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Prevalence of peripheral artery disease in young coronary artery disease patients

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ABSTRACT

Background and objectives. Peripheral artery disease (PAD) and coronary artery disease (CAD) are progressive inflammatory conditions caused by arteriosclerosis, typically presenting after the age of 50. However, assessing peripheral vascular disease (PVD) in younger populations may offer early indications of coronary heart disease (CHD) risk. This study investigates the prevalence of abnormal ankle brachial index (ABI) values among young myocardial infarction (MI) patients and examines the correlation of ABI with other cardiovascular risk factors.

Material and methods. This cross-sectional study was conducted at Saveetha Medical College and Hospital, involving 147 patients aged 40 years or younger who were admitted with MI symptoms. The study focused on the incidence and severity of MI in relation to age, sex, and the presence of risk factors such as smoking, alcohol use, dyslipidemia, hypertension (HTN), and diabetes mellitus (DM).

Results. The study analyzed the incidence of myocardial infarction (MI) in a population under 40 years old. It was found that the incidence rate increased with age within this group. Specifically, males were more frequently affected than females, with 70% of cases occurring in males. Among female participants, all were over 30 years old.
In terms of ankle-brachial index (ABI) values, 40% of females exhibited abnormal ABI, compared to 25% of males. Significant risk factors identified included smoking, with 60% of participants reporting tobacco use, alcohol consumption at 50%, and dyslipidemia present in 45% of cases. Hypertension (HTN) and diabetes mellitus (DM) were less prevalent, affecting 20% and 15% of participants, respectively.
There was a significant correlation between low ABI values and the use of tobacco ($p<0.01$) and alcohol ($p<0.05$). However, the analysis showed no significant relationship between the number of vascular involvements indicated by ABI and the length of hospital stay. The length of hospital stay did increase with patient age, with an average increase of 2 days for every decade of age, but this was not significantly associated with ABI values.

Conclusion. ABI is a valuable diagnostic tool in young populations for detecting early signs of CHD, offering advantages over routine blood pressure measurements. This study supports the broader use of ABI in both young and older populations to improve early detection and management of cardiovascular risks. Further research is needed to explore the implications of ABI in routine clinical practice and its correlation with other cardiovascular risk factors.

Keywords: peripheral artery disease, coronary artery disease, ankle brachial index

Abbreviations (in alphabetical order):

ABI – ankle brachial index
CAD – coronary artery disease
MI – myocardial infarction
PAD – peripheral artery disease

INTRODUCTION

Peripheral artery disease (PAD) and coronary artery disease (CAD) are chronic inflammatory disorders that develop due to fat deposition along the wall of the artery known to be arthrosclerosis and are considered as main cause in the development of

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blockages in the blood vessels that supply blood to the legs and heart respectively [1] but is also seen in brain, arms, pelvis and kidneys. It is uncommon to achieve PAD before 50 years of age even without CAD, however, certain etiological factors like, smoking and metabolic disorders such as diabetes, hypertension enhance the chances of PAD before 50 years of age known as juvenile PAD [2].

It is quite challenging to estimate the prevalence of PAD in young CAD patients, as young individuals are considered to be less vulnerable for CAD, identification of those at risk remains a serious challenge as the number of hospital visits by these young people is also less compared to the older population. In a recent study done by Saleh et al., the prevalence of PAD was 14.7% in patients with CAD, which was significantly higher than that in patients with normal coronaries 4.5%, but was 11% in patients younger than 50 years [3].

As the CVD related to atherosclerosis is generalized, the prevalence of PVD in young CHD will be possible. The known fact is PAD may increase the risk chances of adverse outcomes of CAD at equal or may be at greater magnitude, but it is not known of prevalence of this condition in young CADs. The research gap is to address the appropriate diagnosis and management challenge in young CAD patients. Hence, testing for the presence of PVD in the younger population can give a clue about the development of CHD diagnosis, therefore it is essentially significant to identifying the young population which can significantly reason out the causable factors and to correlate other possible CVDs.

Now our study aims at identifying the presence of abnormal ABI values in the young MI population. To determine the use of ABI in the young population at risk, and correlation between the other risk factors and ABI.

MATERIALS AND METHODS

Study design

This cross-sectional study involved 147 patients aged 40 years or younger. Eligibility criteria included signs of coronary artery disease (CAD) confirmed by one or more of the following: ECG abnormalities, regional wall motion abnormalities on 2D-echo, elevated cardiac biomarkers, positive treadmill test (TMT), angiographic confirmation of CAD, and those who underwent a revascularization procedure. Exclusion criteria were prior statin use, history of cocaine or valvular heart disease, chronic liver or renal disease, anemia, and non-adherence to pharmacological therapy. Notably, four patients had a history of previous MI.

Data collection

Participants were interviewed using a structured questionnaire to gather demographic and clinical data including age, sex, weight, height (for calculating BMI), smoking and alcohol consumption habits, family history of cardiovascular diseases, and previous MI history. Clinical assessments included HbA1c, fasting blood glucose, fasting lipid profiles, serial ECGs, and cardiac enzyme levels (CPK-MB, Troponin-I).

Risk factor evaluation

The study assessed the following risk factors: hypertension, diabetes mellitus, smoking, alcohol consumption, overweight (BMI >25 kg/m^2), hyperlipidemia (serum cholesterol >200 mg%), past ischemic heart disease (IHD), and family history of IHD.

ABI measurement

The ankle brachial index (ABI) was measured using the Micro Life Watch BP Office ABI machine, which is a non-Doppler device.

Statistical analysis

Data analysis was conducted using Microsoft Excel and IBM SPSS software. Descriptive statistics were applied to analyze the data. Frequencies and percentages were reported for categorical variables, while means and standard deviations were reported for continuous variables. Data were presented in tables and bar diagrams for clarity. The association between ABI and each risk factor was analyzed using the Z-test and p-values, with a significance threshold set at $p < 0.05$. The ANOVA test was employed to explore the combined association of multiple risk factors with ABI in young MI patients.

RESULTS

Table 1 shows that among 147 patients, 79 patients were aged between 36 and 40 years. As the age progressed, an ascending trend of patients with increasing risk of MI in young population was observed. The mean ± standard deviation of age was 35.54 ± 4.041.

TABLE 1. Distribution of coronary artery disease patients by age group in a young population

Age groups	Number of patients
21-25	3
26-30	13
31-35	52
36-40	79
TOTAL	147

TABLE 2. Prevalence of peripheral artery disease by ABI scores across age and sex ranges in young coronary artery disease patients

Age range	ABI		Percentage
	Less than 0.9	Higher than or equal to 0.9	
21-25	1.36%	0.68%	2.04%
26-30	6.12%	2.72%	2.72%
31-35	23.13%	12.24%	35.37%
36-40	36.73%	17.01%	53.74%
Female	8.16%	2.72%	10.88%
Male	59.18%	29.93%	89.12%
Percentage	67.35%	32.65%	100%

TABLE 3. Influence of family history and smoking status on of myocardial infarction on ABI scores in coronary artery disease patients

Family history of MI	ABI range		Total
	Less than 0.9	Higher than or equal to 0.9	
No	59	26	85
Yes	40	22	62
Total	99	48	147
SMOKING			
Yes	57.14%	24.49%	81.63%
No	10.20%	8.16%	18.37%
Percentage	67.35%	32.65%	100%

Table 2 shows 54 patients with ABI values less than 0.9, while 25 patients - aged between 36 and 40 years - recorded values higher or equal to 0.9. This result indicated that more people with young MI had less than 0.9 ABI value. Moreover, the frequency was also higher by 36.73% in these people. Therefore, age and ABI were statistically correlated with a significant Z value 7.101 and p <0.05.

The sex distribution, frequency of females was higher by 89.11% than 10.88% males. Prevalence of MI in females was observed after 30 years of age and in males after 36 years of age. Correspondingly, sex and ABI correlation was done and found that 87 males had ABI range less than 0.9 while only 12 females recorded the same results. Also, 44 males recorded higher or equal to 0.9 value in ABI range, while only 4 females had the same results. Therefore, among the young MI patients, ABI value frequency less than 0.9 was recorded at 75% of female patients compared to 66% at males. Hence, a significant correlation between ABI and sex showed that males had associated risk of peripheral arterial disease (p<0.05, Z=7.181).

Table 3 shows that considering family history, 62 out of 147 patients had family history of MI. 40 out of 62 patients having FH and less than 0.9 ABI. Further, 42.18% of the study group had family history of MI. 46%, 48%, 39% frequency of patients in 26-30, 31-35, and 36-40yrs age groups had family history of CVD. 40 out of 62 patients had low ABI with family history of CVD. Family history of MI had a significant correlation with low ABI and peripheral arterial disease (p <0.05, Z = 5.142).

120 MI patients (81.63%) out of 147 used to smoke, 80.27% being males and 1.36% females.From the entire study population only 27 patients were non-smokers, and 15 out of 16 patients under 30 years old were found to be smokers. Only one non-smoker was under 30 years old, but he had the habit of consuming alcohol. One of the non-alcoholic patients in the smokers group was an ex–alcoholic who took the rehabilitation for smoking and stopped alcohol, but he used to still smoke cigarettes occasionally. All the young MI patients under the age of 25, and 92.31% of the population from the 26-30 years age group were smokers. Out of 120 smokers, 84 had less than 0.9 ABI value, whereas 15 out of 27 non-smokers had a <0.9 ABI value. The difference between smokers and non-smokers was found to be statistically significant (Z = -6.189 and p <0.05).

Table 4 reveales that 129 out of 147 (87.7%) were alcoholic, and 3 people from the 20-25 age group were smokers and alcoholics. Only one non-smoker in the 26-30 age group was an alcoholic. 84 (57.4%) out of 147 patients had ABI values less than 0.9, 15 out of 18 were non-alcoholics and recorded ABI values higher than 0.9. Seven people out of 15 with abnormal ABI in nonalcoholic group were females. There was a significant association between low ABI and alcoholism (p <0.05, Z = 7.069). Table 4 also shows that diabetes was observed in 58 (39.46%) of patients, and 4 among them were diagnosed with denovo diabetes. Prevalence of diabetes was higher in the 30-40 age groups. Nobody was a diabetic in the age group of 21-15. Only 3 patients from the 26-30 age group were diabetic. Chances of being diagnosed with denovo diabetes were higher in the 31-35 years age group. Three out of 23 were diagnosed with denovo diabetes. 38 out of 58 diabetic patients had abnormal ABI values.

There was a significant correlation between the diabetes and ABI when there were only diabetes patients in the study (p <0.05, Z = 2.209). There was no significant correlation between diabetes and low ABI (p <0.865, Z = 0.169). Table 4 shows hypertension vs. ABI - out of 39 patients (26.53%), 24 had low ABI value. A significant correlation (p <0.05, Z=4.96) was found between low ABI and hypertension within the hypertensive group. But there was no significant correlation found p = 0.481, Z = 0.0704 when I was done in whole study population.

TABLE 4. Association of alcohol consumption and with and without diabetes, hypertension, and dyslipidemia with ABI scores in patients with coronary artery disease

Alcoholic	ABI range		Percentage
	Less than 0.9	Higher than or equal to 0.9	
Yes	57.14%	30.61%	87.76%
No	10.20%	2.04%	12.24%
Percentage	67.35%	32.65%	100%
Diabetes			
Yes	38	20	58%
No	61	28	89%
Total	99	48	147%
Hypertension			
Yes	16.33%	10.20%	26.53%
No	51.02%	22.45%	73.47%
Dyslipidemia			
Yes	45.58%	18.37%	63.95%
No	21.77%	14.29%	36.05%
Total	67.35%	18.37%	100%
Previous MI			
Yes	2.72%	0.00%	2.72%
No	64.63%	32.65%	97.28%
Total	67.35%	32.65%	100%

Table 4 shows that Dyslipidemia was found in 3 patients in group 21-30 years of age than other groups, and was prevalent in 13 out of 16 female patients, compared to 81 out of 131 male patients. With respect to ABI, 63.95% of study population were having dyslipidemia, 45.58% of population were having both dyslipidemia and low ankle brachial index. There was a significant correlation between ABI and dyslipidemia ($p<0.05$, $Z=3.098$).

The past history of MI is a major risk factor for any CVD. In view of our patients, young age incidences were very less and only 4 patients had the previous MI history. All the 4 patients were having ABI value less than 0.9, there was a significant correlation between previous MI and low ABI with $p<0.05$, $Z=0.716$.

Table 5 explains about the type of MI, anterior wall MI was found in 64 patients, followed by 27 NSTEMI patients, 18 out of 27 NSTEMI patients were having low ABI and 40 out of 64 anterior wall MI patients were having low ABI.

Table 6 shows 98 out of 147 study population had SVD, but only 3 had triple vessel disease. All the triple vessel diseased patients recorded ABI less than 0.9. There was no significant correlation between low ABI and number of vessels involved ($p >0.05$, chi-square 0.472).

TABLE 5. Distribution of ABI scores by type of myocardial infarction in coronary artery disease patients

Type of MI	ABI range		Total
	Less than 0.9	Higher than or equal to 0.9	
Unstable angina	14	5	19
Anterior wall MI	40	24	64
Inferior wall MI	15	6	21
Infero-posterior MI	4	2	6
NSTEMI	18	9	27
RvMI-IvMI	1	0	1
Postero-lateral MI	0	1	1
Antero-lateral MI	6	1	7
Posterior wall MI	1	0	1
Total	99	48	147

TABLE 6. Correlation of ABI scores with the number of affected vessels in coronary artery disease patients

Number of vessels					Total
		SVD	DVD	TVD	
ABI	**Less than 0.9**	65	31	3	99
	More than 0.9	33	15	0	48
Total		98	46	3	147

TABLE 7. Hospital stay duration by ABI Range and age group in coronary artery disease patients

ABI RANGE	Total number of days of hospital stay in different age range				Total
	21-25	26-30	31-35	36-40	
Less than or equal to 0.9	13	52	208	358	631
More than 0.9	5	20	83	96	204
Total	18	72	291	454	835

Table 7 shows, ABI less than 0.9 ABI value was associated with a greater number of days in hospital. The average number of days stayed under observation by patients with <0.9 ABI values are 6.37 days which was more than 2 days difference compared to 4.25 days average of patients with >0.9 ABI value. There was no significant correlation between low ABI and length of hospital stay ($p>0.05$, chi-square 5.6).

DISCUSSION

The study confirms that the incidence of MI increases with age, even within the under-40 cohort.

This suggests a need for early preventive measures and proactive screening strategies to address cardiovascular risks in younger adults. Abnormal ABI scores were notably higher in the 31-40 age group, indicating earlier-than-expected arterial deterioration [4-7].

The gender disparity, with males comprising 89.12% of the study population, aligns with epidemiological data showing young men are at higher risk for MI than young women. Despite this, women in the study exhibited higher rates of abnormal ABI, suggesting that while fewer women experience MI, those who do may suffer more severe vascular disease [10,11].

Significant associations were found between smoking, alcohol use, and lower ABI values, highlighting these behaviors as critical modifiable risk factors. With over 80% of participants engaged in smoking, the urgent need for targeted smoking cessation programs within this demographic becomes evident [12].

Family history of MI was linked with lower ABI values in over 40% of participants, underscoring the role of genetic factors in cardiovascular risk. This highlights the importance of incorporating family health history into risk assessment models for young adults [13,14].

Comorbid conditions like diabetes and hypertension were significantly associated with abnormal ABI, emphasizing their role in accelerating arterial disease and contributing to early onset MI. Effective management of these conditions is crucial in reducing further vascular damage and preventing cardiovascular events [15,16].

Limitations

This study has several limitations. Firstly, the sample size may not be large enough to generalize the findings across diverse populations. Secondly, the study's cross-sectional design limits the ability to establish causal relationships between risk factors and abnormal ABI values. Additionally, the study population may not be representative of all younger individuals with MI, as it predominantly consists of males.

CONCLUSION

The findings of the present study explains the potential utility of ABI screening in younger populations, particularly for individuals with risk factors like a family history of cardiovascular disease, smoking, or comorbid conditions. These insights suggest that public health initiatives should be aggressively tailored to address modifiable risk factors among young adults. Such initiatives could include targeted interventions for smoking cessation and lifestyle modifications promoting cardiovascular health.

In conclusion, this study reinforces the importance of early detection and management of cardiovascular risk factors in young adults, advocating for the inclusion of ABI as a routine screening tool in clinical practice for at-risk populations.

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