RESEARCH PAPERS

Ankle brachial pressure index in chronic cigarette smokers and chronic cheroot smokers

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Abstract

Cigarette smoking has been proven to be associated with a decline in ankle brachial pressure index (ABPI) and development of peripheral arterial disease (PAD). Cheroots as well as cigarettes are used by chronic smokers in this country. Many Myanmar people believe that cheroot smoking is not as harmful as cigarette smoking. Thus, it is essential to study the effects of cheroot smoking as well as cigarette smoking. A cross-sectional comparative study was done to study ABPI in chronic cigarette smokers and chronic cheroot smokers. Ninety apparently healthy male subjects of age 20-45 years including 30 non-smokers, 30 chronic cigarette smokers and 30 chronic cheroot smokers residing in Chan Aye Thar Zan Township, Mandalay were recruited. The ankle and brachial blood pressures were measured by using continuous-wave Doppler machine and mercury sphygmomanometer, and ABPI was calculated. The relationship between amount of smoking, i.e. pack-year, and ABPI was also studied. Mean ABPI of non-smokers, chronic cigarette smokers and chronic cheroot smokers were 1.08 ± 0.07, 0.98 ± 0.08 and 0.97 ± 0.06 respectively. Both chronic smoker groups had a significantly lower ABPI than non-smokers. But there was no significant difference in ABPI between chronic cigarette smokers and chronic cheroot smokers. It was found that there was a strongly significant negative correlation between the amount of smoking and ABPI in chronic smokers ($r = - 0.634$, $n = 60$, $P < 0.01$). It could be concluded that cheroot smoking might be as harmful as cigarette smoking on cardiovascular system.

Introduction

Smoking increases the risk of pulmonary and many extra-pulmonary cancers, peripheral arterial disease, cerebrovascular accidents and peptic ulcer disease[1]. In South-East-Asia (SEA) region, current prevalence of smoking among males ranges from 30.6% to 58.6%[2]. In Myanmar, prevalence of smoking habit is higher in males than females both in urban and rural areas. It ranged from 58% to 74% for males and from 11% to 46% for

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females[3]. The Myanmar sentinel tobacco use prevalence study 2001 reported that among current smokers, 73% smoked cheroots, 17% smoked hand-rolled cheroots, 7% smoked cigarettes, 3% smoked cigars and 0.2% smoked pipes[4].

Peripheral arterial disease (PAD) is not an uncommon condition as a result of atherosclerosis of leg arteries. Risk factors include increasing age, male sex, smoking, diabetes, hyper-cholesterolaemia and hypertension[5]. But the evidence suggests that two most important risk factors for the development of PAD are smoking and diabetes[6]. The association between cigarette smoking and PAD has been extensively studied worldwide[5-11]. Most of the studies proved that prevalence of PAD is significantly higher in cigarette smokers compared with non-smokers.

The presence and severity of lower limb ischaemia can be determined by measurement of the ankle brachial pressure index (ABPI)[12]. The ABPI gradually falls as the leg arteries become stenosed by atheromatous plaques[13]. Thus, there is a preclinical decline in ABPI before the full-blown clinical symptoms of PAD come into notice. Association between cigarette smoking and decline in ABPI has been studied and proven worldwide. But there is limited evidence regarding cheroot smoking and ABPI. In fact, cheroot is the most widely used tobacco in this country and many Myanmar people believe that cheroot smoking is not as harmful as cigarette smoking. Thus, it is essential to study the effect of cheroot smoking on ABPI.

Materials and methods

A total of 90 apparently healthy male subjects, aged 20-45 years, living in Chan Aye Thar Zan Township, Mandalay, including 30 non-smokers, 30 chronic cigarette smokers and 30 chronic cheroot smokers were recruited from April 2011 to September 2011. Chronic smoker was defined as a person who had smoked at least 1 cigarette or cheroot per day continuously for more than 5 years. Non-smoker was defined as a person who had never smoked any forms of tobacco in their life. Subjects who smoked both cigarettes and cheroots, subjects with hypertension (systolic BP $\geq$ 140 mmHg and/or diastolic BP $\geq$ 90 mmHg) and subjects with diabetes (random blood sugar $\geq$ 11.1 mmol/L) were excluded.

Data collected with the proforma were recorded (Table 1). Detailed smoking characteristics including age at which the subject started smoking, duration of smoking and the number of cigarettes/cheroots smoked per day were recorded (Table 2). Then, the amount of smoking was calculated. The amount of smoking is the value calculated by dividing the number of cigarettes/cheroots smoked per day by 20, and then multiplying with duration of smoking (years) and is expressed as pack-year. Body weight was measured by weighing machine with minimum of clothing to nearest 0.1 kg. Height was measured by stadiometer. Body mass index was calculated by dividing weight in kg by height in m^2.

Table 1. General characteristics of the subjects

General Characteristics	Non-smokers (n = 30)	Chronic cigarette smokers (n = 30)	Chronic cheroot smokers (n = 30)	P
Age (years)	35.77 ± 7.39	34.73 ± 8.11	36.03 ± 5.47	0.755
Weight (kg)	57.53 ± 8.63	57.17 ± 8.41	58.03 ± 8.51	0.925
Height (m)	1.64 ± 0.05	1.65 ± 0.06	1.66 ± 0.07	0.825
BMI (kg/m^2)	21.21 ± 3.14	20.91 ± 3.43	21.2 ± 3.15	0.921
SBP (mmHg)	123.67 ± 8.19	124.17 ± 5.74	124.5 ± 9.13	0.917
DBP (mmHg)	77.5 ± 4.5	78 ± 4.47	78.17 ± 4.82	0.843
RBS (mmol/L)	4.99 ± 0.99	5.04 ± 1.21	4.94 ± 0.99	0.941

One way ANOVA

Table 2. Smoking characteristics

	Chronic cigarette smokers	Chronic cheroot smokers	All chronic smokers
1. Age at which the subjects started smoking (years)			
< 20	25 (83.3%)	16 (53.3%)	41 (68.3%)
20 - 30	5 (16.7%)	14 (46.7%)	19 (31.7%)
> 30	0	0	0
2. Duration of smoking (years)			
< 10	7 (23.3%)	0	7 (11.7%)
10 - 20	11 (36.7%)	22 (73.3 %)	33 (55%)
> 20	12 (40%)	8 (26.7%)	20 (33.3%)
3. Number of cigarettes/cheroots smoked per day			
< 10	15 (50%)	17 (56.7%)	32 (53.4%)
10 - 20	14 (46.7%)	12 (40%)	26 (43.3%)
> 20	1 (3.3%)	1 (3.3%)	2 (3.3%)

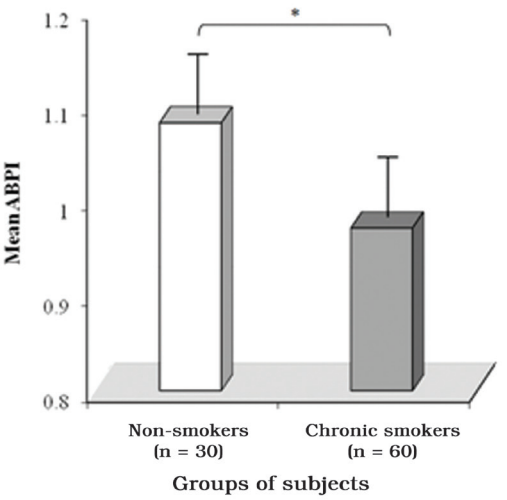
For measurement of ABPI, continuous-wave Doppler machine with an ultrasound probe of 8 MHz frequency (Bidop, model ES-100V3, Hadeco Inc., Japan) (Figure 1) and mercury sphygmo-manometer with cuff size 12 × 22 cm were used. Brachial and ankle systolic pressure were measured, and ABPI was calculated as the ratio of ankle systolic pressure and brachial systolic pressure.

Figure 1. Handheld Doppler machine and transmission gel for detection of vascular flow (Bidop, model ES-100V3, Hadeco Inc., Japan)

Statistical Analysis

Data collected with the proforma were registered and entered by computerized statistical software SPSS 11.5. Independent Student's t-test was used to compare the continuous variables. Data from the three study groups was analyzed by one-way ANOVA and Bonferroni's correction was done for multiple comparisons. Correlation studies were computed by Pearson's correlation. Values were expressed as mean ± SD.

Results



There was no statistically significant difference in general characteristics among the three study groups (Table 1). The mean ABPI of the non-smokers (n = 30) was 1.08 ± 0.07. The mean ABPI of the chronic smokers (n = 60) was 0.97 ± 0.07. It was found that the chronic smokers had significantly lower ABPI value than non-smokers (P < 0.01) (Figure 2).

Figure 2. Comparison of mean ABPI between non-smokers and chronic smokers.

* indicates significant difference at P < 0.01.

The mean ABPI of the chronic cigarette smokers (n = 30) was 0.98 ± 0.08 and that of the chronic cheroot smokers (n = 30) was 0.97 ± 0.06. It was found that mean ABPI was significantly lower in both chronic cigarette smokers and chronic cheroot smokers compared with non-smokers. But there was no statistically significant difference in ABPI between the chronic cigarette smokers and the chronic cheroot smokers (Figure 3).

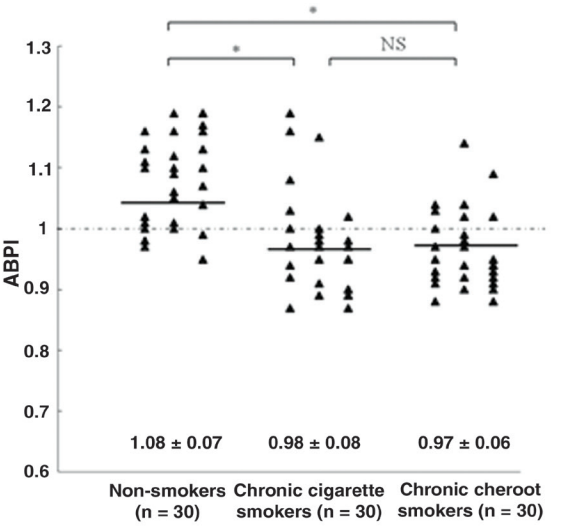


Figure 3. Comparison of ABPI among non-smokers, the chronic cigarette smokers and the chronic cheroot smokers.

Solid lines indicate mean values. Dash line indicates the lower limit of normal ABPI.

* indicates significant difference at P < 0.01.

NS = statistically not significant

All the chronic smokers (n = 60) were divided into 3 groups according to the amount of smoking (pack-year) (Table 3), and mean ABPI values were compared among them (Figure 4). Mean ABPI of the subjects who had smoked less than 5 pack-year (n = 21) was 1.03 ± 0.07, that of the subjects who had smoked 5-10 pack-year (n = 21) was 0.96 ± 0.05 and that of the subjects who had smoked more than 10 pack-year (n = 18) was 0.91 ± 0.03. It was found that mean ABPI values were significantly lower with increasing amount of smoking (pack-year) in the chronic smokers (P < 0.01). In addition, there was a significant negative correlation between ABPI and amount of smoking in the chronic smokers (r = - 0.634, n = 60, P < 0.01) (Figure 5). Therefore, it can be concluded that increasing pack-year is associated with lower ABPI values in the chronic smokers.

Table 3. Amount of smoking

Amount of smoking (pack-year)	Chronic cigarette smokers	Chronic cheroot smokers
Group I (< 5 pack-year)	11 (36.7%)	10 (33.3%)
Group II (5 - 10 pack-year)	9 (30%)	12 (40%)
Group III (> 10 pack-year)	10 (33.3%)	8 (26.7%)

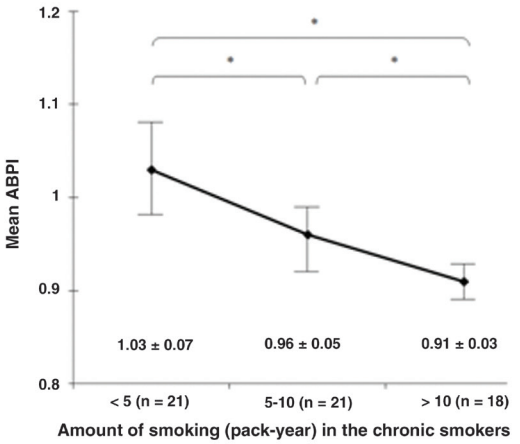


Figure 4. Amount of smoking (pack-year) and mean ABPI in the chronic smokers (n = 60).

Mean ABPI ± SD values are shown at the base of the figure.

* indicates significant difference at P < 0.01.

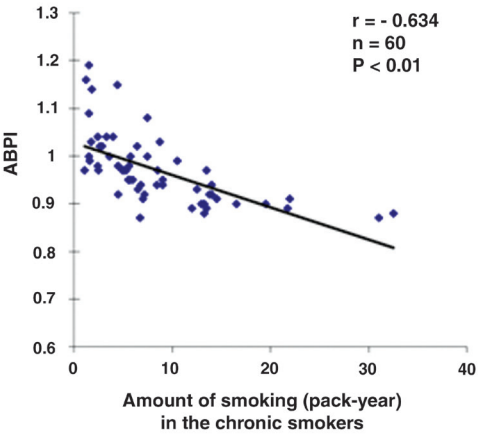


Figure 5. Correlation between amount of smoking (pack-year) and ABPI in the chronic smokers

When chronic cigarette smokers and chronic cheroot smokers were separately analysed for the association between amount of smoking and ABPI, it was found that mean ABPI values were significantly lower with increasing amount of smoking in both types of groups. Similarly, it was also found that there was a significant negative correlation between ABPI and amount of smoking in both cigarette and cheroot groups.

Discussion

Normal ABPI value is between 1 and 1.2 in healthy persons and the cut-off point for PAD is ABPI < 0.913. No subjects in non-smoker group had ABPI below PAD range. Among chronic smokers, 5 chronic cigarette smokers (16.7%) and 2 chronic cheroot smokers (6.7%) were found to have ABPI values less than 0.9. However, none of these subjects had symptoms of PAD such as intermittent claudication, rest pain and lower limb gangrene, indicating that they have asymptomatic PAD. This finding was consistent with the findings of previous studies. Murabito *et al*. (2002) found that 72.5% of subjects with ABPI < 0.9 did not have symptoms of PAD and Hooi *et al*. (2001) also found that 81.3% of the subjects with ABPI value < 0.9 were asymptomatic.

It was also found that the majority of the chronic smokers in this study (35 out of 60 chronic smokers; 58%) had borderline ABPI value (i.e. between 1 and 0.9). Thus, it could be speculated that they might have a tendency to develop PAD later in their life if they continue smoking.

There was no subject with ABPI values more than 1.2 in all three study groups. Camm and Bunce (2009) explained that if lower limb vessels are heavily calcified, they become incompressible by the sphygmomanometer cuff and thus, lower limb blood pressure readings are high and consequently resulting in high ABPI (> 1.2). This arterial wall calcification is found in extreme old age. In the present study, subjects were of age 20-45 years and apparently healthy. Thus, this might be the reason why no subject in this study was found to have ABPI above 1.2.

Conclusion

Both the chronic cigarette smokers and the chronic cheroot smokers had significantly lower ABPI compared with non-smokers and some chronic smokers had ABPI values lower than normal range without no overt clinical symptoms. In addition, the present study demonstrated that cheroot smoking is as dangerous as cigarette smoking in causing a decline in ABPI. In Myanmar, cheroot is the most common form of tobacco used, and people falsely believe that cheroot smoking is not as harmful as cigarette smoking. However, the findings of the present study shed light on the fact that chronic cheroot smoking is as harmful on cardiovascular system as chronic cigarette smoking. Moreover, the present

results indicated that the greater the amount of smoking, the lower the mean ABPI value is. This effect was demonstrated in both the chronic cigarette smokers and the chronic cheroot smokers.

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