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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 revealed an increased incidence of MI with age within the under-40 population. Males were more frequently affected than females, with all female participants being over 30 years of age. Females demonstrated a higher prevalence of abnormal ABI compared to males. Significant risk factors included smoking, alcohol consumption, and dyslipidemia, with less prevalence of HTN and DM. A significant correlation was found between ABI values and the use of tobacco and alcohol. However, no significant relationship was observed between the number of vascular involvements as indicated by ABI and the length of hospital stay, which increased with patient age but 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.

Key Words: Peripheral artery disease, coronary artery disease, ankle brachial index

Abbreviations: Peripheral Artery Disease - PAD; Coronary Artery Disease - CAD; Ankle Brachial Index - ABI; Myocardial Infarction -MI

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 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, 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, among 147 patients, 79 patients were having age between 36-40 years; an increasing trend of patients was observed as the age progressed, this indicated that with increasing age there is increasing risk of MI in young population. The mean±standard deviation of age was 35.54±4.041.

Table 2 shows, 54 patients with ABI value less than 0.9 were higher than 25 patients in group more than or equal to 0.9 were having age between 36-40 years, this indicated that the more number of people with young MI had less than 0.9 ABI value. Moreover, the frequency was also higher by 36.73% in less than 0.9 group. 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. Prevelance of MI in females was observed to be after 30 years of age and in males higher patients were observed after 36 years of age. Correspondingly, sex and ABI correlation was done and found that, 87 males had ABI range less than 0.9 than 12 females and 44 males were higher in group more than or equal to 0.9 ABI range than 4 females. Therefore, among the young MI patients ABI value frequency was 75% in female patients in less than 0.9 ABI group than value compared to 66% in male population. 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 are having family history of MI. 40 out of 62 patients having FH are having less than 0.9 ABI. Further, 42.18% of the study group are having family history of MI. 46%, 48%, 39% frequency of patients in 26-30, 31-35, and 36-40yrs of age groups are having family history of CVD. 40 out of 62 patients are having low ABI with family history of CVD. Family history of MI is having significant correlation with low ABI and peripheral arterial disease (p<0.05, Z=5.142).

The social habits were found in 120 MI patients out of total 147 of having a habit of smoking. Among 81.63% smokers, 80.27% are males and 1.36% was females. In whole study population only 27 patients were non-smokers and 15 out of 16 below 30 years were found to be smokers. Only one was non-smoker was below 30years with a habit of consuming alcohol. One among the nonalcoholic in smokers group is an ex –alcoholic who took the rehabilitation for smoking and stopped alcohol but he smokes cigarette occasionally. All the young MI patients below age of 25 yrs and 92.31% of the population in age group of 26-30 yrs were smokers. Out of 120 smokers, 84 patients have less than 0.9 ABI value, whereas, 15 out of 27 non-smokers have <0.9 ABI value. The difference between smoker and non-smoker was found to be statistically significant (Zvalue-6.189 and p <0.05.)

Table 4 shows that the alcohol group, 129/147 (87.7%) were alcoholic and all 3 people in group of 20-25years were smokers and alcoholics. Only one non-smoker in age group of 26-30yrs was an alcoholic. 84(57.4%) of 147 patients have ABI value less than 0.9, 15 out of 18 were non-alcoholics and were having ABI values of more than 0.9. 7 people out 15 patients 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 also observed in 58 (39.46%) of patients and among them 4 patients were diagnosed of having denovo diabetes. Prevalence of diabetes is more in the 30-40 age groups. No patient is a diabetic in the age group of 21-15. Only 3 patients of 26-30years age group patients are diabetic. Chances of being diagnosed denovo diabetes were more in the 31-35years patient group. 3 out 23 being diagnosed denovo diabetics. 38 out of 58 diabetic patients were having abnormal ABI value.

There was a significant correlation between the diabetes and ABI when it had 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 has shown that out of 39(26.53%) patients, 24 patients had low ABI value. A significant correlation ($p<0.05$, $Z=4.96$) was found between low ABI and hypertension compare 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 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 that, more number of people was having SVD 98 out of 147 study population. Only 3 people were having triple vessel disease. All the triple vessel diseased patients were having ABI less than 0.9 which is 100%. There is no significant correlation between low ABI and number of vessels involved (p >0.05, chi-square 0.472).

Table 7 shows, ABI less than 0.9 ABI value was associated with more 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

This study delves into the applicability and significance of the Ankle Brachial Index (ABI) as a diagnostic tool in a younger population suffering from myocardial infarction (MI), a group traditionally not extensively studied in this context. The findings illuminate several crucial aspects of cardiovascular health and risk in individuals aged 40 and younger, offering insights that could guide both clinical practices and future research.

The age distribution within the study underscores a significant trend: the incidence of MI increases with age, even among those under 40. This age-related escalation is consistent with established cardiovascular risk trajectories, but its confirmation in a younger cohort highlights the need for early preventive measures. The higher prevalence of abnormal ABI scores in the 31-40 age bracket suggests that arterial deterioration may commence earlier than commonly expected, warranting proactive screening and management strategies in younger adults (4-7). The gender disparity observed with males comprising 89.12% of the study population aligns with broader epidemiological data indicating that young men are at a higher risk of MI compared to their female counterparts (8,9). This study adds to the mounting evidence that men in their early adult years exhibit a higher susceptibility to cardiovascular events, potentially due to a combination of biological factors and lifestyle choices (10,11). Notably, women in this study showed higher incidences of abnormal ABI, which could indicate more severe peripheral arterial disease when present. This finding suggests that while fewer young women experience MI, those who do may have more pronounced vascular disease (12).

Smoking and alcohol use were significantly associated with lower ABI values, reinforcing their role as critical modifiable risk factors for cardiovascular disease. The high prevalence of these habits, particularly smoking, which affected over 80% of the participants, mirrors trends seen in broader public health data. The strong correlation between smoking and lower ABI scores further substantiates the direct impact of tobacco on vascular health, which appears to be more pronounced in younger individuals. This emphasizes the urgent need for targeted smoking cessation programs within this demographic (8,9).

The correlation between family history of MI and lower ABI values highlights the genetic or hereditary component of cardiovascular risk. This study found that over 40% of participants had a family history of MI, which was closely aligned with the presence of lower ABI readings. This linkage underscores the importance of family health history in assessing cardiovascular risk from an early age and could be pivotal in refining risk stratification models for young adults (6).

The study also examined the prevalence and impact of comorbid conditions like diabetes and hypertension. While these are well-known risk factors in older populations, their significant association with abnormal ABI in younger patients points to their potent role in accelerating arterial diseases, potentially leading to early onset MI. The management of these conditions, along with dyslipidemia, which was also prevalent, is crucial in mitigating further vascular damage and reducing the incidence of cardiovascular events (13).

The findings from this study suggest several actionable insights for clinical practice and public health. Firstly, the use of ABI screening in younger populations, particularly those with risk factors such as a family history of CVD, smoking, or comorbid conditions like diabetes, could enhance early detection of at-risk individuals (15). Secondly, public health initiatives could be more aggressively tailored to address modifiable risk factors among young adults, incorporating targeted interventions for smoking cessation and healthier lifestyle promotions (16).

CONCLUSION

This study not only reaffirms the importance of ABI as a diagnostic tool in detecting early signs of cardiovascular compromise in young adults but also highlights the need for a comprehensive approach to cardiovascular risk management that integrates both traditional and novel predictors. This could ultimately lead to better preventive strategies and more nuanced patient care protocols, potentially reducing the burden of cardiovascular disease in younger populations

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Tables:

Table 1: Distribution of Coronary Artery Disease Patients by Age Group in a Young Population

AGE GROUPS	NUMBEROF 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	More 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

	ABI range		
Family History of MI	Less than 0.9	More than or equal to 0.9	Total
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 4: Association of Alcohol Consumption and with and without Diabetes, Hypertension, Dyslipidemia with ABI Scores in Patients with Coronary Artery Disease

Alcoholic	**ABI range**		**Percentage**
	Less than 0.9	**More 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 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	More 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 equalto0.9	13	52	208	358	631
More than 0.9	5	20	83	96	204
Total	18	72	291	454	835