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Ageing and ankle pulse pressure

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Abstract

Background: *Pulse pressure (PP) is a marker of arterial stiffness. Ageing of the arterial system is accompanied by atherosclerosis of coronary arteries and atherosclerosis of popliteal artery. However, severe impairment of the brachial artery is rare. This study investigates whether there is any significant inter-limb (brachial/ankle) PP difference.*

Methods: *Blood pressure was measured in a group of young and a group of old non-smoking men; all were free from medication and disease with a mean age of 22 ± 1.3 and 59 ± 2 years respectively. The blood pressure was taken while they were in a supine position on three separate occasions. Lower limb pressure was measured by placing the cuff on the calf muscle. For auscultation of Korotkoff sounds the stethoscope was placed on the posterior surface of the internal malleolus. The mean of the second and third readings were rounded off and used for analysis.*

Results: *Significant differences were found between brachial and ankle PP in both groups ($p < 0.01$). The ratio of brachial PP to ankle PP in the young men was greater than 1. In the old men it was less than 0.15. There was no significant difference between the brachial PP in the two groups, but on both sides the ankle PP was significantly greater in the old men ($p < 0.01$).*

Conclusions: *With the ageing of the arterial system, raised PP is more prominent in the lower limb (e.g. ankle). Cuff measurement of blood pressure at this site may be a useful index of peripheral PP changes with ageing.* (Cardiol J 2010; 17, 2: 163–165)

Key words: pulse pressure, ageing, ankle

Introduction

Pulse pressure (PP) is a marker of arterial stiffness. High PP (> 60 mm Hg) may be a sign of generalized atherosclerosis (AS) and is considered a coronary risk factor [1]. In older people AS of the coronary and popliteal artery is common and may be clinically important. However, severe AS of the brachial artery is rare [2, 3]. These non-homogenous involvements of vessels can also potentate the effects of pulse wave reflections on PP amplitude [4]. So, with ageing, the peripheral PP in muscular arteries of the upper and lower limbs may be influenced unequally. It seems that ankle PP may be more informative than brachial PP in the elderly.

Methods

Blood pressure measurements were taken in the clinical laboratory of the medical faculty between 9.00am and 11.30am. The participants were recruited from staff, students and their relatives. All participants were non-smokers with no drug history or atherosclerosis risk factors (such as tobacco use, family history of coronary artery disease, high body mass index, hypertension, hyperlipidemia). In all cases, blood pressure was determined by two trained medical students over three separate days. The first values were ignored and the mean of the second and the third readings was used. After five minutes of complete rest in the supine position,

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Table 1. The mean ± SEM of systolic and diastolic pressures of the 18–25 years old group (n = 20).

	Brachial		Ankle	
	Right	Left	Right	Left
Systolic pressure	118.10 ± 2.16	117.75 ± 2.34	124.05 ± 2.83	124.60 ± 2.83
Diastolic pressure	73.60 ± 1.49	73.25 ± 1.61	86.15 ± 1.35	87.35 ± 1.86

Table 2. The mean ± SEM of systolic and diastolic pressures of the 50–70 years old group (n = 20).

	Brachial		Ankle	
	Right	Left	Right	Left
Systolic pressure	132.95 ± 3.99	128.85 ± 3.98	144.95 ± 3.71	144.5 ± 4.21
Diastolic pressure	85.85 ± 2.46	81.95 ± 3.12	88.90 ± 2.30	88.60 ± 2.49

Table 3. The mean ± SEM of pulse pressures of the 18–25 and the 50–70 years old groups (n = 20).

	18–25	50–70
Right brachial pulse pressure	44.50 ± 2.03	47.10 ± 2.74
Left brachial pulse pressure	44.50 ± 1.71	46.90 ± 2.65
Right ankle pulse pressure	37.90 ± 2.24	56.05 ± 3.18
Left ankle pulse pressure	37.25 ± 2.30	55.90 ± 4.48

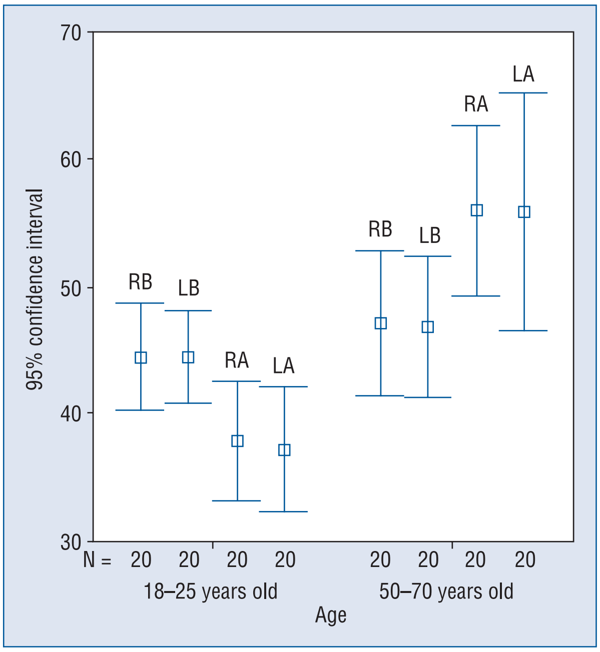

Figure 1. The mean ± SEM of pulse pressures in two groups; RB — right brachial; LB — left brachial; RA — right ankle; LA — left ankle.

blood pressure was measured by the auscultatory method using a mercury-column sphygmomanometer (ERKA, Germany) with appropriate cuff size. To measure the ankle PP, a stethoscope was placed on the posterior surface of the internal malleolus and the cuff was fastened on the lower half of the calf muscles [5]. Any examples of unclear tibialis artery pulse and/or Korotkoff sound were excluded.

Independent student t-test was used for comparison between the two groups. A paired t-test was used for inter-limb assessment in each group.

Results

The range and the mean age of men in the two groups were 18–25 and 22 ± 1.3 years (n = 20) for the young group and 50–70 and 59 ± 2 years (n = = 20) for the old group respectively. The mean of systolic and diastolic pressures is shown in Tables 1 and 2. The mean of ankle and brachial PP in right and left sides is summarized in Table 3.

In each group, there was no significant difference in systolic, diastolic and PP between left and right sides. There was a significant difference between brachial and ankle PP in both groups and also between ankle PP in both groups in right and left sides ($p < 0.05$; Fig. 1).

Discussion

In both groups, as expected, systolic pressures were higher in lower limbs. In the young group, ankle PP was lower than brachial PP on the right and left sides. In the old group, brachial PP was lower than ankle PP on both sides. Very few reports have ever specifically focused on ankle PP. This may be due to a greater emphasis on indices such as ankle brachial index or pulse wave velocity index and so on [6–10]. In the study of Kubo and Andoh, the brachial PP and the systolic pressure of ankles were 67 ± 12, 149 and 148 mm Hg respectively, which are close to our findings [11, 12]. This comparison of course is very rough, because the cases are not the same regarding age, sex, smoking, medication and general health. Our data shows the differences between brachial and ankle PP in each group ($p < 0.01$), the ratio of brachial PP to ankle PP in the two groups (> 1 in the young group and less than 0.15 in the old group) and the much greater differences between the young group's ankle PP and the old group's ankle PP than between their brachial PPs.

In other words, there was no significant difference between brachial PP in the two groups, but on both sides the ankle PP was significantly greater in the old group ($p < 0.01$).

Controversies regarding the normal inter-arm pressure differences, little information about the abnormal ranges of right and left pressure difference in lower limbs, a limited sample and the lack of objective clinical and laboratory examination of cases must be taken into consideration with this study. The latter defect is especially important in the 50–70 years group. Although none of them gave a history of disease or medication, it is possible that there was some abnormality in lipid profiles, blood sugar and/or any other disease which could influence the results. All these conditions exacerbate atherosclerosis. So objective verification of them is not expected to produce any additional important bias. The higher value of ankle PP in the 50–70 year old group and almost the same brachial PP in young and old groups are the main finding of this study, which suggests that ankle PP is a more informative index of arterial stiffness with ageing.

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References

1. Vogal RA, Benitez RM Non-invasive assessment of cardiovascular risk: From Framingham to the future. Rev Cardiovasc Med, 2000; 1: 34–42.
2. Schoen FJ. Blood vessels. In: Kumar V, Abbas AK, Fausto N eds. Robbins and cotran pathologic basis of disease. 7th Ed. Elsevier Saunders, Philadelphia 2005: 515–519.
3. Creager MA, Dzau VJ. Vascular disease of the extremities. In: Fauci AS, Braunwald E, Isselbacher KJ, Wilson JD, Martin JB, Kasper DL, Hauser SL, Longo DL eds. Harrison's principles of internal medicine. 14th ed. McGraw-Hill, New York 1998: 1398.
4. Nichols WM. Clinical measurement of arterial stiffness obtained from noninvasive pressure waveforms. Am J Hypertns, 2005): 18: 3–10.
5. Perloff JK, Braunwald E. Physical examination of the heart and circulation. In: Braunwald E ed. Heart disease a textbook of cardiovascular medicine. 5th Ed. W.B. Saunders, Philadelphia 1997: 20.
6. Stein R, Hriljac I, Halperin JL, Gustavson SM, Teodorescu V, Olin JW. Limitation of the resting ankle-brachial index in symptomatic patients with peripheral arterial disease. Vasc Med, 2006; 11: 29–33.
7. McDermott MM, Greenland P, Liu K et al. The ankle brachial index is associated with leg function and physical activity: The Walking and Leg Circulation Study. Ann Intern Med, 2002; 136: 873–883.
8. Sloan H, Wills EM. Ankle-brachial index. Calculating your patient's vascular risks. Nursing, 1999; 29: 58–59.
9. McKenna M, Wolfson S, Kuller L. The ratio of ankle and arm arterial pressure as an independent predictor of mortality. Atherosclerosis, 1991; 87: 119–128.
10. Doubein CA, Yood RA, Emani S, Gurwitz JH. Identifying unrecognized peripheral arterial disease among asymptomatic patients in the primary care setting. Angiology, 2006; 57: 171–180.
11. Kubo T, Miyata M, Minagoe S, Setoyama S, Maruyama I, Tei C. A simple oscillometric technique for determining new indices of arterial distensibility. Hypertens Res, 2002; 25: 351–358.
12. Andoh N, Minami J, Ishimitsu T, Ohrui M, Matsuka H. Relationship between markers of inflammation and brachial-ankle pulse wave velocity in Japanese men. Int Heart J, 2006; 74: 409–420.