The role of ankle brachial index in detecting peripheral arterial diseases

Dr.Oday Zaki Al-Salami[*1]

[*1]M.B.ch.B., D.M.,Al-Shahid Dhari Al-Fayadh general hospital , Baghdad Russafa health directorate , Ministry of health and environment , Iraq.

Abstract

Background: Peripheral arterial disease (PAD) is a disorder characterized by decreased blood flow to the limbs, due to an obstruction or narrowing of the vessels tributaries. The concept of PAD has a broader meaning, including the impairment of the carotid arteries, vertebral, renal and mesenteric, but not including aortic diseases.Most epidemiological studies have used ankle-brachial index (ABI) as a diagnostic method for PAD. **Aim of the study:** To determine whether ankle brachial pressure index is a valuable test to diagnose peripheral arterial disease. **Methodology:** The study was conducted from (January- October)2021. The study setting included 60 persons aged 40 years and above. The samples were selected using probability sampling (systematic random selection). Each person asked about the presence of risk factors for atherosclerosis and presence of peripheral arterial disease symptoms, then the brachial pressure was measured using a sphygmomanometer and a stethoscope, while the ankle pressure was measured bilaterally using a sphygmomanometer and pulse detection. **Results**: The results in the present study revealed that 29 (48.3%) had normal ABI value, 5 (8.3%) had acceptable ABI value, 8 (13.3%) had some arterial diseases, 13 (21.6%) had moderate arterial diseases, 3 (5%) had severe arterial diseases, 2 (3.3%) had vessel hardening and 8 (13.3%) had bilateral leg arterial diseases.

Conclusion: it can be concluded from our study that the ankle-brachial index is a simple, noninvasive assessment that can be used to detect lower-extremity arterial stenosis in the primary care setting.

Key words: Ankle brachial index (ABI), Peripheral arterial diseases (PAD)

Introduction

The presence of PAD is associated with higher cardiovascular morbidity and mortality, regardless of gender or its clinical form of presentation (symptomatic or asymptomatic), mostly in patients who need peripheral revascularization (these patients having more severe impairment of vascular territories and an increased preoperative risk with frequently associated comorbidities such as age greater than 70 years, diabetes mellitus, renal dysfunction or smoking) [1,2,3].

Risk factors involved in the pathogenesis of PAD are similar to those involved in coronary atherosclerotic processes. The risk factors such as smoking, diabetes, hypertension, dyslipidemia, obesity, physical inactivity and increased age are associated with PAD, the strongest correlation being with smoking and diabetes. Most frequent cause of arterial disease being atherosclerosis (characterized by a chronic process, slowly unfolding in intimal thickening and plaque and finally causing stenosis, sometimes complicated with thrombus), and others such as vasculitis, vasospasm, embolism, thrombosis, fibromuscular dysplasia or compartment syndrome [4,5].

Depending on the degree of obstruction of the affected vessel, clinical manifestations vary from atypical symptoms or intermittent claudication until the critical ischemia (rest pain, ulceration and gangrene), which, in the absence of proper treatment, can lead to amputation. Most patients with PAD (almost two thirds), are asymptomatic or with mild symptoms [4,6,7].Screening patients at risk could lead to a decrease of undiagnosed cases and early diagnosis of PAD [8].

Compared with patients without peripheral vascular damage, patients with PAD have additional lesions in other vascular territories (such as coronary or carotid artery disease) [9].

The prevalence of PAD increases with age, being relatively rare before 40-50 years, more frequent in the next decades of life, especially after 70 years [4]. In patients undergoing arterial surgery, an increase of the pressure index indicated success of the surgery. These findings show that systolic pressure measurement by this method provided a sensitive method for the diagnosis and management of patients with occlusive arterial disease [10].Most epidemiological studies have used ankle-brachial index (ABI) as a diagnostic me¬thod for PAD, and PAD prevalence derived from abnormal ABI value measurements[5].

According to the current guidelines of the American Heart Association (AHA) and the Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II), ABI is defined as the ratio of the higher of the systolic blood pressures of the 2 ankle arteries of that limb (either the dorsalis pedis or the tibial artery) and the higher of the 2 systolic blood pressures of the upper limbs [11].

$$\text{Ankle brachial pressure index} = \frac{\text{Systolic blood pressures of ankle artery}}{\text{Systolic blood pressures of arm artery}}$$

Normal values for ABI are between 0.9 and 1.4 (2). ankle-brachial index below 0.9 is strongly associated with other cardiovascular risk factors. An ankle-brachial index greater than 1.4 means that the pedal arteries are stiff and cannot be compressed by the blood pressure cuff are common among patients with long-standing diabetes mellitus or end-stage renal disease, and obese patients [12].

Patients and methods

The study was designed to determine whether ankle brachial pressure index is a valuable test to detect peripheral arterial disease. The study included 60 randomly selected individuals aged 40 years and above who attended my private clinic and Al-Shahid Dhary hospital using probability sampling (random systematic selection). The study was conducted from (January- October)2021. In our study, both male and female individuals with >40 years age who will to participate in the study and who were available at the time of examination were included, while persons whose ages were less than 40 years were excluded.

A questionnaire format was instructed to assess the risk factors for peripheral arterial diseases.

The socio-demographic characteristics of the study groups including age and gender were recorded and participants were asked about the presence of risk factors for atherosclerosis and presence of peripheral arterial disease symptoms.

The Ankle Brachial pressure index (ABI) was measured 5-10 minutes after placing the patient in the supine position, with the ankle at the same level with the heart, then the brachial pressure was measured using a sphygmomanometer and a stethoscope, while the ankle pressure was measured bilaterally using a sphygmomanometer and pulse detection.

Descriptive data analysis

The data analysis was performed through calculating the following:

a –Statistical tables (frequency and percentage): $\% = \frac{\sum f}{n} x100$

b- Arithmetic mean : Mean $= x = \frac{\sum x1}{n}$

Results

Table (1) showed that the highest number and percentage of participants 27(45%) was in the age group (50-59) years, followed by 13(21%) in the age group (40-49) years, then 10 (17%) in both the age groups (60-69) years and ≥70 years.

Table (1): Distribution of the study sample according to age (N=60).

Age group	No.	Percentage (%)
40-49 years	13	21%
50-59 years	27	45%
60-69 years	10	17%
≥70 years	10	17%

The frequency and percentage of lower limbs arterial diseases revealed that the frequency and percentage of normal persons was the highest 29(48.3%), followed by moderate arterial diseases 13(21.7%), some arterial diseases 8(13.3%), then acceptable 5(8.3%), severe arterial diseases 3(5%) and finally calcification/vessel hardening 2(3.3%) as shown in table (2).

Table (2): Lower limbs arterial disease interpretation according to ABI measurement

Lower limbs arterial disease interpretation	Frequency	Percentage (%)
Calcification/vessel hardening	2	3.3 %
Normal	29	48.3 %
Acceptable	5	8.3 %
Some arterial diseases	8	13.3 %
Moderate arterial diseases	13	21.7 %
Severe arterial diseases	3	5 %

Results in table (3) demonstrated that according to ABI measurement in age groups, measurement of individuals with calcification/vessel hardening was 7.4% in the age group (50-

59) years, while it was (0%) in other age groups. Measurement of normal individuals was 51.9% in the age group (50-59) years, while it was 20% in acceptable individuals ≥70 years, 23% in persons with some arterial diseases in the age group (40-49%), while it was 40% in individuals with moderate arterial diseases in the age group (60-69) years, whereas it was 20% in individuals with severe arterial diseases in the age group ≥70 years.

Table (3): Percentage of lower limbs arterial diseases interpretation according to ABI measurement in age groups

Lower limbs arterial disease interpretation	(40-49) years	(50-59) years	(60-69) years	≥70 years
Calcification/vessel hardening	0	7.4 %	0	0
Normal	61.5 %	51.9 %	40 %	30 %
Acceptable	0	11 %	0	20 %
Some arterial diseases	23 %	7.4 %	20 %	10 %
Moderate arterial diseases	15 %	18.5 %	40 %	20 %
Severe arterial diseases	0	2 %	0	20 %

Discussion

Age and arterial diseases

In the current study, 60 persons aged 40 years and above were included to determine whether ankle brachial pressure index is a valuable test to diagnose peripheral arterial disease. Distribution of the study sample according to the age showed that the majority of samples (45%) were in the age group (50-59) years, (21%) of the samples were in the age group (40-49) years, (17 %) of sample were in the age group (60-69) years age and (17 %) of samples were in the age group 70 years and older.

The age distribution of arterial disease support the evidence that incidence of arterial diseases increase with age.

Prevalence of PAD increases with age. Assessments using non-invasive methods suggest that PAD affects 3% of individuals in the general population below 60 years of age, over 8% of those aged 60-69 years and up to 20% of individuals aged 70 years and above [12].

Lower limbs arterial disease interpretation according to ABI measurement

According to ABI measurement, most of sample were normal (48.3 %), (3.3 %) had vessel hardening , (8.3 %) had acceptable ABI, (13.3 %) had some arterial diseases, (21.7 %) had moderate arterial diseases and (5 %) had severe arterial diseases.

Lower limbs arterial disease interpretation according to ABI measurement in age groups

The findings in the current study agreed with the study of Yao ST, Hobbs JT, Irvine WT. who stated that Ankle systolic pressure measurements in arterial diseases affected the lower extremities. Br J Surg 1969;56: 676-9 [13].

The results in this study showed that ABI has a very important role in patients with PAD as a diagnostic tool, and prognostic predictor. It improved the identification of patients with symptomatic and especially asymptomatic PAD, where ABI may have a key role. In addition, ABI can be considered a generalized atherosclerotic predictor, identifying patients at high risk for developing cardio- or cerebrovascular events and should be incorporated into routine clinical practice.

References

1- Hiatt WR, Goldstone J, Smith SC Jr, et al. Atherosclerotic Peripheral Vascular Disease Symposium II: Nomenclature for vascular diseases . Circulation . 2008 ;118:2826–2826. [PubMed] [Google Scholar].

2- Dawson DL, Hiatt WR, Creager MD, et al. Peripheral Arterial Disease Medical Care and Prevention of Complications. Prev. Cardiol. 2002;5:119–130. [PubMed] [Google Scholar].

3- Leng GC, Lee AJ, Fowkes FG, et al. Incidence, natural history and cardiovascular events in symptomatic peripheral arterial disease in the general population. Int J Epidemiol. 1996;25:1172–1181. [PubMed] [Google Scholar].

4- European Stroke Organisation, Tendera M, Aboyans V, et al. ESC Guidelines on the diagnosis and treatment of peripheral artery diseases. Eur Heart J. 2011;32:2851–906. [PubMed] [Google Scholar].

5- Elsevier; 2011. Braunwald's Heart Disease: A Textbook of Cardiovascular Medicine, 9th Edition. Cap. 61, Peripheral Artery Diseases. pp. 1338–1340. [Google Scholar].

6- Hooi JD, Kester ADM, Stoffers HEJH, et al. Asymptomatic peripheral arterial occlusive disease predicted cardiovascular morbidity and mortality in a 7 year follow-up study. J Clin Epidemiol. 2004;57:294–300. [PubMed] [Google Scholar].
7- Twine CP, Coulston J, Shandall A, et al. Angioplasty versus stenting for superficial femoral artery lesions. Cochrane Database Syst Rev. 2009;2:CD006767–CD006767. [PubMed] [Google Scholar].
8- Bittl JA, Hirsch AT. Concomitant Peripheral Disease and Coronary Artery Disease. Circulation. 2004;109:3136–3144. [PubMed] [Google Scholar].
9- Mendelson G, Aronow WS, Ahn C. Prevalence of coronary artery disease, atherothrombotic brain infarction, and peripheral arterial disease: associated risk factors in older Hispanics in an academic hospital-based geriatrics practice. J Am Geriatr Soc. 1998;46:481–483. [PubMed] [Google Scholar].
10- Haugen S, Casserly PI, Regensteiner GJ, et al. Risk assessment in the patient with established peripheral arterial disease. Vasc Med. 2002;12:343–350.
11- Hirsch AT, Haskal ZJ, Hertzer NR, et al. ACC/AHA 2006 guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): Executive summary a collaborative report from the American Association for Vascular Surgery/Society for Vascular Surgery, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, Society of Interventional Radiology, and the ACC/AHA Task Force on Practice Guidelines (Writing Committee to Develop Guidelines for the Management of Patients With Peripheral Arterial Disease) endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation; National Heart, Lung, and Blood Institute; Society for Vascular Nursing; TransAtlantic Inter-Society Consensus; and Vascular Disease Foundation. J Am Coll Cardiol. 2006;47:1239–1239. [PubMed] [Google Scholar].
12- Tekin, N., Baskan, M., Yesilkayali, T. et al. Prevalence of peripheral arterial disease and related risk factors in Turkish elders. BMC Fam Pract 12, 96 (2011).
13- Yao ST, Hobbs JT, Irvine WT. Ankle systolic pressure measurements in arterial disease affecting the lower extremities. Br J Surg. 1969; 56:676–679.