**Relationship between Pulmonary Vein (PV) Leak Flow Velocity Assessed by Intracardiac Echography and Characteristics of Electrical PV Gap in Cryoballoon Catheter Ablation – A High-density Electroanatomical Mapping Validation Study.**

Atsushi Suzuki  
Ryudo Fujiwara  
Tomohiro Miyata  
Hiroyuki Asada  
Kohei Iwasa  
Kotaro Higuchi  
Hidenobu Seo  
Eri Masuko  
Shokan Kyo  
Fumitaka Soga  
Hiroyuki Shibata  
Amane Kozuki  
Ryoji Nagoshi  
Yoichi Kijima  
Junya Shite

**Introduction:** The Cryoballoon (CB) has been widely accepted as a tool for pulmonary vein isolation (PVI). However, usage of contrast media for fluoroscopy-based confirmation of PV occlusion with the cryoballoon is one of the limitations in patients with impaired renal function. Therefore, the aim of this study was to evaluate an approach where intracardiac echography (ICE) positioning was compared to fluoroscopy-positioning for evaluation of PV occlusion before ablation. Characteristics of electrical lesions were assessed with a high-density electroanatomical mapping system.

**Methods:** Paroxysmal AF patients who underwent PVI using the 2nd generation cryoballoon catheter were investigated. Prior to freeze, the peri-CB leak flow from the occluded PV was assessed using ICE and followed by contrast injection from the CB to be compared. CB ablation was performed using standard protocols, freeze of 180 sec or additional 60 sec freeze after electrical PV isolation. A high-density electroanatomical map was obtained prior to CB ablation and after each freeze to identify electrical PV lesion gap.

**Result:** A total of 76 freezes to 64 PVs in 16 patients (7 males, 69±9 year old, left atrial diameter of 37.4±6.0mm and PV antrum diameter of 19.8±3.4×18.2±5.2mm) were investigated. Baseline PV flow during sinus rhythm was 32.3±6.9 cm/sec. Twelve of 64 PVs required a 2nd freeze for electrical PV isolation and subsequently, in all PVs electrical isolation was achieved. In 64 first freezes, 17 peri-CB PV leaks on ICE and 35 contrast leaks were observed. All PV leaks on ICE were consistent with contrast leaks. Forty-seven PVs without leak on ICE were successfully isolated with the 1st freeze and did not show electrical PV gaps on high-density electro-anatomical mapping. Five of 17 PVs were electrically isolated with the 1st freeze and electrical PV gaps were not observed. Twelve PVs showed an electrical PV gap with a diameter of 9.0±4.2mm (Range; 2.7 to 14.5 mm). The figure shows a PV leak flow on ICE with and without electrical PV gap. PV leak flow velocity without electrical PV gap tended to be
higher than that with electrical gap (108.4±41.9 vs. 60.3±13.7 cm/sec, p=0.061). Spearman correlation test showed negative correlation between PV leak flow velocity and electrical PV gap diameter (r=-0.625, p=0.007).

**Conclusion:** In this study, PV leak flow velocity assessed by ICE showed a potential for predicting presence of electrical PV gap after CB ablation and ICE PV leak assessment could be a key to ICE guided contrast-free CB ablation.