

The Different Central Hemodynamics in Patients With Bicuspid Aortic Valve and its Association With Ascending Aorta Dilation

*In Jeong Cho, Chi Young Shim, Jeonggeun Moon,
Woo-In Yang, Sungha Park, Jong-Won Ha,
Yangsoo Jang, Namsik Chung*

**Severance Cardiovascular Hospital
Yonsei University College of Medicine**

Background (I)

- **A reduced elasticity and dilatation of the proximal aorta are highly prevalent in patients with BAV even in the absence of significant valvular dysfunction.**
- **Recently, intrinsic pathology of the aortic wall has been reported.**
- **Patients with normally functioning BAV demonstrated impairment in aortic elasticity.**

Background (II)

- **The exact mechanisms leading to dilation are not fully understood, but pulsatile stress probably plays an important role.**
- **However, the characteristics of central hemodynamics and their association with aortic dimension in patients with BAV are unknown.**

Purpose

- **To evaluate central hemodynamics in patients with BAV comparing to controls and its association with ascending aorta dilatation.**

Methods

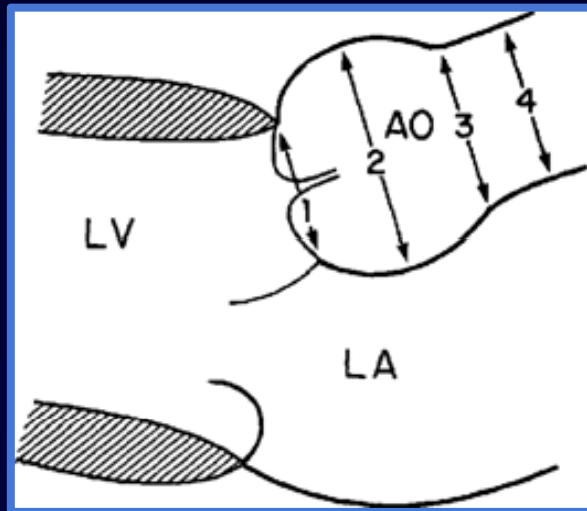
- 30 BAV patients with no or mild AV dysfunction
 - 30 age-, gender-matched controls

Between June. 2009 and Jan. 2010

- 2D TTE : aortic root and ascending aorta diameters
LV function and structure
- Radial artery tonometry

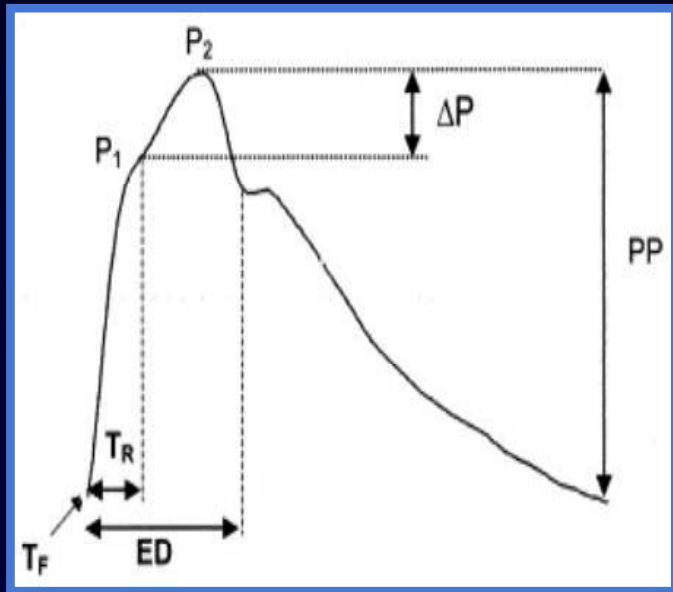
Echocardiography

- Standard 2D and Doppler echo
- Measurement of Aortic diameter



- 1: Annulus
- 2: Sinus of Valsalva
- 3: Sinotubular junction
- 4: Proximal ascending aorta 1cm above the sinotubular junction ; normalized by BSA

Radial Artery Tonometry



Central Hemodynamic Parameters

- Central BP
 - Central PP
 - Augmentation Pressure (AP)
: $P_2 - P_1$ (ΔP)
 - Augmentation Index (Aix)
: $AP / \text{central PP}$
-
- Aix@75: Aix normalized for heart rate 75 /min
 - PP amplification: peripheral PP / central PP
-
- SphygmoCor®, AtCor Medical, Sydney, Australia

Clinical Characteristics

	Controls (n = 30)	BAV (n = 30)	P value
Age (year)	55±13	55±14	0.760
Male (%)	25 (83.3)	25(83.3)	0.999
Height (cm)	168±8	167±9	0.405
BMI (kg/m ²)	24.2±3.3	24.2±3.4	0.952
Hypertension (%)	17 (56.7)	13 (43.3)	0.302
DM (%)	6 (20.0)	4 (13.3)	0.448
Dyslipidemia (%)	6 (20.0)	6 (20.0)	0.999
CAD (%)	2 (6.7)	4 (13.3)	0.389
Medications			
Diuretics (%)	5 (16.7)	7 (23.3)	0.519
Beta blocker (%)	4 (13.3)	8 (26.7)	0.197
ACEi /ARB (%)	12 (40.0)	14 (46.7)	0.602
CCB (%)	7 (23.3)	9 (30.0)	0.559

Echocardiographic Parameters

	Controls (n = 30)	BAV (n = 30)	P value
Aortic diameter			
Annulus (mm/m ²)	12.0±1.3	13.4±2.2	< 0.001
Sinus of Valsalva (mm/m ²)	18.8±2.0	20.5±3.7	0.012
ST junction (mm/m ²)	16.8±2.1	18.5±3.4	0.021
Ascending aorta (mm/m ²)	17.3±2.4	20.7±3.7	< 0.001
LVEDD (mm)	48 ± 4	51 ± 3	0.011
LVESD (mm)	32 ± 4	33 ± 3	0.075
LV EF (%)	67 ± 5	67 ± 6	0.661
LVMI (g/m ²)	92 ± 19	100 ± 22	0.123
LAVI (ml/m ²)	22 ± 5	25 ± 10	0.083
E (cm/sec)	58 ± 18	67 ± 13	0.019
DT (msec)	199 ± 34	204 ± 46	0.592
E' (cm/sec)	7.2 ± 2.9	6.3 ± 2.1	0.077
E/E'	8.5 ± 2.5	11.6 ± 3.9	< 0.001

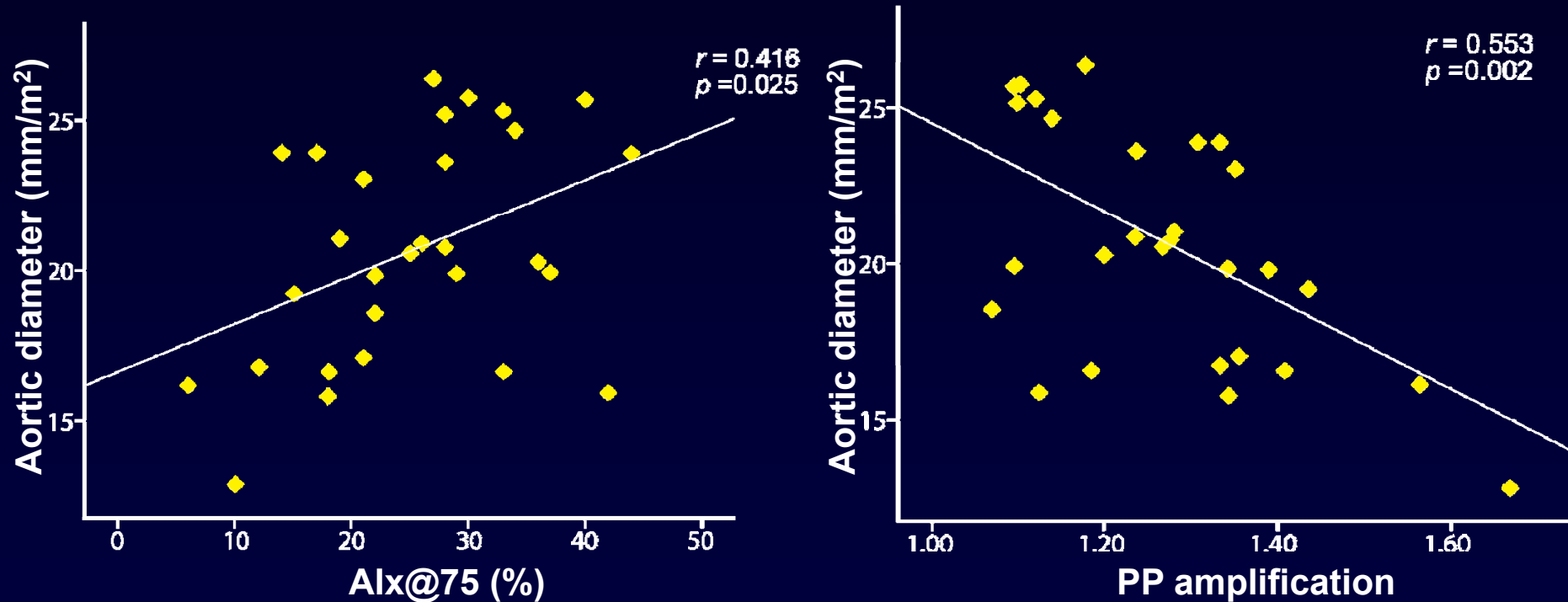
Hemodynamic Parameters

	Controls (n = 30)	BAV (n = 30)	P value
Brachial SBP (mm Hg)	117 ±11	119 ±16	0.435
Brachial DBP (mm Hg)	73 ± 11	75 ±11	0.459
Brachial PP (mm Hg)	44 ± 6	45 ±11	0.727
Central SBP (mm Hg)	106 ±12	111 ±15	0.101
Central DPB (mm Hg)	74 ±11	76 ±11	0.422
Central PP (mm Hg)	32 ± 5	35 ±9	0.015
Heart rate (bpm)	70 ± 11	65 ±9	0.076
AP (mm Hg)	6.6 ± 4.8	10.9± 5.6	0.003
Alx (%)	19.6 ± 9.1	30.0 ± 11.0	< 0.001
Alx@75 (%)	16.7 ± 10.1	24.8 ± 9.9	0.003
PP amplification	1.40 ± 0.11	1.28 ± 0.15	< 0.001

BAV & Central Aortic Stiffness

Variable	Standardized coefficient	Standard error	P value
AIx@75			
Presence of BAV	0.258	2.636	0.041
Age	0.188	0.100	0.132
Height	-0.210	0.146	0.040
AsAo diameter	0.265	0.457	0.084
PP amplification			
Presence of BAV	-0.253	0.035	0.048
Age	-0.124	0.001	0.324
Height	0.099	0.002	0.408
AsAo diameter	-0.395	0.006	0.012

Aortic Diameter & Central Aortic Stiffness in BAV



Summary (I)

- **Patients with BAVs have increased ascending aortic diameter, higher $Alx@75$ and lower PP amplification compared with control subjects.**
- **The diameter of ascending aorta was positively correlated with $Alx@75$ and negatively with PP amplification in patients with BAV.**

Summary (II)

- **Both PP amplification and Alx@75 were independently associated with the presence of BAV, despite after adjusting age, height and ascending aorta diameter.**

Conclusion (I)

- In patients with BAV even in the absence of significant valvular dysfunction, central hemodynamics are significantly different from controls with tricuspid aortic valves.
- Increased central aortic stiffness was associated with ascending aorta dilatation.

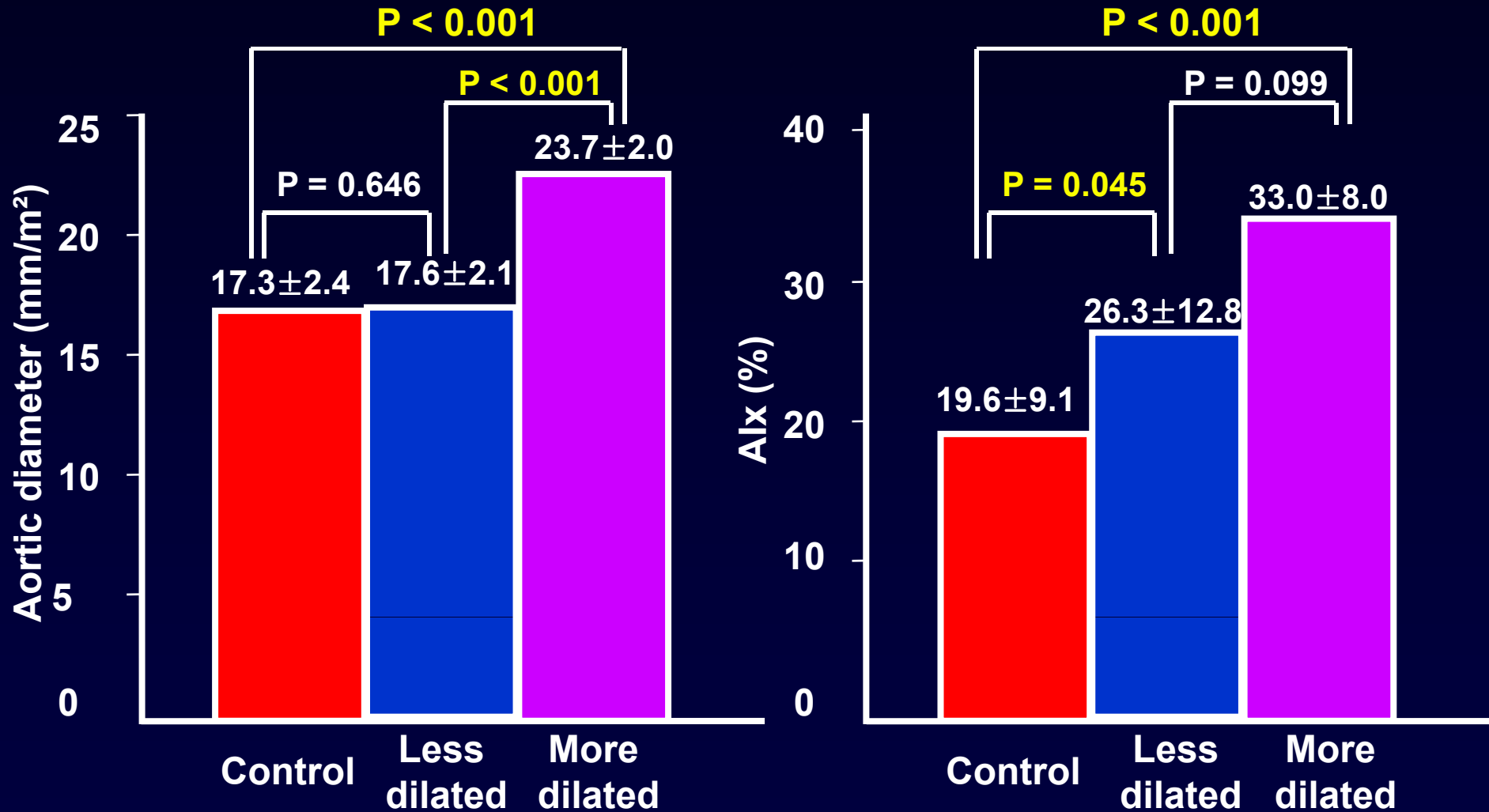
Conclusion (II)

- **Measurement of aortic stiffness including PP amplification and Aix, could be useful for evaluating the risk for subsequent aortic dilation in patients with BAV.**

Thank you for your attention.



Dilation of Aorta in BAV



Dilation of Aorta in BAV

