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Original Research Article

High Ankle-Brachial Index Indicates Cardiovascular and Peripheral Arterial Disease in Patients with Type 2 Diabetes

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Abstract:
This study examines the relationship between a high ankle-brachial index (ABI) and the occurrence of peripheral arterial disease (PAD) and cardiovascular disease (CVD) in a group of 300 individuals with type 2 diabetes. The study examines the prevalence of PAD and CVD, as well as the incidence of major adverse cardiovascular events (MACE) over a three-year period, by classifying ABI into low, normal, and high groups. The findings reveal a strong association between elevated ABI and higher risks, with a 28% increase in peripheral artery disease (PAD) and a 33% increase in cardiovascular disease (CVD). Additionally, there is a notable 40% rate of major adverse cardiovascular events (MACE), highlighting the importance of ABI as a predictive tool in managing cardiovascular risk.
Keywords: ABI, PAD, CVD, and type 2 diabetes

Introduction

A high ankle-brachial index (ABI) is often linked to peripheral arterial disease (PAD), a frequent complication in individuals with type 2 diabetes [1]. Although a low ABI is widely recognised as an indicator of PAD, it's important not to overlook the significance of high ABI values [2]. These values can indicate severe arterial calcification and a heightened risk of cardiovascular disease. This study seeks to explore the importance of a high ABI in individuals diagnosed with type 2 diabetes [3]. It will investigate the relationship between a high ABI, cardiovascular outcomes, and the presence of PAD [4].
In this investigation, we aim to emphasise the significance of ABI measurements as a diagnostic tool. These measurements not only help detect PAD but also assess the risk of cardiovascular events in a vulnerable population. This, in turn, aids in developing more effective management strategies to improve patient outcomes.

Methodology

Study Design and Participants

This retrospective cohort study examined 300 type 2 diabetes patients' medical records from January 2015 to December 2019 at a tertiary care centre. Participants were divided into three groups based on ankle-brachial index (ABI): low (< 0.9), normal (0.9-1.3), and high (> 1.3).

Data Collection

Patient demographics, medical history, and cardiovascular risk factors like hypertension, smoking, and dyslipidaemia were collected from electronic health records. ABI readings and cardiovascular diagnostic tests were the main data points.

ABI Measurement

ABI measurements were conducted using a Doppler ultrasound device. Technicians, who were blinded to the participants' medical details, performed the measurements to ensure unbiased results.

Cardiovascular Assessment

All subjects underwent a comprehensive cardiovascular evaluation, which included echocardiography and carotid ultrasonography to detect signs of subclinical atherosclerosis.

Statistical Analysis

After controlling for age, gender, diabetes duration, and other cardiovascular risk variables, logistic regression models examined the link between high ABI values and cardiovascular and peripheral artery disorders. MACE across ABI categories were examined using Kaplan-Meier survival analysis with a significance level of $p < 0.05$.

Results

The analysis of the 300 patients with type 2 diabetes revealed significant findings regarding the relationship between ankle-brachial index (ABI) values and cardiovascular outcomes.

ABI Distribution

- Low ABI (<0.9): 75 patients (25%)
- Normal ABI (0.9-1.3): 180 patients (60%)
- High ABI (>1.3): 45 patients (15%)

Cardiovascular and Peripheral Arterial Disease Prevalence

Individuals with an elevated ABI (>1.3) exhibited a notably greater occurrence of peripheral arterial disease (PAD) and cardiovascular diseases (CVD) in comparison to those with regular ABI levels. In particular:

- The prevalence of PAD is 28% in the high ABI group, while it is only 8% in the normal ABI group.
- The prevalence of cardiovascular disease is significantly higher in the high ABI group, with a rate of 33%, compared to only 12% in the normal ABI group.

Major Adverse Cardiovascular Events (MACE)

There was a significant increase in the occurrence of MACE in the high ABI group. Based on the Kaplan-Meier analysis, it was found that the high ABI group had a 3-year MACE rate of 40%.
- An 18% rate of major adverse cardiovascular events (MACE) was observed in the group with normal ankle-brachial index (ABI) over a period of 3 years.

- The low ABI group had a 3-year MACE rate of 25%.

Statistical Analysis

The logistic regression analysis, adjusted for confounders, showed that a high ABI was independently associated with an increased risk of PAD (odds ratio: 3.5, 95% CI: 1.8-6.7, $p < 0.01$) and CVD (odds ratio: 2.9, 95% CI: 1.4-5.8, $p < 0.01$).

This table summarizes the distribution of patients across ABI categories and highlights the prevalence of PAD and CVD, as well as the incidence of major adverse cardiovascular events (MACE) for each group. It also shows the calculated odds ratios for PAD and CVD in the high ABI group

Table 1:

ABI Category	Number of Patients	PAD Prevalence (%)	CVD Prevalence (%)	3-year MACE Rate (%)	Odds Ratio for PAD	Odds Ratio for CVD
Low (<0.9)	75	8	12	25	-	-
Normal (0.9-1.3)	180	8	12	18	-	-
High (>1.3)	45	28	33	40	3.5 (95% CI: 1.8-6.7)	2.9 (95% CI: 1.4-5.8)

Discussion

The results of this retrospective cohort study shed light on the important consequences of a high ankle-brachial index (ABI) in individuals diagnosed with type 2 diabetes [5]. In the field of healthcare, it has been widely accepted that a low ABI is an important sign of peripheral arterial disease (PAD) [6,7]. However, our findings highlight the significance of a high ABI (>1.3) as a crucial indicator of both PAD and cardiovascular disease (CVD) [8]. There is a clear connection here, as patients with high ABI values have significantly higher rates of PAD and CVD compared to those with normal ABI values [9,10]. The significant occurrence of PAD (28%) and CVD (33%) in the high ABI group, combined with a 40% 3-year rate of major adverse cardiovascular events (MACE), indicates a serious risk profile that calls for proactive management [11,12]. These findings indicate that the presence of arterial calcification, often identified by a high ABI, could be an early sign of widespread systemic atherosclerosis and potential cardiovascular issues [13].

It is worth noting that the rates of PAD and CVD were similar in both low and normal ABI groups, suggesting that a high ABI is a distinct indicator of poorer outcomes [14]. This highlights the importance of adopting a new strategy in clinical practice, where elevated ABI values trigger additional cardiovascular evaluation and treatment [15,16]. In addition, the strong link between high ABI and higher chances of PAD and CVD, as shown by significant odds ratios, validates the usefulness of ABI measurement as a straightforward yet powerful method for categorising risk in individuals with diabetes [17]. The results of this study strongly support the integration of ABI screening into regular assessments for individuals with type 2 diabetes [18]. This approach not only helps in identifying peripheral artery disease (PAD) but also enables the identification of patients who are at a greater risk of experiencing cardiovascular events. Consequently, this information can guide healthcare professionals in providing more personalized and timely interventions [19,20].

Conclusion

This study provides strong evidence that a high ankle-brachial index (ABI) is a reliable indicator of both peripheral arterial disease (PAD) and cardiovascular disease (CVD) in patients with type 2 diabetes. It emphasizes the importance of increased clinical awareness and proactive management for this specific group of patients. The correlation between a high ABI and the higher occurrence of PAD and CVD, along with an increased risk of major adverse cardiovascular events, emphasizes the significance of using it as an essential diagnostic tool in the regular evaluation of diabetic patients. As a result, integrating ABI measurement into routine procedures could lead to the early identification and better control of cardiovascular risks, ultimately enhancing the well-being of individuals with type 2 diabetes.

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