

## 한국적 의학 기준에 근거한 고혈압환자의 Angiotensin II Receptor Blockers와 Calcium Channel Blockers의 약물 평가

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### Evaluation of Therapeutic Differences of Angiotensin II Receptor Blockers and Calcium Channel Blockers Among Hypertensive Patients Classified by Oriental Traditional Way

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**Abstract — Background:** Oriental lifestyle for treating diseases has been developed and well-accepted for a long time among Koreans. Sasang Constitution theory, originated from Korean traditional medicine, suggests that medication treatment should be differentiated by each patient's body classification (So-yang [SY], So-eum [SE], Tae-yang [TY], and Tae-eum [TE]), in contrary to western medicine's theory that medication should be applied equally by disease indication without such classification. However, the pharmacotherapeutic outcomes of these theories have not been compared to date. In this study, we aimed to compare the two theories by evaluating blood pressure (BP), which is lowered as a therapeutic outcome, among hypertensive patients taking angiotensin II receptor blockers (ARBs) or calcium channel blockers (CCBs), two most commonly used antihypertensive classes in Korea. **Methods:** From April 2006 to June 2012, we retrospectively collected data on hypertensive patients with Sasang Constitution classification at Kyunghee University Hospital at Gangdong, one of the East-West collaborative medical centers in Korea. We collected information on age, gender, underlying diseases, anti-hypertensive drugs (ARB, CCB, ARB+CCB), and BP by reviewing the electronic medical records. We excluded patients with missing blood pressure at baseline or follow-up, or those who had a change in their antihypertensive drug class during follow-up. **Results:** We selected a total of 573 patients (SY: 165, SE: 158, TY: 0, TE: 250). Baseline BPs were on average 139.0/82.0 mmHg for SY, 137.8/78.5 mmHg for SE, and 138.7/79.2 mmHg for TE. In all three groups, CCBs were the most prescribed, followed by combination therapy with ARB+CCB, then ARBs. BP reduction after 1 month of initial medication was significantly different among the drug classes, but not in Sasang constitutional classification (ARB [SY: -12.4/-4.7, SE: -12.3/-2.5, TE: -8.6/-1.8], CCB [SY: -12.3/-5.4, SE: -13.0/-2.3, TE: -10.8/-6.0], ARB+CCB [SY: -15.6/-6.7, SE: -18.4/-8.1, TE: -20.2/-6.7], drug [ $P \leq 0.05$ / $P > 0.05$ ], constitutional type [ $P > 0.05$ / $P > 0.05$ ]). **Conclusion:** We observed significant differences in reduction of blood pressure by classes of drugs (ARB+CCB > CCB > ARB) but not by Sasang constitutional classification. Therefore, current approach of antihypertensive pharmacotherapy assisted by Western medicine is appropriate for treatment of hypertension. However, further larger scale or prospective studies are required in order to confirm these results.

**Keywords** □ Hypertension, Sasang Constitution, Electronic medical record, Antihypertensive drugs, Angiotensin II receptor blockers, Calcium channel blockers

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Hypertension is a highly prevalent chronic cardiovascular disease, globally affecting 29.2% of males and 24.8% of females over 25 years of age according to 2012 World Health Organization reports. According to JNC-7 guidelines, blood pressure (BP) can be classified into 4 stages (normal, pre-hypertension, stage 1 or stage 2 hypertension), and systolic blood pressure (SBP) above 140 mmHg or diastolic blood pressure (DBP) above 90 mmHg is considered hypertensive.<sup>1)</sup> As uncontrolled hypertension can result in complications of major organs such as the heart, brain, kidneys, liver, and eyes, it is important to control the blood pressure for each patient's individual goal. Although it is ideal to keep the BP less than 120/80 mmHg, which is the "normal" blood pressure, most hypertensive patients' blood pressure goal is <140/90 mmHg, with the exception of patients with diabetes or chronic kidney disease, whose BP goal is <130/80 mmHg to prevent coronary artery diseases.<sup>2-4)</sup>

Hypertension can be treated nonpharmacologically with lifestyle modifications such as dietary changes and exercise, and pharmacologically with the use of antihypertensive agents. As blood pressure is determined by cardiac output and peripheral vascular resistance, antihypertensive agents reduce BP by inhibiting various pathophysiologic mechanisms of blood pressure elevation. American Heart Association 2007 guideline recommends angiotensin converting enzyme inhibitors (ACE-Is), angiotensin II receptor blockers (ARBs), calcium channel blockers (CCBs) and thiazide diuretics as first-line agents for hypertension, and mono- or combination therapy of these agents.<sup>5)</sup> In patients with comorbid diseases, selections of antihypertensive agents are directed by compelling indications,

and additional antihypertensives can be added depending on patient's BP control.<sup>1)</sup> Response to antihypertensive therapy varies with each patient, and hence, continuous monitoring of blood pressure and signs and symptoms of other complications are crucial, and changes or additions of medications may be necessary for optimal blood pressure control.

In the Western medicine, patients with the same diseases receive the same treatment based on the approved indications. However, it has been recognized that variability in drug response occurs within the patients with same diseases, and many research studies identified factors that cause these variabilities, such as genes, gender and environmental factors.<sup>6-9)</sup> A lot of efforts are being made to enable personalized medicine. On the other hand, In Sasang Constitution, the part of Korean traditional medicine, physical constitutions are used to classify individuals into different constitution types to guide therapy.

Sasang Constitution medicine is a widely accepted theory in Korean traditional medicine proposed by Lee Jema, a renowned physician and scholar. Sasang Constitution classifies individuals into four categories by external ("yang") and internal ("eum") energy ("qi"): Tae-yang (TY), Tae-eum (TE), So-yang (SY) and So-eum (SE) (Fig. 1). The theory is that the constitution affects the body and characters of humans, and the energy of the organs in the body differ based on the types of constitution, causing different manifestations of diseases; Sasang Constitution medicine is a distinguished therapy based on constitutional classifications.<sup>10-13)</sup>

Oriental and Western medicine have coexisted in Korea for a long time, but there has been long-lasting dispute between the

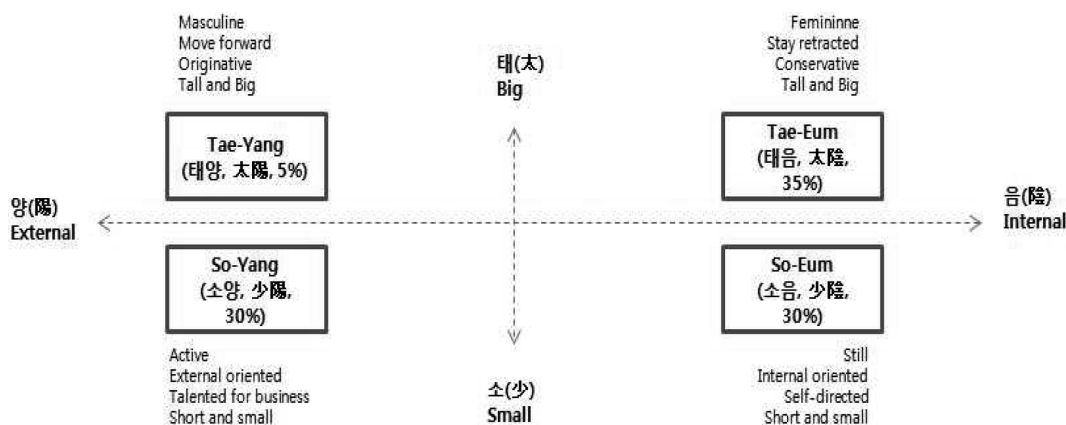


Fig. 1 – Classification of Sasang constitutional types.

\*Modified from Chae H, Lyoon IK, Lee SJ, Cho SH, Bae H, Hong M, Shin MK (2003), "An Alternative way to individualized medicine: Psychological and Physical traits of Sasang Typology," *The Journal of Alternative and complementary medicine*, 9(4), 519-528.

two due to their differences in medical approach. Recently, there have been studies that found prevalence rates of Western medicine diseases, such as hypertension, varying in Sasang constitutional types,<sup>7,14)</sup> but no studies have compared the effects of Western drug therapy, such as antihypertensives, based on Sasang Constitution.

Therefore, this study aimed to investigate whether the “constitution” asserted by Oriental medicine results in differences in Western medicine’s drug response. Thus, we assessed the effects of angiotensin II receptor blockers (ARBs) and calcium channel blockers (CCBs), first line agents in the treatment of hypertension and the two most commonly used antihypertensive classes in Korea, by examining the changes in blood pressure. This study, which investigated the association between Western medicine’s drug response and the “constitution” of Oriental medicine, may not only enhance the understanding of the two different theories, but may also serve as an evidence in clinical settings in the use of drug therapy and contribute to the enhancement of medical management of patients.

## Methods

### Patient inclusion and data collection

We identified 1714 patients from April 8, 2006 to June 30, 2012 (7 years 3 months) who have been diagnosed with hypertension and have been classified into one of the Sasang constitutions at Kyunghee University Hospital at Gangdong, one of the East-West collaborative medical centers in Korea. Of these patients, we included 819 patients who were prescribed ARB, CCB, or ARB+CCB and retrospectively screened their medical records. We excluded patients who did not have baseline BP or follow-up BP from the first day of antihypertensive prescription or those who were concurrently taking other antihypertensives besides ARBs or CCBs.

A total of 573 patients met the inclusion and exclusion criteria (Fig. 2) and we collected data on age, gender, co-morbid diseases, constitutional classification, type of antihypertensive agent(s) prescribed and BP measurements. We collected BP measurements before and after the first day of antihypertensive prescription, and in cases of chronic BP follow up, we collected monthly BP measurements. We classified the BP measurements into baseline BP (measured prior to initial medication), follow-up BP (BP during medication administration), and final BP (last BP measurement during the study period).

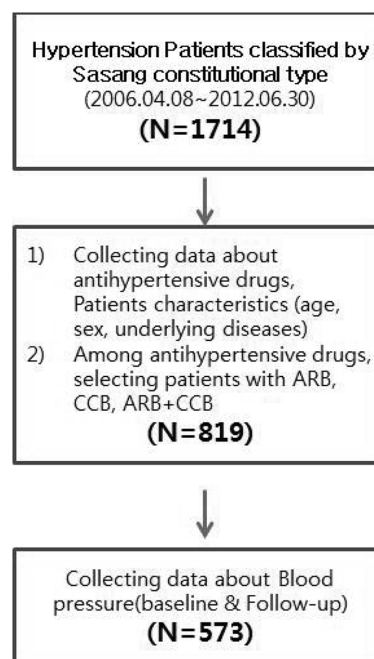


Fig. 2 – Patient selection process.

- 1) Collected data on antihypertensive drugs, patient characteristics (age, sex, underlying diseases).
- 2) Collected data on blood pressure (baseline & follow-up).

Both systolic blood pressure (SBP) and diastolic blood pressure (DBP) measurements were collected.<IRB#: KHNMC IRB 2012-146>

### Study medications

We selected ARBs and CCBs, the two most widely used antihypertensive agents in Korea, and as some patients took both classes concurrently, we classified the patients into ARB, CCB, and ARB+CCB groups.

ARBs used at the hospital included candesartan, eprosartan, fimasartan, irbesartan, losartan, olmesartan, telmisartan, valsartan, and CCB included both dihydropyridines (nifedipine, felodipine, benidipine, nimodipine, amlodipine, S-amlodipine, clinidipine, efonidipine, lacidipine, lecardipine) and non-dihydropyridines (diltiazem and verapamil).

### Blood pressure analysis

We examined the following:

- (1) Change in blood pressure in all patients by ARB, CCB, or ARB+CCB administration
- (2) Change in blood pressure from use of ARB by constitutional types (SY, SE, TY)
- (3) Change in blood pressure from use of CCB by constitu-

tional types (SY, SE, TY)

(4) Change in blood pressure from use of ARB+CCB by constitutional types (SY, SE, TY)

### Statistical analysis

Statistical analysis was performed by Microsoft Excel 2007 and SPSS (Ver. 12.0). We used paired *t*-test and one-way ANOVA to test for differences in treatment response between the constitution groups (TE, SY, SE). Extent of reduction in BP between constitutions by drug classes was determined by two-way ANOVA. We excluded BP measurements that were over 3 times the standard deviation (average $\pm$ 3Xstandard deviation), and *P* values <0.05 were considered significant.

## Results

### Baseline patient characteristics

Of the 573 included patients, there were no TYs, 250 TE patients, 165 SY patients, and 158 SE patients. SE group had the highest average age, but the average age in all groups was over 60. TE and SE groups consisted of more females,

whereas the SY group consisted of more males.

Average baseline BP in SY group was the highest at 139.0/82.0 mmHg ( $p=0.869/0.024$ ), and the percentage of patients with high BP (>140/90 mmHg) was the highest in SY patients at 67.6% (Stage 1 [41.8%], Stage 2 [15.8%]) ( $p=0.008$ ) (Table I).

Cardiovascular comorbidities such as stroke, angina, myocardial infarction, and left ventricular hypertrophy were the most prevalent group of diseases across all constitutional types; TE had the highest prevalence of cardiovascular diseases at 99.8%, followed by SY (72.1%) and SE (64.6%). Endocrine-related diseases were the next most prevalent (TE 38.8%, SY 37.6%, SE 29.7%), and the majority of the endocrine diseases were diabetes (Table I).

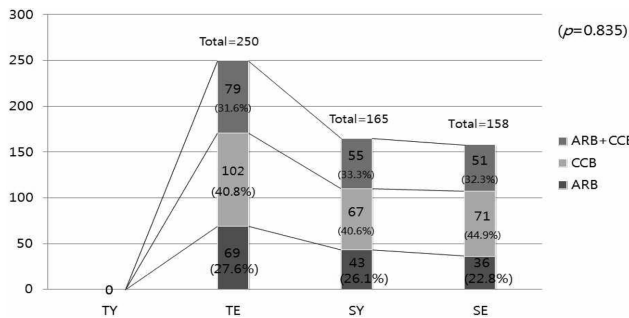
### Distribution of antihypertensive usage by constitution

Examining the 573 included patients by constitution, CCB was the most widely used in all constitution groups, followed by ARB+CCB, then ARB. No significant differences were detected in the use of certain class of drugs amongst the groups. However, no prescribing pattern was observed with regards to the constitutional types currently (Fig. 3).

**Table I** – Patient characteristics

		Tae Yang	Tae Eum	So Yang	So Eum	P-value
Number of patients (N=573)		0	250	165	158	N/A
Age (years), mean $\pm$ S.D.		-	65.5 $\pm$ 12.7	61.1 $\pm$ 13.3	69.1 $\pm$ 11.7	<0.001
Gender (%)	Male (N=279)	-	45.2	70.9	31.0	<0.001
	Female (N=294)	-	54.8	29.1	69.0	
Comorbidities (%)	Cardiovascular disease	-	99.8	72.1	64.6	N/A
	(Cerebrovascular disease)	-	(99.2)	(66.1)	(59.5)	
	Endocrine disease	-	38.8	37.6	29.7	
	(Diabetes mellitus)	-	(25.6)	(26.7)	(22.2)	
	Neurologic disease	-	26.4	24.2	19.0	
	Musculoskeletal disease	-	12.0	14.5	10.1	
	Gastrointestinal disease	-	8.4	9.1	6.3	
	Urogenital disease	-	7.6	12.1	8.2	
	Respiratory disease	-	6.4	2.4	7.0	
	Psychiatric disease	-	6.0	4.8	5.7	
	Neoplasm disease	-	3.2	8.5	6.3	
	Infection disease	-	2.8	3.0	3.8	
	Hematologic disease	-	2.8	1.2	0.0	
Skin disease	-	0.8	0.0	0.6		
Baseline blood pressure	SBP (mmHg), mean $\pm$ S.D.	-	138.7 $\pm$ 23.4	139.0 $\pm$ 20.6	137.8 $\pm$ 19.8	0.869
	DBP (mmHg), mean $\pm$ S.D.	-	79.2 $\pm$ 13.5	82.0 $\pm$ 12.7	78.5 $\pm$ 12.0	0.024
	Normal (%)	-	21.2	17.6	17.1	0.008
	Prehypertension (%)	-	27.2	24.8	33.5	
	Phase I (%)	-	28.4	41.8	38.0	
Phase II (%)	-	23.2	15.8	11.4		

\*S.D.: Standard Deviation, SBP: systolic blood pressure, DBP: diastolic blood pressure



**Fig. 3** – Distribution of antihypertensive agents by sasang constitutional types. TY, Tae-yang; TE, Tae-eum SY, So-yang; SE, So-eum; ARB, Angiotensin II receptor blocker; CCB, Calcium channel blocker.

**Changes in blood pressure among all patients**

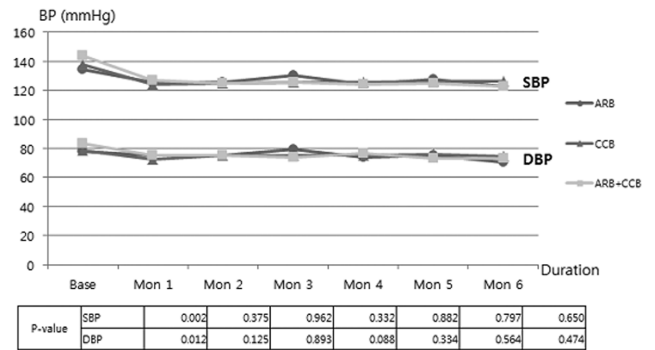
Reduction in blood pressure was observed from 1 month after initiation of therapy and lasted for the entire 6 months in all patients in all drug classes, (ARB, CCB, ARB+CCB) (Fig. 4, Table II).

Significant differences in blood pressure reduction by drug classes were observed in the first month after initial medication; the combination therapy showed the greatest antihypertensive effect (-17.6/-7.6 mmHg), and among monotherapy agents, CCBs had greater effect (-12.1/-5.6 mmHg) than ARBs (-11.1/-2.6 mmHg) (p=0.023/0.055) (Fig. 4).

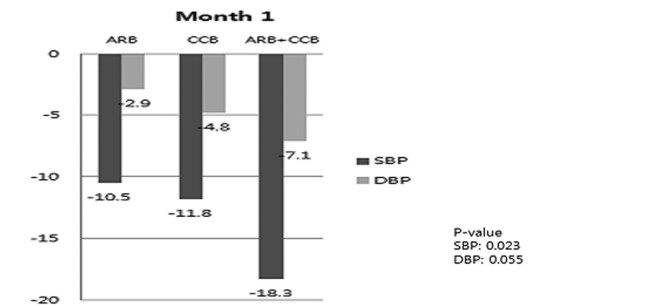
**Blood pressure reduction comparison among constitutional types by drug classes**

**(1) ARB**

Reductions in BP by ARBs in SY (-12.4/-4.7 mmHg) and SE



**A) Blood pressure trends from baseline to Month 6**



**B) Reduction in blood pressure 1 month after medication initiation**

**Fig. 4** – Changes in Blood Pressure among Patients by Drug Class. ARB, angiotensin II receptor blocker; CCB, calcium channel blocker; SBP, systolic blood pressure; DBP, diastolic blood pressure.

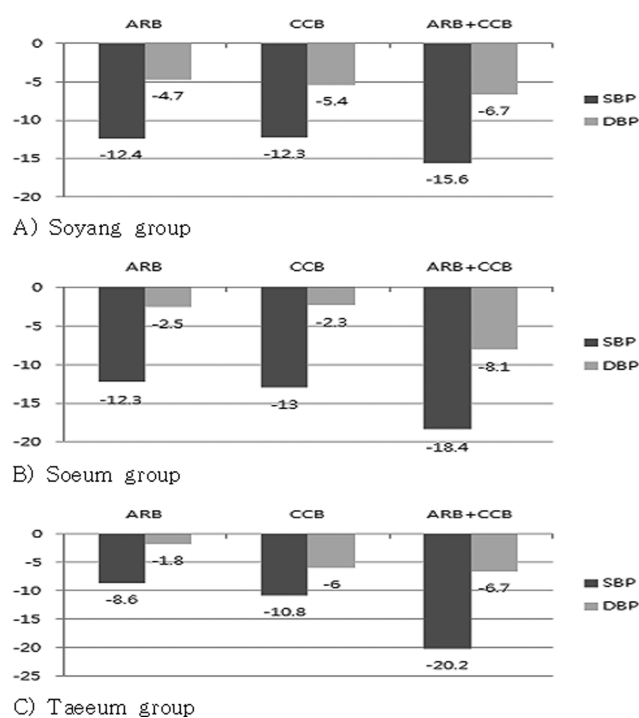
(-12.3/-2.5 mmHg) groups were not statistically significant (p=0.261/0.731), but TE group (-8.6/-1.8 mmHg) had less reduction in BP in comparison to SY and SE groups (p=0.08/0.025, 0.004/0.053) (Fig. 5).

**(2) CCB**

Among patients treated with CCB monotherapy, no differ-

**Table II** – Blood Pressure from Baseline to 6 Month by Sasang Constitutional Types

Sasang type	Drug	Baseline		Mon 1				Mon 2				Mon 3				Mon 4				Mon 5				Mon 6			
		SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP	SBP	DBP				
SY	ARB	138.9	82.6	126.9	76.3	123.2	74.7	126.3	75.8	121.3	71.8	129.4	74.9	122	75.3												
	CCB	137.2	79.8	123.2	71.4	122.8	75.5	126.2	74.6	126.1	74.5	130.5	75.8	134	73	0.8											
	ARB+CCB	141.5	84.4	128.6	77.6	121.9	74.7	123.1	72.7	125	77.5	131.5	77	119	72.6												
SE	ARB	136.9	80	130.6	78.4	129.8	76.6	129.5	77.3	127.6	76	129.8	77.7	123.4	73.6												
	CCB	135.3	77.5	123.6	73.5	123	74.9	124.2	75.9	126.1	74.5	121.4	74.8	124.7	74.4	1											
	ARB+CCB	142	78.7	126.4	72.1	121	71.9	124.2	72.3	107.2	68.8	96.5	67	131	73.7												
TE	ARB	132.6	76.2	122.1	73.5	123.9	75.4	132.9	83.9	123.8	74.1	121.8	73.7	122.9	65.6												
	CCB	138	78.4	125.4	73.2	127.2	75.7	126.1	75.7	124.1	75.3	126.5	76.6	123.4	75.5	0.3											
	ARB+CCB	145	82.7	126	75.1	127.7	76.8	128.4	75.6	129	78.8	123.5	71.8	124.2	73.2												
p	ARB	0.523	0.123	0.15	0.238	0.276	0.854	0.628	0.174	0.536	0.6	0.445	0.608	0.987	0.421												
	CCB	0.688	0.571	0.724	0.958	0.364	0.945	0.882	0.874	0.873	0.682	0.407	0.921	0.288	0.863												
	ARB+CCB	0.685	0.108	0.73	0.111	0.244	0.257	0.526	0.769	0.021	0.093	0.037	0.301	0.55	0.982												



**Fig. 5** – Blood Pressure Reduction by Drug Class and Constitutional Types 1 Month after Medication Initiation.

※ Two-way ANOVA by drug class:  $p=0.049/0.065$ . Two-way ANOVA by constitutional type:  $p=0.912/0.768$ . ARB, angiotension II receptor blocker; CCB, calcium channel blocker; SBP, systolic blood pressure; DBP, diastolic blood pressure.

ences were observed in the reduction of BP in SY (-12.3/-5.4 mmHg) and SE (-13.0/-2.3 mmHg) groups, but TE group (-10.8/-6.0 mmHg) had smaller reductions in BP in comparison to SY and SE groups ( $p=0.003/0.342$ ,  $0.434/0.315$ ) (Fig. 5).

### (3) ARB+CCB

ARB+CCB combination therapy showed greater BP reduction than monotherapy in SY (-15.6/-6.7 mmHg), SE (-18.4/-8.1 mmHg), and TE (-20.2/-6.7 mmHg) groups. No difference was observed among constitution types ( $p=0.203/0.418$ ,  $0.732/0.986$ ,  $0.345/0.404$ ) (Fig. 5).

Two-way ANOVA analysis on reduction of BP by drug classes and by constitutional types showed that significant differences were detected by drug class ( $p=0.049/0.065$ ) but not by constitutional types ( $p=0.912/0.768$ ).

## Discussion

Hypertension is a common chronic disease world-wide, and it affects 28% of Korean adults, and additional 60% of adults are at risk for the disease. However, treatment of hyperten-

sion is challenging, with only 53% of hypertensive patients reported to have their blood pressure controlled to target levels.<sup>15)</sup> Although pathophysiologic mechanisms and genetic and environmental factors that elevate BP have been continuously studied, the exact mechanism has not been identified, and blood pressure control in hypertensive patients varies among individuals. Sasang Constitution, original medicine from Korea, treats patients based on each individual's constitutional characteristic. These constitutional types have been reported to be correlated to the prevalence rates of diseases such as hypertension and diabetes, so this study aimed to examine whether the constitutional differences affected blood pressure control in response to antihypertensive therapies by reviewing the electronic medical records in the East-West collaborative medical center.

Subjects in this study were hypertensive patients who received treatment with Oriental medicine. The proportion of TY patients in Korea is less than 5%,<sup>13,16)</sup> and no TY patients were included in this study. According to constitutional characteristics, TE patients outnumber SY or SE patients, and the risk and occurrence of hypertension is also at a higher proportion in TE patients.<sup>7,14)</sup> Most of the patients in this study were over 60 years of age as prevalence of hypertension increases with age and because treatment with Oriental medicine was usually done in those who had stroke and/or cerebrovascular disorders. Additionally, cardiovascular diseases were the most common amongst comorbid diseases, and most of those patients had cerebrovascular diseases. The study results showed that in all constitution types, antihypertensives reduced blood pressure, and combination therapy showed greater effect than monotherapy with ARB or CCB alone. However, no significant differences in blood pressure reduction among SY, SE, and TY constitutional types were observed in each drug class. Additionally, the study hospital most commonly used CCBs and CCB monotherapy was more effective in blood pressure reduction than ARB monotherapy. Our analysis showed that while constitutional types did not result in differences in the blood pressure reduction, differences in the pathophysiological mechanism of the drugs drove the differences in blood pressure reduction.

Blood pressure is determined by cardiac output and peripheral vascular resistance, and is regulated by complex factors including sympathetic and parasympathetic nervous system, amount of fluids or Na<sup>+</sup> in the body and renin-angiotensin-

aldosterone.<sup>17)</sup> Hypertension is treated by inhibition of various pathophysiological factors that can elevate blood pressure with antihypertensives such as diuretics, sympathetic nervous system inhibitors (beta-blockers, alpha1-antagonists, alpha 2-agonists), renin-angiotensin-aldosterone system inhibitors (angiotensin converting enzyme inhibitors [ACE-Is], ARBs, renin inhibitor), CCBs and vasodilators. AHA or JNC-7 recommends first-line therapy agents for hypertension, but differences exist in commonly used antihypertensives by country. Based on 2007 data evaluation of prescribing rates in tertiary hospitals in Korea, CCBs (53.96%) were most common, followed by ARBs (49.64%) and diuretics (37.49%).<sup>18)</sup> ARB is an inhibitor of angiotensin II receptor type 1, which is located in blood vessels, myocardium, brain, kidneys and glomerular cells.<sup>17)</sup> ARB directly inhibits angiotensin II-mediated vasoconstriction and promotes vasodilation by NO-mediated vascular endothelium. CCB inhibits the intracellular influx of Ca<sup>2+</sup> in vascular smooth muscles and myocardial cells, which results in inhibition of vasoconstriction and cardiac contraction; CCBs are used for the treatment of hypertension, angina, and arrhythmia.<sup>17)</sup> When blood pressure is not maintained merely with monotherapy, combination of antihypertensives with high efficacy and safety are often used to decrease the risk of cardiovascular diseases and other complications. Both European Society of Hypertension-European Society of Cardiology (ESH-ESC) guideline and JNC-7 recommend combination therapy with 2 or more agents to attain blood pressure goal.<sup>1,19)</sup> Using concurrent antihypertensives with different mechanisms of action can reach blood pressure goal with less dosages and can be more safe as it can blunt other drugs' adverse effects. Combination therapy with ARB and CCB are known to have more effects than two agents independently.<sup>20-22)</sup> ARB mitigates peripheal edema exacerbated by arterial dilation from vasodilatory effects of CCB, and while decreased heart rate caused by CCB stimulates the renin-angiotensin-aldosterone system and increase angiotensin II level, ARB can inhibit the RAS, and reflex tachycardia provoked by dihydropyridines can be checked by ARB which inhibits sympathetic nervous system, causing not only greater efficacy, but also excellent safety.<sup>23)</sup>

While Western medicine uses the pathophysiologic and mechanistic approaches to inhibit factors that cause high blood pressure for pharmacotherapeutic treatment of hypertension, Oriental medicine uses different treatment strategies based on

the symptom of each hypertensive patient, which is believed to be caused by disharmony among organs.<sup>24)</sup> Hypertension is believed to be related to constitutional characteristics and usual lifestyle habits, and the approaches of treatments differ by TE, SY, and SE groups, as distinctive character and bodily features of each constitutional types show different disease appearance.<sup>24)</sup> Approaches and treatments of hypertension differ by constitution; for TE patients, Korean traditional medicine such as Chungpesagan-tang helps to strengthen cardiovascular and intestinal function while quenching inner body heat; for SY patients, Korean traditional medicine such as Yanggyuksanhwa-tang reduces heat caused by tension; for SE patients, Korean traditional medicine such as Palmulgunja-tang relieves stress caused by rage and restores fatigued body and spirit.<sup>24)</sup>

As Sasang Constitution medicine uses different treatments for concomitant symptoms by constitutions, we aimed to examine if differences in response to antihypertensive medications would exist by constitutional types. The result showed that antihypertensives (ARB, CCB, and ARB+CCB) which control blood pressure by pathophysiologic mechanisms did not show differences in blood pressure reduction by constitution types. Currently, antihypertensive agents are being prescribed without regards to the Sasang Constitution, and our study findings indicate that antihypertensives have effects on blood pressure reduction, the most effective in the order of ARB+CCB, CCB, followed by ARB. As CCBs are the most commonly used antihypertensive class of drugs in Korea and has better efficacy than ARBs, the use of CCBs can be considered appropriate for greater blood pressure control.

This was a single-centered, retrospective study. Study limitations include not being able to control for confounding factors such as lifestyle differences (obesity, smoking, etc), or medication adherence. Additionally, as the data were retrospectively collected by electronic medical records, all patients' blood pressure measurements over 6 months were not at same intervals, and possible errors during blood pressure measurements could not be controlled for. Further studies will be necessary to confirm our findings by prospectively following blood pressure measurements at multiple centers to overcome these limitations. Despite the coexistence of Western and Oriental medicine and many patients receiving treatments by both approaches in Korea, there has been lack of research to truly understand each others' approaches in medicine. This study is meaningful as it is the first study examining the Western med-

icine's pharmacologic drug response based on the Sasang Constitution. This is one piece of evidence that can be applied in clinical practice, and it adds significance as it contributes to Western and Oriental medicine's interdisciplinary clinical research in the treatment of diseases.

### Acknowledgement

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