The Effect of Acupuncture at Nèiguān Point on the Circulatory System
: Evaluation by Pulse Doppler Echocardiography

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Summary : Acupuncture at Nèiguān point (P6) was applied for the various circulatory diseases such as hypertension, and congestive heart failure. We examined the effect of acupuncture at Nèiguān point by the pulse Doppler method in healthy adult males. The acceleration time (ACT), ejection time (ET), and acceleration rate (ACR) of the blood flow pattern at the left ventricular outflow tract, blood pressure and heart rate were measured, and the ACT／ET ratio was calculated.

A significant decrease in the ACT／ET ratio and an increase in ACR were observed in compared with control values, whereas blood pressure and heart rate were not significantly changed. These results suggest that acupuncture at Nèiguān point increases contractility of the left ventricular while reducing peripheral vascular resistance. Acupuncture at the point may have therapeutic effects for hypertensive cardiac disease.

Key Words : Acupuncture, Nèiguān (P6), Pulse Doppler echocardiography, Hemodynamics.

There are some indications that acupuncture is effective in various circulatory diseases[1,2,3,4,5,6]. Several workers have suggested that acupuncture at Nèiguān point (P6) is effective for such disease as hypertension[7] and congestive heart failure[8], and so on[9,10,11]. As far as we know, there has been no report that evaluates hemodynamic effect of Nèiguān point by Doppler echocardiography. In this study, we investigated the effect of acupuncture at Nèiguān point on hemodynamics by pulse Doppler echocardiography in healthy adult males.

Material and Method

The study was performed in six healthy adult males ranging in range from 22 to 29 years old (mean, 23.7 years). The Nèiguān point is located for each subject 2 sun (a sun = 3.03cm: measure of Japanese) above the transverse line of wrist, between the tendons of m. flexor carpi radialis and m. palmalis longus. A stainless acupuncture

needle (made in Japan), of 40 mm length, of 0.20 mm thickness, was used.

A pulse Doppler echocardiography with an electronic sector scanner and 2.5 MHz transducer (model SSHα-160 A, Toshiba Corporation) was used. Figure 1 shows the measurement point at the left ventricular outflow tract, on which a systolic flow velocity signal was obtained. The systolic flow velocity signal is shown in Figure 2. The ejection time (ET) was measured as the time from the onset to the end of the systolic flow velocity signal. The acceleration time (ACT) was measured from the onset of ejection to the point of peak flow velocity, and the acceleration rate (ACR) was obtained at the early phase of acceleration time. The ACT/ET ratio was calculated as a index of left ventricular function.

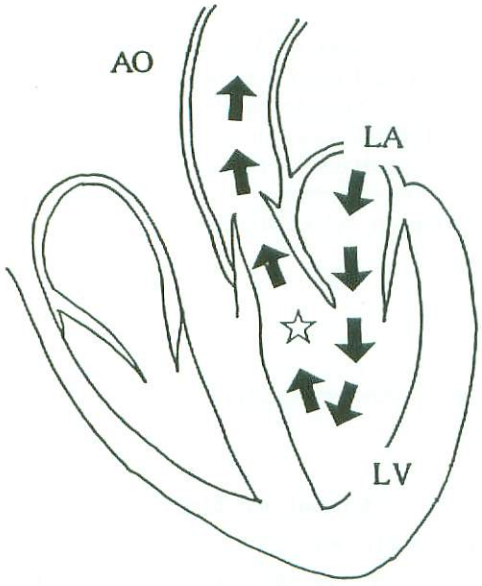


Fig.1. A schema of longitudinal section of heart and aorta.

Asterisk(☆) shows a measurement point at the left ventricular outflow tract. Arrows indicate intra ventricular blood floow.
LA: left atrium, LV: left ventricle,
AO: aorta

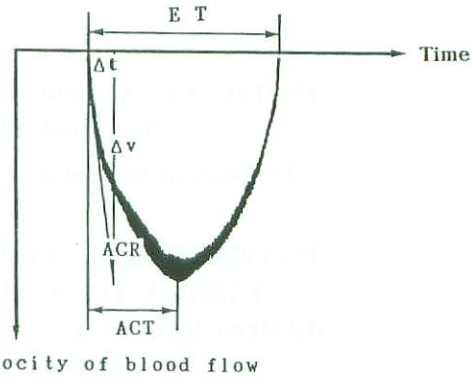


Fig. 2. Blood flow pattern at the left ventricular outflow tract.

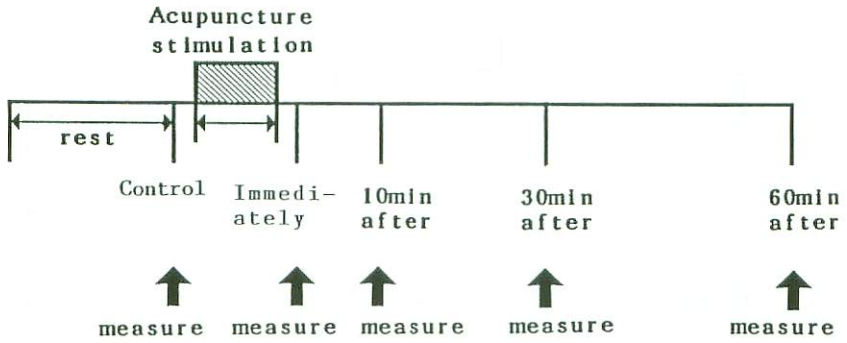
E T: Ejection time,
ACT: Acceleration time,
ACR: Acceleration rate=△v/△t

After bed rest in the left lateral position for 30 minutes, blood pressure, heart rate and echocardiogram were examined. Then acupuncture on Nèiguān point of both sides was continued for 10 minutes after confirmation of the needling sensation appeared on the meridian. The above parameters were determined immediately, 10, 30 and 60 minutes after the acupuncture (Fig. 3).

All data were expressed as mean ± standard deviation. The statistical significance examined by paired t test of a value at each time point in comparison with the control. P-value of less than 0.05 was considered to be significant.

Results

Blood pressure and heart rate: The mean systolic and diastolic blood pressure and



Acupuncture point : Bilateral Nèiguān point (P6)

Needle : Stainless (made in Japan) of 40mm length, of 0.20mm thickness.

Stimulate method : Leaving needle for 10 minutes, after the subjects feel the needling sensation.

Fig.3. Examination process.

Table. Changes of indices before and after acupuncture

		Control	Immediately	10min after	30min after	60min after
ACT／ET	Mean	0.340	0.320**	0.298**	0.300	0.282***
	S. D.	±0.025	±0.044	±0.037	±0.044	±0.036
ACR (cm／sec²)	Mean	1037.270	1417.590*	1357.410***	1336.110**	1234.440
	S. D.	±228.076	±477.048	±268.619	±291.204	±394.238
Systolic blood pressure (mmHg)	Mean	116.0	113.7	112.3	114.3	114.0
	S. D.	±2.8	±5.0	±5.0	±5.6	±8.0
Diastolic blood pressure (mmHg)	Mean	62.7	61.7	61.7	62.3	66.8
	S. D.	±11.1	±12.7	±11.5	±7.5	±1,8
Heart Rate (beat／min)	Mean	61.8	58.7	59.3	59.7	63.4
	S. D.	±7.2	±2.0	±2.4	±3.1	±3.0

Significance compared to value before acupuncture. (*$p<0.05$, **$p<0.02$, ***$p<0.01$)

heart rate before and after acupuncture are shown in the Table and shown in Figure 4. The mean blood pressure showed a tendency to decrease from the control of 116.0／62.7 to 113.7／61.7 immediately after, to 112.3／61.7 10 minutes after, to 114.3／62.3 30 minutes after, and to 114.0／66.8 60 minutes after acupuncture, but there were no significant differences between the values before and after acupuncture.

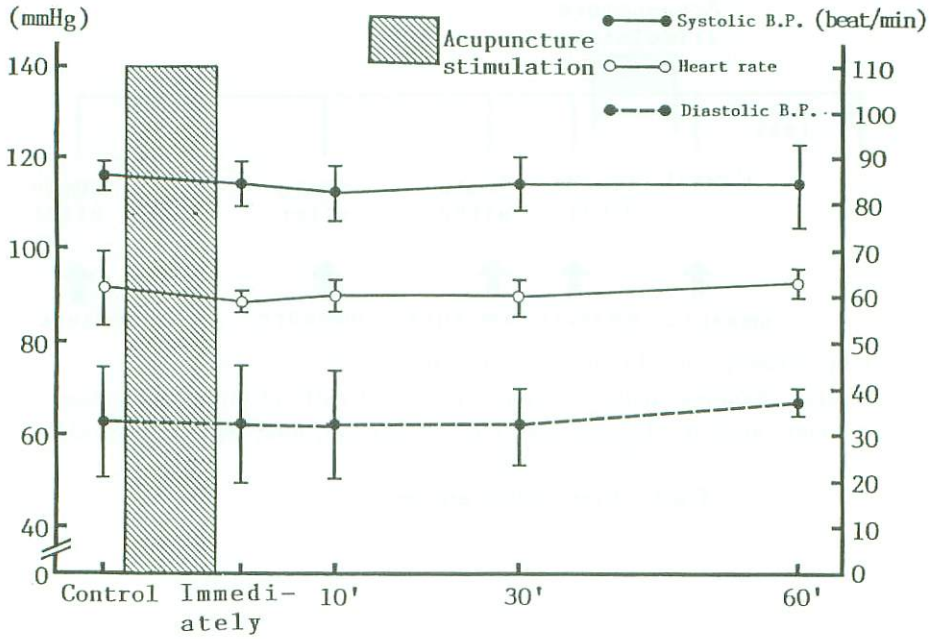


Fig.4. Blood pressure and heart rate.

The mean systolic and diastolic blood pressure showed a tendency to decrease, but statistically not significant.

Echocardiographic data: Doppler echocardiographic data are also shown in the Table. Figure 5 shows that the mean ACT / ET ratio decreased significantly from the control of 0.340 to 0.302 immediately after ($p<0.02$), to 0.298 10 minutes after ($p<0.02$) and to 0.282 60 minutes after acupuncture ($p<0.01$). The mean ACR measurements before and after acupuncture stimulation are shown in Figure 6, whereas the mean ACR values increased significantly from the control of 1037.27 cm / sec^2 to 1417.59 cm / sec^2 immediately after ($p<0.05$), to 1357.41 cm / sec^2 10 minutes after ($p<0.01$), and to 1336.11 cm / sec^2 30 minutes after acupuncture ($p<0.02$).

Discussion

The ACT / ET ratio and ACR measured at left ventricular outflow tract are useful indices of left ventricular function[12].

In this study, a significant decrease in the ACT / ET ratio and an increase in ACR were observed after acupuncture. These results suggest that left ventricular function was potentiated by acupuncture at Nèiguān point. On the other hand, blood pressure and heart rate were not significantly changed in healthy subjects. It is speculated that the increased contractility of left ventricle seems to be counterbalanced by the simultaneous reduction of peripheral vascular resistance, based on the fact that Nèiguān point

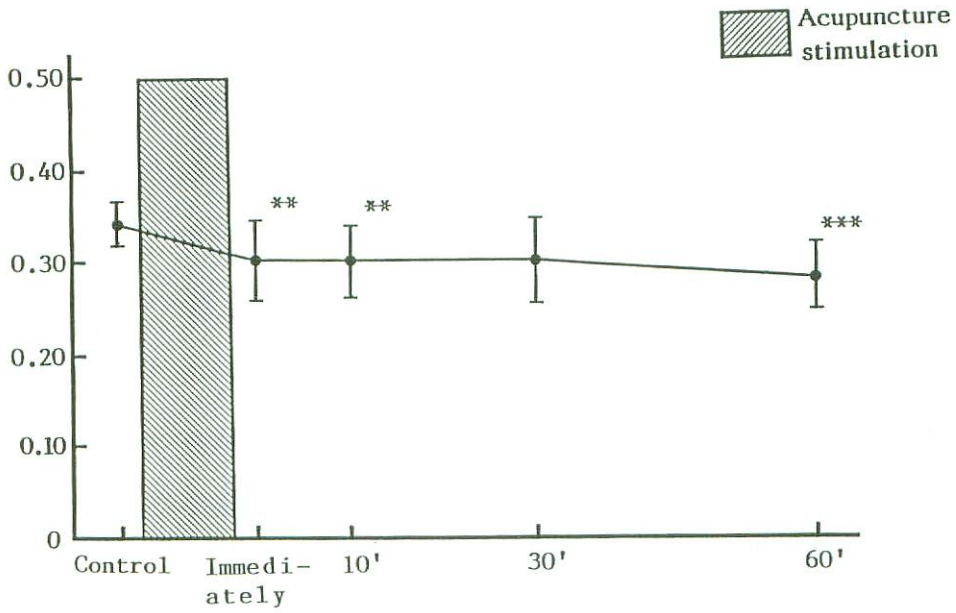


Fig.5. ACT/ET ratio.
The mean ACT/ET ratio decreased significantly after acupuncture.
(**$p<0.02$, ***$p<0.01$)

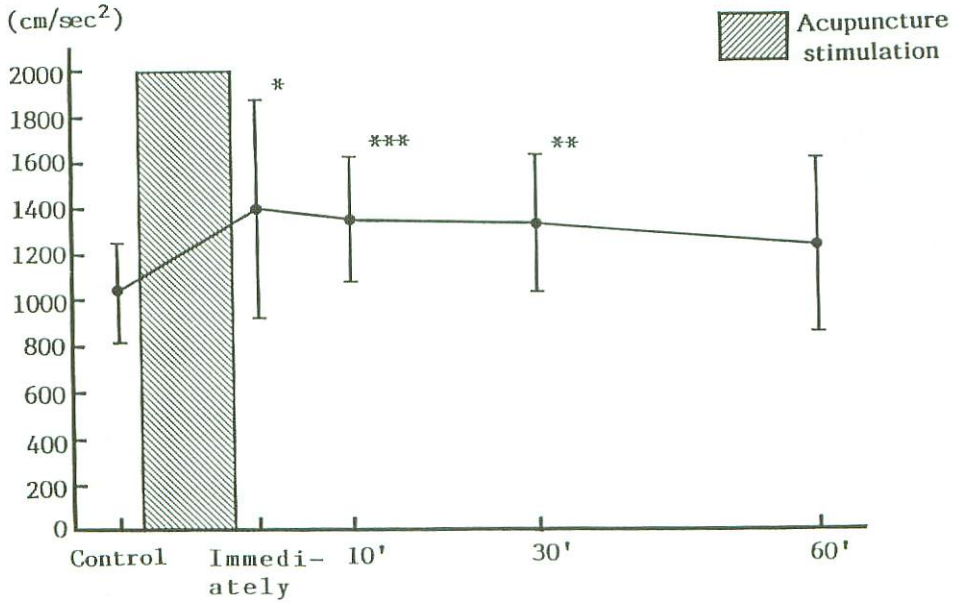


Fig.6. Acceleration rate. (ACR)
The mean ACR increased significantly after acupuncture.
(*$p<0.05$, **$p<0.02$, ***$p<0.01$)

has traditionally been used for the treatment of high blood pressure.

Similar studies has been done by two groups. Tayama et al. reported that Nèiguān (P6)-Ximén(P4) electro-acupuncture effectively increased stroke volume and cardiac output. The effect was observed immediately after the acupuncture and lasted for 10 minutes[7]. On the other hand, Huang et al. reported the acupuncture on Nèiguān effectively enlarged left ventricular endsystolic diameter and increased stroke volume. The effect was maximum 60 min after the acupuncture, in accordance with our results. We and Huang et al. used acupuncture at Nèiguān point as stimulation, while Tayama et al. used electro-acupuncture between Nèiguān and Ximén points. It is likely that a time lag occurs in the appearance of the stimulatory effect by different methods.

Both Tayama et al. and Huang et al. found no significant changes of blood pressure and heart rate, in accordance with our results. Tayama et al. observed that total peripheral vascular resistance decreased slightly. This result is similar to our result that blood pressure tended to decrease.

On the other hand, Akimoto et al. reported that acupuncture at the carotid sinus in healthy adults significantly decreases blood pressure without significantly changing heart rate, because acupuncture at this site may not induce the vagal cardiac inhibition but changes peripheral vascular resistance[13]. However, they did not examined the contractility of the left ventricle. There may be several mechanisms for the changes of contractility of the left ventricle, blood pressure, and heart rate by acupuncture. They may be caused by the autonomic nervous system[13,14], endogenous factors, such as renin, prostaglandins[15,16,17] and diuretic mechanisms[15,18]. It seems that acupuncture at Nèiguān point differs from that at the carotid sinus in the mechanism related to contractility of the left ventricle, blood pressure and heart rate.

It is speculated that Nèiguān point acupuncture evokes left ventricular function associated with a reduction of peripheral vascular resistance and may serve in the treatment for hypertensive heart disease.

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内関穴刺激時の循環系に及ぼす影響
：パルスドップラー法による評価

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要旨：内関穴刺鍼が循環系に如何なる影響を及ぼすかをパルスドップラー法，血圧，脈拍により観察し，検討した．対象は健常成人男性6名，パルスドップラー法による血流速度測定は左室流出路にて行い，左室駆出時間（ＥＴ），加速時間（ＡＣＴ），駆出加速（ＡＣＲ）を測定した　その結果，10分間の両側内関穴刺鍼により，ＡＣＴ／ＥＴの有意な減少と，ＡＣＲの有意な上昇が得られ，左室収縮能の亢進が観察された．一方，血圧・脈拍には有意な変化が見られず左室収縮能の亢進が末梢血管抵抗の減衰を相殺した形になったと推察された．

内関穴刺鍼による左室収縮能の亢進が認められ，又，末梢血管抵抗の減衰が推察され，同刺鍼が高血圧症・高血圧性心疾患等の循環器疾患に効果をもたらす可能性が示唆された．