Multiple Approaches for the Ablation of Atrial Tachycardia Originating from Right Upper Pulmonary Veins

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Introduction: Pulmonary veins are common sources of focal atrial tachycardia (AT). AT originating from right upper pulmonary veins (RSPV) are frequently encountered and can mimic AT from posterior right atrium (PRA) due to their close anatomical relationship. Double potentials (DPs) recorded from PRA or RSPV are helpful in distinguishing the true foci of the arrhythmia.

Methods: 5 patients with RSPV-AT underwent electrophysiology study (EPS) and radiofrequency catheter ablation (RFCA). Surface ECG were carefully analyzed before procedure. During mapping, the morphology of DPs (far-field vs. near-field) could be utilized to differentiate RSPV origins from PRA origins (Figure 1). RSPV-AT was confirmed by the earliest near-field atrial activation in RSPV. If early far-field potential is recorded at PRA, RSPV-AT was also highly suspected. Para-venous pacing maneuver was used for identification of electrical connection between RSPV and PRA. Ablation strategies included (A) Direct RF delivery at PRA where DPs were present; (B) Focal ablation at the earliest activation site if it was at the ostium of RSPV; (C) Circumferential isolation of RSPV or right pulmonary veins (Figure 2).

Result: All 5 patients had monophasic positive P wave in V1 and inferior leads during tachycardia. P wave in lead I were positive in 3 patients and flat in 2 patients. Mean cycle length was 274.8±103.9 msec. DPs could be recorded in 3/5 (60%) patients from either PRA or RSPV, with a mean time interval between both potentials of 39.7±4.0 msec. All 5 ATs were successfully ablated. The earliest activation time was 89.4±7.8msec prior to coronary sinus. Direct ablation at PRA where DPs were recorded was performed in three patients but was associated with tachycardia elimination in only one patient. In the other four patients, either focal ablation or pulmonary vein isolation was done. Para-venous pacing was performed in 3 of them and electrical connection between RSPV and PRA was identified in one patient. Considering the safety and effect, pulmonary vein isolation was performed if the target was deep inside the pulmonary vein and no connection between PRA and RPV, otherwise focal ablation was carried out. Long-term freedom of tachycardia was achieved in all of them and no pulmonary vein stenosis or phrenic nerve injury was observed.

Conclusion: A typical “posterior-superior and septal” origin on surface ECG and local DPs during mapping at PRA/RSPV were helpful in the diagnosis of RSPV-AT. Ablation can be performed via multiple approaches, among which direct RF at PRA seems less effective. Decision between pulmonary vein isolation and focal ablation can be made based on the proximity of the target to RSPV ostium, and whether there’s electrical connection between RSPV and PRA.