Effect and safety of CT-fluoroscopy overlay system-guided cryoballoon application in right middle pulmonary vein

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Introduction: Right middle pulmonary vein (RMPV) is a relatively common pulmonary vein (PV) anomaly and a potential arrhythmogenic source of atrial fibrillation (AF). However, selecting RMPV during cryoballoon procedure (CRYO) is often difficult and poses a risk of phrenic nerve paralysis (PNP) because the phrenic nerve is in front of the right PV. Therefore, this study aimed to validate the usefulness and safety of selective CRYO-RMPV isolation using the computed tomography (CT)-fluoroscopy overlay system.

Methods: In total, 35 consecutive patients who had AF with RMPV, confirmed by 3D-CT prior to the CRYO, were included in this study. All patients underwent CRYO-RMPV isolation based on the CT-fluoroscopy overlay system. The PVs were considered successfully isolated if (1) the PV potentials recorded by Achieve® during freezing disappeared and (2) no PV potentials were detected by Achieve®. Post-ablation voltage mapping was performed on a 3D mapping system. During the ablation of the right PVs, we used the compound motor action potential (CMAP) for PNP monitoring by stimulating the phrenic nerve in the superior vena cava using a catheter. Transient PNP was defined as a hemidiaphragm paresis or paralysis detected by decreased CMAP, palpation, and X-ray during the procedure, which completely resolved before the end of the procedure. Furthermore, persistent PNP was defined as an elevated hemidiaphragm paresis or paralysis that persisted after the procedure.

Result: Guided by the CT-fluoroscopy overlay system, Achieve® was inserted into the RMPV in all 35 patients. All of the main PVs, including the RMPV, were isolated successfully in all patients. The number of applications owing to RMPV was 1.2 times (1–5 times). Although transient PNP occurred in one patient (0.3%), persistent PNP did not occur. Post-ablation map revealed that potentials in carina between the right superior PV and right inferior PV disappeared.

Conclusion: Selective CRYO-RMPV isolation using the CT-fluoroscopy overlay system to create a broad isolated region in the right PV is useful and safe for patients with RMPV.