

Association Between Systolic Interarm Differences in Blood Pressure with Atherosclerotic Disease

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Background/Aims: Systolic interarm blood pressure difference (IAD) is known to be associated with adverse cardiovascular outcomes. The aim of this study was to assess the association between systolic IAD and atherosclerosis in young people using arterial stiffness and coronary artery calcium score (CACS), which are non-invasive surrogate markers of atherosclerosis.

Methods: We conducted a cohort study of 117,407 individuals who participated in the Kangbuk Samsung Health Study including measurement of bilateral arm blood pressure between January 1, 2010 and December 31, 2018 (1067 men; mean age, 43.6 ± 5.1 years). Systolic IAD was defined as the absolute difference in systolic blood pressure (BP) in bilateral arms. CACS was assessed using a multi-detector computed tomography and arterial stiffness was assessed using brachial-ankle pulse wave velocity (baPWV).

Results: The mean systolic IAD in the total subjects was 3.09 ± 2.83 mmHg, and men had higher systolic IAD than women (3.17 ± 2.93 mmHg vs. 2.91 ± 2.62 mmHg, p < 0.001). As systolic IAD increased, the morbidity of cardiovascular risk factors such as hypertension or diabetes also increased, but there was no statistical relationship with age. In the multivariable-adjusted analysis of 92,949 subjects excluding those with a history of hypertension, diabetes and cardiovascular disease, increasing systolic IAD did not statistically increase the risk of developing CAC > 0. On the other hand, when systolic IAD was categorized into 5 groups, IAD was associated with baPWV > 1400 cm/s (OR [95% CI], 1.23 [1.13-1.35] in total, 1.19 [1.08-1.31] in men, 1.39 [1.11-1.73] in women).

Conclusions: Systolic IAD was significantly associated with the arterial stiffness, but not with presence of CAC in a large sample of middle-aged population. Systolic IAD may be a valuable tool for early detection of increased burden of atherosclerosis in asymptomatic, low-risk individuals.

Table 1. Baseline characteristics according to BP difference

BP difference (mmHg)	0-2	3, 4	5, 6	7, 8	9 -	p for trend
Number	60433 (51.5)	30314 (25.8)	14999 (12.8)	6446 (5.5)	5215 (4.4)	
Age (years)	45.1 (10.2)	45.1 (10.2)	45.1 (10.2)	44.9 (10.2)	45.2 (10.1)	0.885
Male, n (%)	65.8	67.3	68.4	70.4	74.8	<0.001
Waist circumference (cm)	82.7 (9.2)	83.3 (9.3)	83.9 (9.3)	84.9 (9.5)	87.6 (10.2)	<0.001
BMI (kg/m ²)	23.7 (3.2)	23.9 (3.2)	24.2 (3.3)	24.5 (3.4)	25.7 (3.9)	<0.001
Systolic BP (mmHg)	111.2 (13.0)	112.0 (13.1)	113.1 (13.4)	114.1 (13.5)	117.4 (13.9)	<0.001
Diastolic BP (mmHg)	72.1 (9.9)	72.6 (10.0)	73.3 (10.3)	73.9 (10.1)	75.8 (10.6)	<0.001
Heart rate (bpm)	65.2 (9.3)	65.5 (9.4)	66.0 (9.6)	66.3 (10.0)	67.0 (10.5)	<0.001
Hypertension (%)	14.6	15.3	16.6	17.2	21.5	<0.001
Hypertension treatment (%)	66.4	65.3	61	60.5	53.6	<0.001
Diabetes (%)	6.9	6.9	7.1	7.7	9.4	<0.001
Diabetes treatment (%)	54.3	55.1	53.7	50	48.9	0.013
Fasting glucose (mg/dL)	97.8 (17.4)	98.1 (18.1)	98.4 (17.2)	99.1 (17.5)	100.7 (19.3)	<0.001
HbA1c (%)	5.6 (0.6)	5.6 (0.6)	5.6 (0.6)	5.7 (0.6)	5.7 (0.7)	<0.001
Total cholesterol (mg/dL)	194.4 (35.1)	194.8 (35.2)	195.4 (35.8)	195.9 (35.7)	198.3 (36.3)	<0.001
HDL-C (mg/dL)	57.9 (15.7)	57.5 (15.8)	57.2 (15.5)	56.4 (15.3)	55.1 (15.2)	<0.001
Triglycerides (mg/dL)	101 (71-149)	103 (71-152)	104 (73-154)	108 (75-160)	118 (82-173)	<0.001
Insulin	6.6 (4.3)	6.7 (4.5)	7.0 (4.5)	7.3 (4.8)	8.4 (5.7)	<0.001
HOMA-IR	1.3 (0.9-2.0)	1.4 (0.9-2.1)	1.4 (0.9-2.2)	1.5 (1.1-2.3)	1.7 (1.1-2.7)	<0.001
CVD history (%)	2.13	2.23	2.11	2.22	2.55	0.137
hsCRP	0.05 (0.03-0.09)	0.05 (0.03-0.10)	0.05 (0.03-0.10)	0.05 (0.03-0.11)	0.06 (0.04-0.12)	<0.001
HEPA (%)	15.2	15.4	15.9	15.9	15.7	0.04
Current smoker (%)	22.7	23.5	24	24.1	25.9	<0.001
College graduate or higher (%)	74.5	75.1	74.4	75.6	76.7	0.002

Table 2. ORs for CAC > 0 according to BP difference

BP difference (mmHg)	OR (95% CI)				
	0-2 (n=6,683)	3, 4 (n=3,472)	5, 6 (n=1,638)	7, 8 (n=735)	9 - (n=610)
Total (n=13,318)	1 (ref)	1.05 (0.93-1.18)	1.12 (0.96-1.30)	0.89 (0.71-1.11)	1.01 (0.80-1.28)
Male (n=11,021)	1 (ref)	1.05 (0.93 - 1.19)	1.13 (0.97-1.32)	0.85(0.67-1.08)	0.98(0.77-1.25)
Female (n=2,117)	1 (ref)	1.03 (0.64-1.65)	1.08 (0.60 - 1.97)	1.52 (0.70 - 3.31)	1.70 (0.65-4.49)

Table 3. OR for baPWV > 1400 cm/s according to BP difference

BP difference (mmHg)	OR (95% CI)				
	0-2 (n=44,807)	3, 4 (n=22,245)	5, 6 (n=10,734)	7, 8 (n=4,503)	9 - (n=3,302)
Total (n=85,591)	1 (ref)	1.06 (1.02-1.11)	1.15 (1.09-1.22)	1.13 (1.04-1.22)	1.23 (1.13-1.35)
Male (n=55,205)	1 (ref)	1.06 (1.01 - 1.12)	1.13 (1.06-1.20)	1.10 (1.00 - 1.20)	1.19 (1.08-1.31)
Female (n=30,386)	1 (ref)	1.04 (0.94-1.15)	1.19 (1.05-1.36)	1.18(0.97-1.43)	1.39 (1.11-1.73)