Serial Measurement of Brachial-ankle Pulse Wave Velocity after Intramuscularly Administration of Scopolamine Butylbromide

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ABSTRACT

Background Pulse wave velocity (PWV) is a useful and noninvasive tool for evaluation of arterial stiffness. In PL Tokyo Health Care Center, we attempt to perform physical and brain check-up combined with PWV.

Purpose Multiphasic health test, including physical and brain check-up, is usually finished within three hours. PWV must be measured in the same day before or after gastrography with scopolamine butylbromide. We need to confirm whether this anticholinergic drug has effects on PWV. The purpose of this study is to evaluate serial changes of PWV after treatment with scopolamine butylbromide.

Method We analyzed serial PWVs in nine volunteers (men). The range of age was 28 to 59 years and the mean age (mean±SD) was 51.1±9.4 years. The first brachial-ankle PWV (baPWV) was measured at noon before injection of scopolamine butylbromide. Scopolamine butylbromide (20 mg) was administered intramuscularly at 1 PM. baPWV was performed at 30, 60, 120 and 180 minutes after administration of scopolamine butylbromide. baPWV was applied by form PWV/ABI sphygmograph, Colin AT company, Japan.

Results Heart rate was increased approximately 8.8% at 30 minutes after injection of scopolamine butylbromide. Afterwards, heart rate returned to the baseline levels. baPWV was increased slightly at 30 minutes after injection, but baPWV did not significantly change after 60 minutes of injection.

Conclusion Intramuscular administration of scopolamine butylbromide transiently increased heart rate but did not significantly act on baPWV. Our results indicate that heart rate is most sensitive marker on sphygmmography after injection of scopolamine butylbromide. baPWV can be measured at least 60–90 minutes after injection of scopolamine butylbromide. We should carefully interpret heart rate for evaluation of baPWV after gastrography with scopolamine butylbromide.

Key Words Pulse Wave Velocity; Heart Rate; Scopolamine Butylbromide

INTRODUCTION

Arterial stiffness is a crucial determinant of cardiovascular risk factor. Pulse wave velocity (PWV) is an accurate marker of arterial stiffness and strongly associated with atherosclerosis.1,11 Recently, ankle brachial index (ABI) is used as a noninvasive method for the diagnosis of peripheral arterial disease.11,12 Multiphasic health test, including physical and brain check-up, is performed in our center. We are currently planning brain or physical check-up combined with PWV. In our multiphasic health system, total time containing physical check-up and that consultation is only a few hours. The possibility is raised that PWV is occasionally measured in the same day after gastrography with scopolamine butylbromide. However, it remains unknown whether scopolamine butylbromide acts on PWV. We need to confirm whether this anticholinergic drug has effects on PWV and ABI. Here we studied serial changes of PWV after treatment with scopolamine butylbromide.

SUBJECTS AND METHODS

Serial measurement of sphygmmography was performed in nine volunteers (men). The range of age 28 to 59 years and the mean age (mean±SD) was 51.1±9.4 years. Two subjects had obesity (body mass index >25.0 kg/m2) and past smoking, respectively. One subject had diabetes mellitus (fasting blood sugar >126 mg/dl) and three subjects had hypercholesterolemia total cholesterol >220 mg/dl). Hypertension and arrhythmia were not seen in all subjects. The first brachial-ankle PWV (baPWV) was performed at noon before injection of scopolamine butylbromide. Scopolamine butylbromide (20 mg/body) was administered intramuscularly at 1 PM. baPWV was measured at 30, 60, 120 and 180 minutes after injection of scopolamine butylbromide. PWV was applied by form PWV/ABI sphygmmograph, Colin AT company, Japan. Heart rate, mean arterial pressure (MAP) in the arm and the ankle, and ABI were analyzed simultaneously. MAP was calculated as diastolic blood pressure+1/3×(systolic blood pressure−diastolic blood pressure). baPWV was measured at supine position when all subjects relaxed sufficiently after a few minutes of rests.

RESULTS

At 30 minutes after administration of scopolamine butylbromide, heart rate was increased in all subjects and the mean rate of increment was approximately 8.8%. Sixty minutes later, heart rate returned to the baseline levels (Fig. 1). Brachial MAP (mean±SD mm Hg) at the baseline levels was 92.3±7.5 in the right side and 94.4±9.5 in the left side. Brachial MAP was not significantly altered after administration of scopolamine butylbromide (Fig. 2). Ankle MAP (mean±SD mm Hg) at the baseline levels was 96.2±7.8 and 93.0±7.3 in the right and the left side, respectively. Ankle MAP did not also differ between before and after administration of scopolamine butylbromide (Fig. 3). The first baPWV (mean±SD cm/sec) at the baseline levels was 1,402.8±125.0 in...
Ikeda et al.: PWV After Scopolamine Butylbromide

Fig. 1 Heart rate. Heart rate increases at 30 minutes after injection. Sixty minutes later, heart rate returns to the baseline levels.

Fig. 2 Brachial MAP. Brachial MAP does not differ between before and after intramuscular injection of scopolamine butylbromide.

Fig. 3 Ankle MAP. Ankle MAP does not change after intramuscular injection of scopolamine butylbromide.

Fig. 4 baPWV. After intramuscular injection of scopolamine butylbromide, baPWV does not change significantly.

Fig. 5 ABI. ABI does not alter after intramuscular injection of scopolamine butylbromide.

DISCUSSION

The present study suggested that intramuscular administration of scopolamine butylbromide had no significant short-term effects on baPWV, MAP and ABI. Heart rate had a tendency of the transient increase at 30 minutes after injection of scopolamine butylbromide.

PWV assesses arterial stiffness quantitatively. PWV is well correlated with cardiovascular risk factors, such as age, blood pressure and heart rate.[3] This test has benefits for a prospective indicator of cardiovascular mortality in elder subjects.[4] The Rotterdam study of PWV indicates that carotid-femoral PWV is associated with the common carotid intima-media thickness and the severity of plaques in the carotid artery and aorta in older subjects.[1]

Recently, baPWV is measured easily with form PWV/ABI sphygmograph, Colin AT Company. The benefit and reproducibility of baPWV are studied on this sphygmograph among patients with coronary artery disease, and healthy subjects with and without cardiovascular risk factors.[5] ABI is used as a noninvasive screening test of peripheral arterial disease and for the diagnosis of arteriosclerosis obliterans.[2] ABI is measured simultaneously using form PWV/ABI sphygmograph. Effects of treadmill walking stress test (slope 12%, 2.4 km/hour, 3 minutes) on ABI using form PWV/ABI sphygmography are studied in 48 patients with arteriosclerosis obliterans and 80 healthy controls. ABI is reduced significantly in the patients whereas that does not differ before and
after treadmill test in healthy subjects. The recovery time of ankle blood pressure is also much longer in the patient group in comparison with the control group (personal communication by Masaki). PWV and ABI may be useful for therapeutic evaluation of coronary heart diseases or stroke. Arterial blood pressure, age and sex are well known to play a major role for the determination of PWV. Several environmental factors, including mental or sympathetic stress, may also contribute to PWV. Serial changes of baPWV and ABI after administration of drugs are reported. Sildenafil citrate, a nitric oxide donor, is a therapeutic drug for ejection dysfunction. This drug also acts as vasodilator on blood pressure and heart rate. After oral administration of sildenafil citrate (25 or 50 mg/body), baPWV and blood pressure using form PWV/ABI device are analyzed in eight men with ejection dysfunction. This drug trends to reduce PWV and blood pressure at 30 and 60 minutes after oral administration (personal communication by Shigemura). Recent report shows effects of a nitric oxide synthase inhibitor on PWV. When L-Nω-monomethyl arginine is intravenously given to eight healthy men, aortic PWV and MAP are increased dose-dependently.

Our results elucidate that heart rate responds on scopolamine butylbromide-stress test. Anticholinergic effects of this drug starts at approximately 5–10 minutes after intramuscular injection. The effects for gastrography withdraw less than 40 minutes although the serological half time is 2 to 6 hours in human. Those pharmacological data are in a similar way to transient increase of heart rate at 30 minutes after administration of scopolamine butylbromide in our subjects. Previous report suggests that augmentation index is inversely correlated with heart rate during right atrial pacing (80–120 beats/min) in twenty healthy subjects. Aortic PWV is not modified by acute changes of heart rate. However, another report shows that PWV depends on heart rate. Aortic PWV is measured at five different pacing frequencies (60–100 beats/min) in 22 older patients with permanent cardiac pacing. PWV is increased during pacing although blood pressure is not varied. Those results points out that heart rate is more important factor for variation of PWV in older patients, rather than blood pressure. PWV need to be carefully interpreted with changes of heart rate in older subjects. In our studies, heart rate temporally responds on scopolamine butylbromide. There are no significant changes of MAP, ABI and PWV between before and after injection of scopolamine butylbromide. Thus, we design to perform baPWV at least the interval time >60 minutes after injection of scopolamine butylbromide. PWV should be measured again in other day if heart rate is markedly increased after administration of this anticholinergic drug, especially in older subjects.

REFERENCES