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Comparison of the effect of pericardium 6 acupoint (Neiguan) on cardiovascular parameters in healthy subjects versus smokers and diabetic patients

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Abstract

Introduction: Smoking and diabetes are known to be associated with increased arterial disfunction. Blood pressure, heart rate, and pulse pressure are simple indicators of cardiovascular functioning. Pericardium 6 (PC6) is an acupoint that has been shown to modify cardiovascular pathophysiology.

Aim: This study aimed to compare the effects of manual acupuncture at PC6 on cardiovascular parameters in healthy subjects versus smokers and type 2 diabetic patients.

Methods: Three study groups: 14 healthy subjects, 19 smokers, and 15 patients with type 2 diabetes mellitus were compared. Systolic and diastolic blood pressures and heart rate were measured through an oscillometric device. Pulse pressure was calculated as the difference between systolic pressure with diastolic pressure. PC6 right was stimulated by manual needling for 5 min (1-6 min). Parameters were compared in each subject in the pre- versus post-acupuncture periods (0 versus 20 min, respectively).

Results: Acupuncture in healthy people decreased SP, and HR both significantly; in smokers, decreased SP, DP, and HR all significantly and in diabetic patients, decreased SP, DP, and HR all significantly. The effect of acupuncture on systolic pressure increases with age in healthy subjects and diabetics patients. Otherwise, it decreases with age in smokers. The effect of acupuncture on heart rate increases with age in healthy subjects. Otherwise, it decreases with age in diabetics' type 2 patients and has no relationship in smokers.

Conclusion: Manual acupuncture of PC6 evoked a diminution of systolic pressure, diastolic pressure, and heart rate in healthy subjects, smokers, and diabetic patients. Besides, acupuncture significantly decreased pulse pressure in smokers; and not significantly in healthy subjects or diabetics patients. A decreased in HR response age-related to acupuncture was observed in older diabetics. These results suggest that diabetic patients present a refractory state to acupuncture stimulation, probably due to vascular neuropathy.

Keywords: pericardium 6, blood pressure, heart rate, diabetes, smoking

Introduction

Hypertension causes 9.4 million deaths per year globally and contributes to 12.8% of all-cause mortality [1]. It is estimated that 450,000 new cases are diagnosed annually in Mexico and that this figure could double considering that up to 47.3% of the hypertensive population is unaware that they suffer from this disease [2]. Smoking increases this raised risk of hypertension by some 2 to 3 times [3]. The combined action of smoking and hypertension usually increases cardiovascular complications and leads to a progression of atherosclerosis [4]. Hypertension and type 2 diabetes are common comorbidities. Hypertension is twice as frequent in patients with diabetes compared with those who do not have diabetes [5]. More than a half of patients with type 2 diabetes mellitus (T2DM) have arterial hypertension [6].

Pericardium 6 acupoint is considered effective in managing cardiovascular disorders by modulating the activity of this system [7] and more effectively than other points such as ST36 [8]. Besides, its benefit at the cardiovascular level has been proven even in laboratory animals [9]. Its therapeutic effect occurs through different mechanisms [10].

Aim

This study aimed to compare the effects of manual acupuncture at PC6 on cardiovascular parameters in healthy subjects versus smokers and type 2 diabetic patients.

Methods

Population

An experimental cross-sectional study was carried out. Fourteen healthy subjects, 19 smokers, and 15 patients with type 2 diabetes mellitus with oral glycemic control were included in the study. None had total serum cholesterol values > 200 mg/dl or electrocardiogram abnormalities. Subjects were studied fasting and abstaining from caffeine or alcohol 12 hours before the study.

Ethical Aspects

The Ethics Committee of the Division of Biological and Health Sciences of the Iztapalapa Unit of the Autonomous Metropolitan University approved the study, which conforms to the revised version of the Declaration of Helsinki (World Medical Association 2013) for medical research with human beings. The subjects gave their written informed consent to participate.

Instrumentation and Recordings

Blood pressure measurement was performed using an oscillometric device that recorded the pressure of the right brachial artery (OMRON Hem 907XL, Kioto, Japón).

Interventions

Acupuncture was applied to the PC6 or Neiguan point according to its Chinese name (Figure 1), and it was stimulated manually unilaterally in the right arm and contralaterally to the side of the recording of the PVD 5 minutes (minutes 1 to 5). The needle was inserted at an average depth of 1.2 cm. A stainless steel needle 0.30 X 40 mm (Hwato, Suzhou, Jiangsu, China) was used.

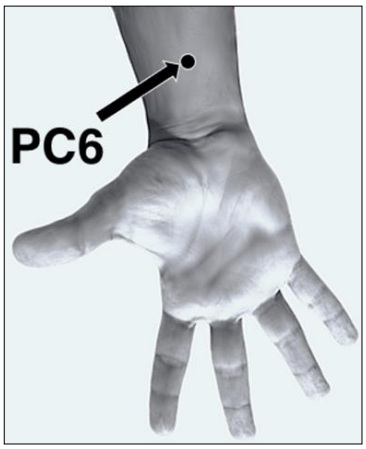

Fig 1: Pericardium 6 (Neiguan) acupoint

Study Protocol

The recordings were made in a clinical setting with a temperature of 23 °C ± 2 °C. All subjects were allowed to rest and acclimatize for at least 20 minutes before the start of the recordings. The subjects were instructed to abstain from alcohol for ≥ 24 h before the experiment, coffee, tea, and exercise on the day of experiments, and have a light meal two h before each experiment. After registration of its clinical information, the subjects remained resting supine for a period ≥ 15 min before starting the records. The measurements were taken between 9:00 a.m. to 12:00 p.m. to standardize the conditions regarding the circadian variations in blood pressure and heart rate. After the rest period, the variables were recorded in the baseline state, then acupuncture was applied for 5 min, and after 15 minutes, the variables were recorded again.

Outcomes

Records of systolic pressure (SP), diastolic pressure (DP), and heart rate (HR) were obtained. Pulse pressure (PP) was calculated as the difference between systolic pressure with diastolic pressure. The correlation of age with the magnitude of the changes elicited by acupuncture in the variables studied was analyzed.

Statistical Analysis

Baseline values were compared with those corresponding to post acupuncture period using the two-tailed t-student test. Data are reported as means ± standard deviation (SD) and analyzed using the statistical package for social sciences (SPSS, version 22.0) (Chicago, USA). Data are presented as means ± standard deviation. The chosen level of statistical significance was $p < 0.05$.

Results

The demographic data of the studied groups are shown in Table 1.

Table 1: Subject characteristics

Clinical parameters	Healthy subjects (n = 14)	Smokers (n = 19)	Type 2 diabetes subjects (n = 15)
Age (years)	44.8 ± 6.4	46 ± 6.6	47 ± 7.9
Females	6	---	7
Systolic BP (mmHg)	129.4 ± 13.9	128.4 ± 11.6	135.5 ± 14.6
Diastolic BP (mmHg)	86.3 ± 14.7	83 ± 5.6	85.5 ± 7.2
Heart rate (beats/min)	74.6 ± 11.3	73.7 ±14.9	77.6 ± 7.8

Mean ± SD

The result of the application of PC6 on cardiovascular variables in the studied groups is shown in Table 2.

Results of the PC6 application on cardiovascular variables in the studied groups are shown in Table 2.

Table 2

Parameters	Basal	Posacupuncture	P value
Healthy subjects			
Systolic BP (mmHg)	129.4 ± 13.9	121.9 ± 16.2	0.0206*
Diastolic BP (mmHg)	86.3 ± 14.7	81.6 ± 13.8	0.0711
Heart rate (beats/min)	74.6 ± 11.3	69.4 ± 6.3	0.0371*
Smokers			
Systolic BP (mmHg)	128.4 ± 11.6	118.6 ± 9.7	0.0017*
Diastolic BP (mmHg)	83 ± 5.6	80.3 ± 5.8	0.0018*
Heart rate (beats/min)	73.7 ± 14.9	68.8 ± 8.6	0.0036*
Diabetic patients			
Systolic BP (mmHg)	135.5 ± 14.6	125.7±18.6	0.0020*
Diastolic BP (mmHg)	83.5 ± 7.2	78.3 ± 11.5	0.0331*
Heart rate (beats/min)	77.6 ± 7.8	71.8 ± 9.1	0.0185*

Mean ± SD
*p< 0.05

Table 2 shows that acupuncture in PC6 decreased significantly SP and HR (p = 0.020, p= 0.0371, respectively), and DP decreased non-significantly (p = 0.0711) in healthy people. Besides, acupuncture decreased SP, DP and HR all significantly (p = 0.0017, p = 0.0018, and p = 0.0036, respectively). Also, decreased SP, DP and HR all significantly (p = 0.0020, p = 0.0331, and p = 0.0185, respectively) in diabetic patients.

Pulse Pressure

Acupuncture at PC6 significantly decreased pulse pressure (-7.1 ± 9.9, mean ± 10.7; p= 0.0062) in smokers; and not significantly in healthy subjects (-2.7857 ± 10.7, mean ± 10.7; p= 0.3471) and in diabetic patients (-4.6 ± 9.7, mean ± 10.7; p= 0.0889).

Relationship of PC6 acupuncture effect and age

The relationship between the delta of systolic pressure, heart rate, and pulse pressure is depicted in Figures 2, 3, and 4, respectively.

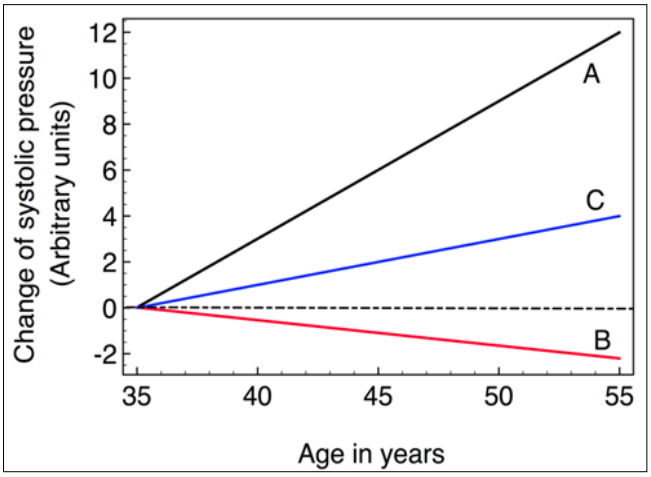

Fig 2: Relationship between the delta of systolic pressure elicited through manual acupuncture in PC6 acupoint and age in A. healthy subjects, B. smokers, and C. diabetic patients.

Figure 2 shows that the effect of acupuncture on systolic pressure increases with age in healthy subjects and diabetic patients; otherwise, it decreases with age in smokers.

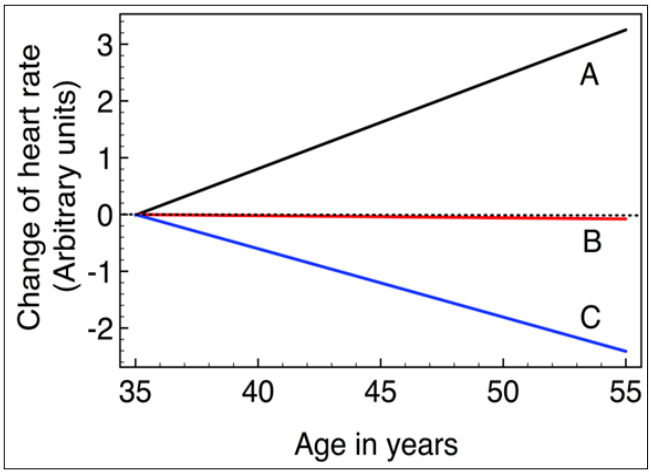

Fig 3: Relationship between the delta of heart rate elicited through manual acupuncture in PC6 acupoint and age in A. healthy subjects, B. smokers, and C. diabetic patients.

The effect of acupuncture on heart rate increases with age in healthy subjects. Otherwise, it decreases with age in diabetic patients, with no relationship in smokers.

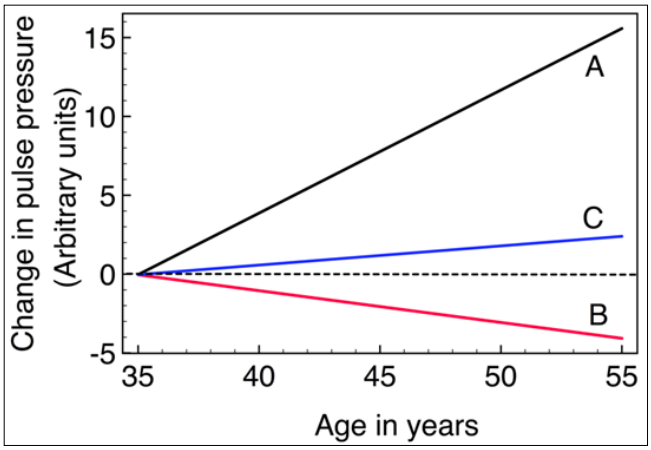

Fig 4: Relationship between the delta of pulse pressure elicited through manual acupuncture in PC6 acupoint and age in A. healthy subjects, B. smokers, and C. diabetic patients.

The effect of acupuncture on pulse pressure increases with age in healthy subjects and diabetic patients. Otherwise, it decreases with age in smokers.

Discussion

The most important findings of this study are:

- Manual acupuncture in PC6 decreased SP and HR significantly and decreased DP non-significantly in healthy people.
- Manual acupuncture in PC6 decreased SP, DP, and HR all significantly in smokers.
- Manual acupuncture in PC6 decreased significantly SP, DP, and HR in diabetic patients.
- The effect of acupuncture on systolic pressure increases with age in healthy subjects and diabetic patients. Otherwise, it decreases with age in smokers.
- The effect of acupuncture on heart rate increases with age in healthy subjects. Otherwise, it decreases with age in

diabetic patients and has no relationship in smokers.
- The effect of acupuncture on pulse pressure increases notably with age in healthy subjects and to a lesser degree in diabetic patients. Otherwise, it decreases with age in smokers.

PC6 and Hypertension

Previous preliminary studies suggested that the stimulation of acupoints can elicit different effects on arterial blood pressure [10]. Besides, manual acupuncture of PC6 evoked a complex cardiovascular response, probably related to a vagal response and a negative inotropic effect [11]. Our results are consistent with previous findings that showed acupuncture in PC6 modifies SDDVP indices related to the stiffness of the great arteries in normal and hypertensive subjects [12].

Acupuncture in Smokers

Our experiments showed that the response to acupuncture in smokers decreased with age compared to healthy subjects, especially in systolic pressure and pulse pressure. This finding is consistent with the cardiovascular alterations produced by tobacco smoking and that increase with age [13]. Besides, smoking that arterial stiffness and wave reflection might significantly affect central blood pressure, which is more closely related to target organ damage [14].

Acupuncture in Diabetic Patients

In diabetic patients, the effect of acupuncture on the systolic pressure, heart rate, and remarkably pulse pressure decreased with age. This finding coincides with the possible presence of diabetic neuropathic heart disease [15,16]. Besides, patients with diabetes mellitus experience increased peripheral artery resistance caused by vascular remodeling and increased body fluid volume; both mechanisms elevate systemic blood pressure [17].

Conclusion

Our findings point towards a differentiated age-related response to acupuncture in PC6 between healthy subjects, smokers, and diabetic patients. This age-related response may represent that smokers and diabetic patients present a refractory state to acupuncture stimulation, probably due to chronic vascular pathophysiology.

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