Left Atrial Volume Index as a Predictor of Non-Pulmonary Vein Foci in Patients with Atrial Fibrillation

Takashi Ikenouchi
Osamu Inaba
Gaku Narita
Yohei Tamura
Giichi Nitta
Shunichi Kato
Toshikazu Kono
Kazuya Murata
Yasuaki Hada
Miki Kanoh
Tomomasa Takamiya
Yukihiro Inamura
Ken Negi
Akira Sato
Tsunehiro Yamato
Yutaka Matsumura
Junichi Nitta
Yoshihide Takahashi
Masahiko Goya

Introduction: Since the trigger of atrial fibrillation (AF) was found to be associated with firing from cardiomyocytes inside the pulmonary vein (PV), the isolation of PV (PVI) has become the cornerstone of treatment for AF. On the other hand, it is widely known that the trigger of AF sometimes originates from outside of PV, which is called non-PV foci and leads to the reduction of success ratio of PVI. However there is paucity on data about the predictors for non-PV foci. Dilated left atrium (LA) is also reported to be the risk of recurrence after PVI, and the best parameter to evaluate the LA size supported by American Society of Echocardiography and the European Association of Cardiovascular Imaging is LA volume index (LAVI). In this single-center, retrospective study, we aimed to analyze the relationship between LAVI and non-PV foci in AF patients.

Methods: We retrospectively analyzed 1590 consecutive AF patients who underwent their first PVI by cryoballoon catheter from September 2014 to March 2018. Patients who underwent PVI by radiofrequency catheter were excluded from this study because their electrically isolated area contain some part of LA posterior wall which may potentially be the non-PV foci. In all patients, LA volume was measured with transthoracic echocardiogram before the procedure. After PVI, induction of non-PV foci was performed by using intravenous infusion of isoproterenol, atrial burst pacing, and intracardiac defibrillation. The location of non-PV foci were divided into the following; superior vena cava (SVC), interatrial septum (IAS), coronary sinus (CS), right atrium (RA), left atrium (LA), unmappable, and peri-mitral atrial flutter (PMFL).

Result: Non-PV foci were identified in 507 (32%) patients including 46 (3%) with unmappable non-PV foci. The locations of non-PV foci were mostly found in SVC (n=239, 15%), followed by IAS.
(n=163, 10%), LA (n=145, 9%), CS (n=143, 9%), RA (n=140, 9%), PMFL (n=10, 1%). LAVI (Hazard ratio [HR] 1.01; 95% confidence interval [CI] 1.00-1.02; p=0.011), BMI (HR 0.96; 95% CI 0.93-0.99; p=0.014), and age (HR 1.01; 95% CI 1.00-1.02; p=0.027) were found to be the independent predictors for overall non-PV foci. The Multivariate cox regression analysis revealed that large LAVI was significantly independent predictors of non-PV foci in IAS (HR 1.01; p=0.014), LA (HR 1.03; p<0.001), CS (HR 1.01; p=0.03), PMFL (HR 1.05; p=0.002), and unmappable (HR 1.03; p<0.001). Also LAVI had good predictive value for the PMFL (area under the curve [AUC], 0.79; 95% CI 0.60-0.98), unmappable (AUC, 0.66; 95% CI, 0.57-0.74), and non-PV foci in LA (AUC, 0.66; 95% CI, 0.61-0.71).

Conclusion: Large left atrial volume index was significantly associated with the presence of non-PV foci; especially those in interatrial septum, left atrium, coronary sinus, peri-mitral atrial flutter, and unmappable non-PV foci.