Alterations of resting heart rate and coefficient of variation of R-R interval after cryoballoon ablation in the patients with paroxysmal atrial fibrillation

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Introduction: While it is generally accepted that cardiac autonomic nervous system (CANS) plays an important role in atrial fibrillation (AF) and pulmonary vein isolation (PVI) by radiofrequency catheter ablation modifies the ganglionated plexi (GP), the alterations of CANS after PVI are not clarified. The objective of this study was to investigate the alteration of CANS after conventional cryoballoon (CBA) by using a non-invasive examination method of measuring resting heart rate (R-HR) and coefficient of variation of R-R interval (CVR-R). CVR-R reflects R-R interval variation affected by respiration. Declines of CVR-R indicate the parasympathetic dysfunction and the normal range of it varies depend on the age. As age increases from 30s to 70s, the average value of CVR-R decreases from 4.0% to 2.4%.

Methods: Consecutive patients of paroxysmal AF treated with initial CBA in our institute participated. Subjects were limited to the patients who maintained sinus rhythm through the study and whose prescription had not been changed after procedure. All patients recorded 12-lead electrocardiogram to measure R-HR and CVR-R before and the day after procedure. We compared R-HR and CVR-R of all patients before and after CBA. And in addition, we compared them in each of two groups whose pre-procedural R-HR were under 50bpm (Group-U50) and over 70bpm (Group-O70). All procedures were performed with second generation 28mm cryoballoon (CB)s under the conscious sedation with Dexmedetomidine. CB temperature was down to a minimum of -60°C and target application time was 180 seconds.

Result: In the procedure of all 105 patients (male gender, 54%; age, 66.9±10.4 years; CHADS2 score , 1.15±1.04; diabetes mellitus, 14%; beta-blocker therapy, 16%), 1 of touch-up for PVI, 6 of supra vena cava isolation and 21 of cavotricuspid isthmus linear ablations with radiofrequency catheter were added. In all patients, R-HR increased from 58.9±9.2bpm to 72.4±9.5bpm (p< 0.01) and CVR-R decreased from 2.36±1.08% to 1.24±0.68% (p< 0.01), respectively. In Group-U50 (n=14; male gender 64%; age 67.6 ±12.4 years), R-HR increased from 47.1±2.1bpm to 66.4±7.9bpm (p< 0.01) and CVR-R decreased from 2.58±1.59% to 1.34±0.82% (p< 0.01), respectively. In Group-O70 (n=17; male gender 43%; age 67.4±12.6 years), R-HR increased from 73.7±2.8bpm to 81.8±7.4bpm (p< 0.01) and CVR-R decreased from 2.33±0.94% to 1.14±0.52% (p< 0.01), respectively. Values of CVR-R before and after CBA showed no significant difference between the two groups.

Conclusion: After CBA, R-HR increment and CVR-R decrement were significantly observed. CVR-R was halved regardless of pre-procedural R-HR. Damages to GP by CBA would be reflected as denervation of vagus nerves in CANS. R-HR increment might be associated with parasympathetic suppression of CABS.