

# Usefulness of Bioelectrical Impedance Analysis to Measure Calcium Channel Blockers-Related Edema

<sup>1</sup>고려대학교 구로병원, <sup>2</sup>연세대학교 신촌 세브란스병원, <sup>3</sup>연세대학교 원주 세브란스 기독병원

\*김현아<sup>1</sup>, 김응주<sup>1</sup>, 이상학<sup>2</sup>, 김장영<sup>3</sup>

**Background/Aims:** Dihydropyridine calcium channel blockers (CCBs) are one of the most common antihypertensive agents; however, are often associated with peripheral edema, a cause for poor drug adherence. This study aimed to objectively evaluate CCBs-related peripheral edema using Bioelectrical Impedance Analysis (BIA) which can measure the edema as the ratio of extracellular water to total body water. **Methods:** A total of 46 patients with mild to moderate hypertension were randomly administered either Manidipine (20 mg/day;  $n=20$ ) or Amlodipine (10 mg/day;  $n=26$ ) for 8 weeks (Figure 1). All patients have undergone Direct Segmental Multi-frequency Bioelectrical Impedance Analysis (DSM-BIA) at the screening visit and at the end of the treatment. Blood pressure and adverse events during the study were collected. **Results:** Blood pressure reductions after 8-week treatment were significant in both groups, but there were no significant between-group differences (Table 1). In comparison to the Manidipine group, the incidence of peripheral edema was higher in the Amlodipine group during the 1st 4-week (10.0% vs. 11.5%,  $p=1.0$ ) and the 2nd 4-week (5.6% vs. 27.3%,  $p=0.105$ ) (Table 2). The changes in leg edema score during the treatment with Manidipine or Amlodipine were not significantly different between two groups (right leg:  $(1.938 \pm 2.720) \times 10^{-3}$  vs.  $(2.071 \pm 4.233) \times 10^{-3}$ ,  $p=0.828$ ; left leg:  $(3.875 \pm 3.948) \times 10^{-3}$  vs.  $(1.786 \pm 5.041) \times 10^{-3}$ ,  $p=0.326$ ) (Table 3). Comparing the changes of edema score over the course of the study according to edema development, changes was consistently higher in edema (+) group than in edema (-) group, although the results were not statistically significant (Table 4). **Conclusions:** This study suggests the usefulness of BIA measurements as an objective tool to estimate CCBs-related fluid retention and edema. However, the results were not statistically significant. Larger study is needed to confirm robust results.

Figure 1 Flow Diagram of Study Patients

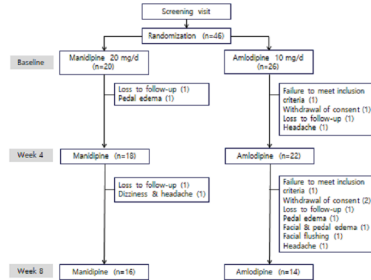


Table 1. Blood pressure parameters at baseline and end of treatment (Week 8) with manidipine or amlodipine

	Manidipine (n=18)	Amlodipine (n=16)	p
Systolic BP (mmHg)			
Baseline	151.2 ± 7.5	158.8 ± 14.5	
Study end	126.8 ± 12.4	128.8 ± 9.4	
p	0.005	0.001	
Delta	-24.4 ± 12.6	-30.0 ± 18.3	0.134
Diastolic BP (mmHg)			
Baseline	95.2 ± 9.5	99.8 ± 8.9	
Study end	84.9 ± 9.2	86.6 ± 9.6	
p	0.002	0.002	
Delta	-10.3 ± 9.9	-13.2 ± 10.0	0.012
Kidney rate (g/min)			
Baseline	80.5 ± 14.9	78.5 ± 12.6	
Study end	84.8 ± 14.4	79.4 ± 13.9	
p	0.079	0.168	
Delta	4.3 ± 13.7	-1.0 ± 5.4	0.058

Table 2. Adverse events (AEs) during 8-week treatment with manidipine or amlodipine

	Manidipine (n=20)	Amlodipine (n=26)	p
Edema	2 (10.0%)	3 (11.5%)	1.0
Head	2 (10.0%)	1 (3.8%)	0.572
Leg	0	1 (3.8%)	1.0
Face & leg	0	1 (3.8%)	1.0
Facial flushing	0	1 (3.8%)	1.0
Headache	2 (10.0%)	2 (7.7%)	1.0
Dizziness	2 (10.0%)	1 (3.8%)	0.572
Disturbance	1 (5.0%)	0	0.298
Others	1 (5.0%)	0	

Table 3. Edema score difference between study end and baseline according to study group

	Manidipine (n=18)	Amlodipine (n=16)	p
Whole body	(2.492 ± 2.497) × 10 <sup>-3</sup>	(3.460 ± 3.268) × 10 <sup>-3</sup>	0.085
Right arm	(3.000 ± 2.877) × 10 <sup>-3</sup>	(3.460 ± 3.268) × 10 <sup>-3</sup>	0.787
Left arm	(3.460 ± 2.877) × 10 <sup>-3</sup>	(3.460 ± 3.268) × 10 <sup>-3</sup>	0.589
Trunk	(2.000 ± 2.382) × 10 <sup>-3</sup>	(2.800 ± 2.382) × 10 <sup>-3</sup>	0.589
Right leg	(3.000 ± 2.720) × 10 <sup>-3</sup>	(2.771 ± 4.233) × 10 <sup>-3</sup>	0.828
Left leg	(3.875 ± 3.948) × 10 <sup>-3</sup>	(1.786 ± 5.041) × 10 <sup>-3</sup>	0.326

Table 4. Edema score difference between study end and baseline according to edema development

	Edema (-) (n=7)	Edema (+) (n=26)	p
Whole body	(2.537 ± 3.000) × 10 <sup>-3</sup>	(2.176 ± 3.066) × 10 <sup>-3</sup>	0.965
Right arm	(3.429 ± 2.173) × 10 <sup>-3</sup>	(3.089 ± 2.769) × 10 <sup>-3</sup>	0.460
Left arm	(3.429 ± 2.173) × 10 <sup>-3</sup>	(3.761 ± 2.894) × 10 <sup>-3</sup>	0.339
Trunk	(3.000 ± 2.708) × 10 <sup>-3</sup>	(3.571 ± 2.894) × 10 <sup>-3</sup>	0.181
Right leg	(3.000 ± 4.083) × 10 <sup>-3</sup>	(3.423 ± 3.712) × 10 <sup>-3</sup>	0.120
Left leg	(3.286 ± 4.123) × 10 <sup>-3</sup>	(3.463 ± 4.965) × 10 <sup>-3</sup>	0.130

ECW: extracellular water; TBW: total body water; ECW/TBW: extracellular fluid; TBW: total body fluid