The Electrophysiological Feature of Coalescence Inferior Common Pulmonary Veins in Patients with Atrial Fibrillation and the Usefulness of Ripple Map Guided Ablation

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Introduction: Although anatomical variations in branching pattern of pulmonary veins (PVs) to the left atrium have been reported using a multidetector computed tomography (MDCT) scan or magnetic resonance imaging, coalescence inferior common pulmonary veins (CICPVs) are known as rare anatomical variations. The electrophysiologic characteristics and the way of effective isolation remain to be elucidated. The aim of the present study was to examine the electrophysiologic characteristics of the CICPVs and to evaluate the usefulness of CARTO-based ripple maps to identify the conducting pathway as a target for ablation.

Methods: We conducted 362 cases pulmonary vein isolation (PVI) for drug-resistant atrial fibrillation (AF) from January 2016 to Jun 2019 at a single institution. All of them underwent contrast-enhanced 32-row MDCT of the chest and branching patterns of PVs were evaluated using reconstructed 3-dimensional PV models from CT scan data prior to the PVI procedure. Out of 362 cases, 4 cases had CICPVs. We collected High-density bipolar left atrial endocardial electrograms of them using CARTO3 system in pacing at coronary sinus and the conducting pathways in CICPVs were assessed using ripple maps.

Result: In all 4 patients, broad low voltage area (LVA) was recognized at the posterior wall of the CICPVs where none of ectopic firings triggering AF occurred. There was no electrical connection between CICPVs and the superior PVs. In addition, 3 out of 8 inferior PVs had no connection to left atrium. Ripple maps revealed a few narrow electrical pathways connecting between the LVA of CICPVs and LA, resulting in a small number of application of ablation to isolate the posterior of CICPVs.

Conclusion: CICPVs were present in 1.1 % of cases in patients with AF who underwent the PVI isolation procedure in our institution. There were a few connection sites between CICPVs and left atrium because of LVA in the posterior wall. Ripple map guided ablation could be an effective strategy for patients with the CICPVs by visualizing the limited electrical connection with LA.