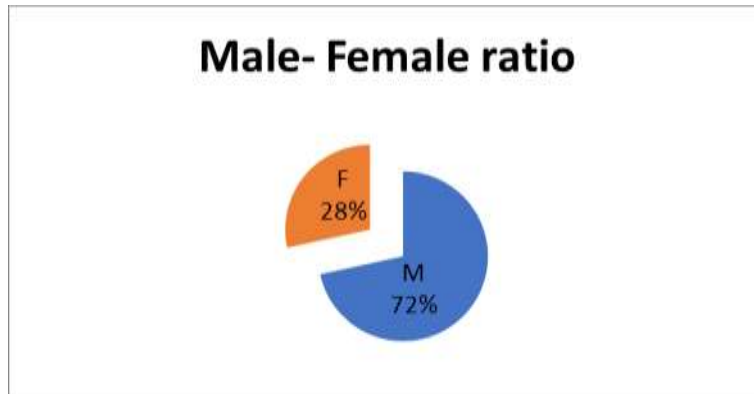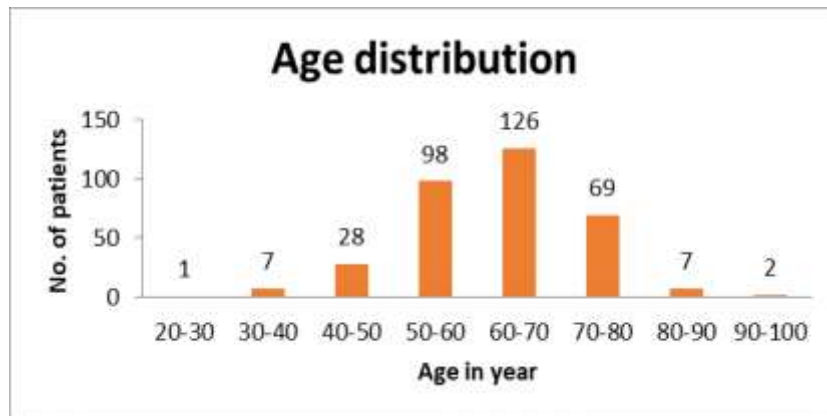

Figure 2: male to female ratio
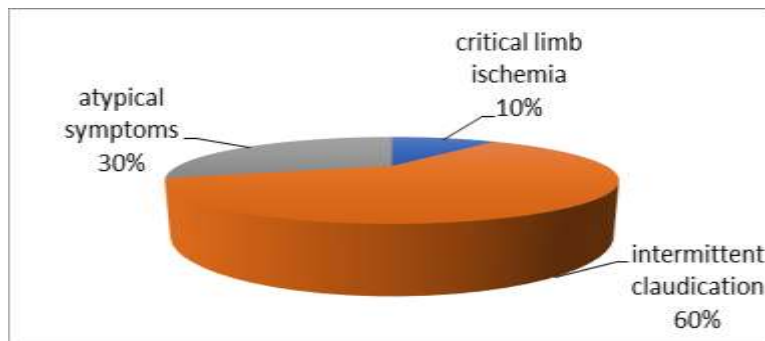

Figure 3: age distribution

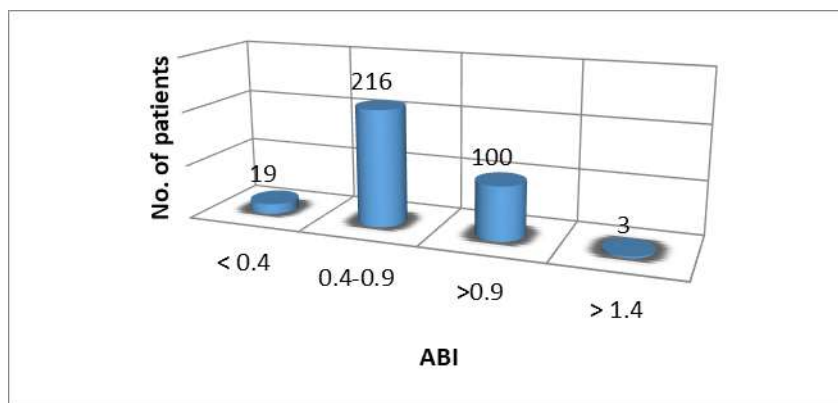**Figure 4:** A pie chart of clinical presentation

Figure 5: Ankle brachial index values

4. DISCUSSION

Peripheral arterial disease remains underdiagnosed, which has been of limiting factor in decreasing cardiovascular morbidity and mortality among those patients. Our study shows that males are predominantly more prone to develop PAD; this may be due to high exposure to risk factors like smoking, hyperlipidemia, and low physical activity. This goes with Fugiwara T, et al; and Hirsch AT, et al. [10, 11] The data revealed old age group patients with low ABI less than 0.4 carries poor prognosis, these findings were as that of Murabito JM, et al. [12]

Patients with ABI below 0.9 are presented with limbs claudication, and as the ABI decreases the patients can be presented with even limb ischemia with poor prognosis, and the patient may lose his limb. The study of McDermott MM et al, shows low ABI values are associated with impaired walking abilities. [13]

CONCLUSIONS

The presence of peripheral arterial disease is associated with higher risk of cardiovascular morbidity and mortality. The diagnosis of PAD is a dilemma, and sometimes the patient can presented with gangrene without prior proper diagnosis. Ankle brachial index is found to be a cost effective, simple, non-invasive tool for reaching PAD diagnosis, it's of high sensitivity and specificity and even a good prognostic tool, and further prospective studies can be conducted to assess ABI values post vascular and endovascular interventions.

DISCLOSURE

No conflicts of interest.

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