EARLY DIAGNOSIS OF ASYMPTOMATIC PERIPHERAL ARTERIAL DISEASE BY ANKLE-BRACHIAL PRESSURE INDEX METHOD IN SMOKERS

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Abstract: Background & Objectives: Cigarette smoking is a major risk factor for the development of atherosclerosis, coronary heart disease, acute myocardial infarction, and sudden cardiac death. Smokers are at an increased risk of developing early and asymptomatic PAD as compared to non-smokers..Ankle-Brachial Pressure index is a non-invasive vascular test measured by comparing systolic blood pressures in the ankle to the higher of the brachial systolic blood pressures, which is the best estimate of central systolic blood pressure ABPI is the gold standard screening test for the diagnosing PAD with a cut-off value of >0.9. **Materials and Methods:** Present study was carried out at cardiovascular function lab, Department of physiology, Government medical college, Bhavnagar, among 200 subjects, out of which 100 were Smokers and 100 were Non-Smokers, in age group of 20-50 years. Smokers were further categorized into Mild (n=44), Moderate (n=26), and Heavy (n=30) based on the smoking index.**Observations and Results:** The ABPI of both the limbs of Smokers was significantly lower than the non-smokers and this was further intensified among the smokers as the intensity and duration period of smoking increases amongst smokers with lowest ABPI in the Heavy Smokers and the highest ABPI in the mild smokers. Our study also found out generalized extremely significant decrease in ABPI in smokers as compared to non-smokers. A high relative risk of 4.9, odds ratio of 9.5 of asymptomatic PAD in smokers as compared to non-smokers was also observed. **Conclusions:** Cigarette Smoking plays a major role in degradation and decreased function of Cardiovascular System and in particular causative factor for PAD. Through this study we can educate the smokers about the adverse effects of smoking on various systems of the body particularly the lesser known and the cardiovascular system to the general population. Furthermore there is also a need to incorporate ABPI as a screening procedure in peripheral health centres.

Key Words: Smoking, ABPI, PAD, Cardiovascular System

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Introduction:

"SMOKING IS INJURIOUS TO HEALTH" is a caption written in almost all the tobacco containing products[1]. Despite this, smoking is widely prevalent in the developing as well as the developed nations. Cigarette smoking is a major modifiable risk factor for the development of atherosclerosis, Central and Peripheral Arterial Disease, Acute Myocardial Infarction and Sudden Cardiac Death. It has been estimated that symptomatic PAD is just a tip of the iceberg and most of the diseased patients are asymptomatic[2]. To diagnose the prevalence of asymptomatic PAD, ABPI is simple, non-invasive, reproducible, and cost-effective [3], hence measured routinely to screen for asymptomatic PAD patients with a cut off value of <0.9 for its diagnosis[4]. Previous studies have shown that age, sex, smoking status, Diabetes, hypertension, hypercholesterolemia are the most important risk factors of developing asymptomatic PAD[5]. The present study was done to compare ABPI between the smokers and non-smokers to establish the relationship of Smoking and PAD by measuring ABPI which is the Gold Standard Screening procedure by diagnosing of asymptomatic PAD.

Material and Methods:

After obtaining prior IRB permission, this Study was carried out at Cardiovascular Function Lab in the Department Of Physiology, Government Medical College, Bhavnagar. The study population included 200 healthy male subjects comprising of 100 smokers and 100 non smoker controls aged between 20-50 years. Participant subjects were from staff members, resident doctors and relatives of patients attending the OPD of Sir Takhtasinhji Hospital Bhavnagar. Case Group was selected the Smokers with history of smoking for at least 1 year with no history of major illness like Hypertension, Diabetes Mellitus, Peripheral Neuropathy, Obesity and taking drugs like anti-platlet drugs, thrombolytic, statins etc in past or present. While Control Group was

selected subjects who have never smoked in life and not having any other addiction related to tobacco and with no history of major illness like Hypertension, Diabetes Mellitus, Peripheral Neuropathy, Obesity and taking drugs like anti-platlet drugs, thrombolytic, statins etc in past and present.Both groups were selected after proper counseling & written consent.

Smoking Index[6]: It is criteria considered for present study to classify the smokers according to their severity. Here smoking index is calculated by multiplying numbers of cigarette smoked per day & duration of smoking in years. According to this index smokers were classified in three groups as shown in Table no 1:

Table No.1

Type of Smokers	Smoking Index
Light smokers	0-100
Moderate smokers	100-200
Heavy smokers	>200

Statistical analysis

Statistical analysis was done using Graph Pad Instat 3 (demo version).Continuous data with normal distribution are given as mean± standard deviation. Student's t-test was used for testing the relationship of ABPI between smokers and non-smokers. Fisher's exact test for testing the significance of percentages of Subjects with PAD and without PAD. A p value of <0.05 is considered significant.

Result:

The anthropometric data of the study group is shown in table 2.

Table 2 Distribution of Anthropometric Data in Subjects

	Non-Smokers (n=100)	Total Smokers (n=100)	P value
Mean Age in Years	33.21 ± 7.61	33 ± 7.65	>0.05
Mean Height cm	163.4 ± 8.79	164 ± 9.79	>0.05
Mean Weight kg	64.49 ± 6.62	65.38 ± 10.16	>0.05
Mean BMI	24.25 ± 2.81	24.34 ± 3.46	>0.05

The anthropometric data and p value of unpaired t test suggests that the case and the control group are matched with respect to Age, Height, Weight and BMI.

Table 3: Mean value of Ankle Brachial Pressure Index in Non-Smokers, Mild Smokers, Moderate Smokers and Heavy Smokers

	RIGHT ABPI	LEFT ABPI
Non-Smokers	1.085 ± 0.1063	1.08 ±0.1072
Total Smokers	0.9173 ± 0.1027	0.9121 ± 0.1136
p value	**<0.05**	**<0.05**
Non-Smokers	1.085 ± 0.1063	1.08 ±0.1072
Mild Smokers	0.9905 ± 0.0772	0.9952 ± 0.0856
p value	**<0.0001**	**<0.0001**
Non-Smokers	1.085 ± 0.1063	1.08 ±0.1072
Moderate smokers	0.9146 ± 0.0728	0.9065 ± 0.0688
p value	**<0.0001**	**<0.0001**
Non-Smokers	1.085 ± 0.1063	1.08 ±0.1072
Heavy smokers	0.8123 ± 0.0551	0.795 ± 0.0663
p value	**<0.0001**	**<0.0001**

Table 4: Comparison of Smokers who had asymptomatic PAD with Non-Smokers and the Relative risk and Odds Ration of PAD in smokers

	PAD	Not Diseased	Relative Risk In Smokers	Odds Ratio in Smokers
Smokers	54	46	4.9	9.5
Non-Smokers	11	89		

Table 3, shows the actual comparison of Left and Right ABPI between Non-Smokers with Mild, Moderate Heavy and Total Smokers. From the table no 3 it is evident that in both the Left and Right ABPI there is a significant decrease in the Smokers as compared to the non-smokers and this

is further enhanced as the Smoker Category goes from Mild to Severe Smokers.

Table 4 shows the comparison of Smokers who has PAD with non-smokers and the Relative Risk and Odds Ratio of PAD in smokers as compared to non-smokers which is 4.9 and 9.5 respectively.

Discussion:

The ABPI is considered as a surrogate marker of generalized atherosclerosis because low ABI levels have been associated with elevated risk of future coronary heart disease[7,8] stroke [7,9,10]and a higher risk of all-cause and cardiovascular mortality [7,11,12].

Table No. 3 shows that both the Left and Right ABPI show statistical significant difference with low ABPI in Non-Smokers and Mild Smokers (p<0.05) and a extremely significant difference between Non-Smokers and Moderate, Heavy Smokers and Total Smokers (p<0.0001). Thus the difference increases and the ABPI decreases with the intensity and Duration of Smoking.

Recio-Rodriguez et al[13] have got similar results between smokers and Non-Smokers though they did not differentiate the smoker group based on the intensity and duration of smoking while Syvanen et al[14]found a significant difference between ABPI values in smokers and nonsmokers and Jong Bum Kim, et al[15]who had male predominance as smoker group also found the expected decrease in ABPI in smokers as compared to non-smokers.

Table no. 4 shows that the relative risk of PAD in those who are exposed to tobacco smoking is 4.9 times higher than the unexposed in the development of PAD.

Edinburg artery study[16]which found out the relative risk of PAD in moderate smokers to be 1.94 and heavy smokers to be 3.94. Crique at al[17] reported a relative risk of 2.55 while Newman et al[18] found a relative risk of 3.5 in smokers as compared to general population. From the table it is evident that the relative risk of PAD in those who are exposed to tobacco smoking is 4.9 times higher than the unexposed in the development of PAD. The difference observed between previous study

and our study is that they had studied in General Population which had other risk factors like Diabetes, Hypertension, advanced age etc in contrast to our study which is an exclusive case-control study. Also the number of subjects were far higher in their study as compared to our study.

Hooi et al[5] reported an odds ratio of 4.3 in current smokers who had symptomatic PAD. Young-Hoon Lee et al [19] reported an odds ratio in 4.3 in current smokers. Fowler et al[20] reported an OR of 3.9 in current smokers as compared to the general population. In agreement with previous studies [16,21], we also observed a significant increasing rise in the smoking index of smoking and PAD, confirming that the effect of cumulative smoking exposure on PAD.

Conclusion:

Our study concluded there was a significant decrease in the values of ABPI in smokers as compared to the non-smokers and the Relative Risk as well as Odds Ratio of PAD as measured by ABPI was substantially higher in smokers. Therefore there is an urgent need to educate the smokers about the health hazards of smoking particularly related to the lesser known effects on cardiovascular system

Recommendation:

There is a need of ABPI to be done in general population as there is a severe lack of Indian Data and the demographics of Indians differ from the western people in terms of age, lifestyle habits, environment etc. There is also a need to use ABPI as a screening tool of choice in the PHCs to screen patients for asymptomatic PAD, to unearth the disease and promptly treat it.

Limitations and Strengths

There are several limitations to our study. Firstly, the probable measuring error is that the smoking characteristics are self-reported and measuring biological markers, such as serum cotinine, might have attenuated the relationship between cigarette smoking and PAD. Secondly, because information on environmental tobacco smoke exposure was not collected, the effect of passive smoking on PAD cannot be accessed.

Nevertheless, this study has several strengths. First, the main strength is that few studies have investigated the association between smoking characteristics (including smoking index) and PAD risk. Secondly, our more detailed analysis, allowed us to find a significant association between smoking habits and PAD. Thirdly, ABPI was measured on both the left and right sides, and the smallest ABPI was used in defining PAD.

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