Case 1: typical AVNRT Therapy Cool Flex Cath

A 65 years old man was referred to our lab because of long lasting history of palpitation and ECG evidence of supraventricular tachycardia. His past medical history included hypertension, mild obesity and recurrent episodes of atypical chest pain. Physical examination was unremarkable. Baseline ECG was normal; echocardiography evaluation showed concentric left ventricular hypertrophy with preserved wall motion and mild mitral regurgitation.

Informed consent was obtained for electrophysiological study and ablation which were performed in non sedated, fasting state. Three quadripolar catheters were introduced through right femoral vein and placed respectively in His bundle region, high right atrium and right ventricle, another quadripolar catheter was placed inside the Coronary Sinus (CS) via left subclavian vein. Baseline recordings showed normal AH and HV interval. Ventricular pacing showed 1:1 retrograde VA conduction under 400 msec drive cycle. Programmed ventricular stimulation with single extrastimulus showed concentric and decremental retrograde conduction properties. (fig.1)

Fixed pacing at 360 msec drive cycle from high right atrium resulted in 1:1 AV conduction, sudden prolongation of AH interval and short RP supraventricular tachycardia induction (cycle length 350 msec - TCL). (fig.2) Earliest atrial activation was demonstrated on His bundle catheter during a short run of ventricular pacing during tachycardia, anticipation of local ventricular depolarization without altering the ongoing tachycardia exposed the atrial electrogram on proximal His bundle recording catheter that previously was buried inside the ventricular electrogram. (fig.3)

Programmed atrial stimulation at 600 msec drive cycle with single extrastimulus at 310 msec. demonstrated once again dual AV nodal conduction properties (fig.4); further shortening of coupling interval easily induced the same arrhythmia with short RP and 1:1 AV and VA relationship.

A diagnosis of AV nodal reentrant tachycardia was made.
Figure 1: From top to bottom are leads DI, aVL, aVF, V₁, V₂, and electrograms from the high-right atrium (RA 1-2), proximal and distal His bundle area (HBE p and HBE d), proximal and distal CS (CS 3-4, CS 1-2) and right ventricular apex (RV 1-2). Panel A, the RV 1-2 is being paced at a basic drive cycle length of 350 msec. with evidence of 1:1 retrograde conduction. Panel B, programmed ventricular stimulation from RV 1-2 shows decremental VA conduction with earliest atrial activation on His bundle catheter.
Figure 2: From top to bottom are leads DI, aVL, aVF, V1, V6 and electrograms from the high-right atrium (RA 1-2), proximal and distal His bundle area (HBE p and HBE d), proximal and distal CS (CS 3-4, CS 1-2) and right ventricular apex (RV 1-2). The RA 1-2 is being paced at a basic drive cycle length of 360 msec. with evidence of 1:1 AV conduction and sudden prolongation of AH interval (4th beat), consistent with slow-pathway conduction jump, and short RP supraventricular tachycardia.
Figure 3: From top to bottom are leads DI, aVL, aVF, V1, V6 and electrograms from the high-right atrium (RA 1-2), proximal and distal His bundle area (HBE p and HBE d), proximal and distal CS (CS 3-4, CS 1-2) and right ventricular apex (RV 1-2). The RV 1-2 is being paced at a basic drive cycle length of 350 msec. during ongoing tachycardia without altering atrial activation with evidence of earliest atrial activation on His catheter (arrow).
Figure 4: From top to bottom are leads DI, aVL, aVF, V_1, V_6 and electrograms from the high-right atrium (RA 1-2), proximal and distal His bundle area (HBE p and HBE d), proximal and distal CS (CS 3-4, CS 1-2) and right ventricular apex (RV 1-2). Programmed atrial stimulation protocol from RA 1-2 with single extrastimulus demonstrate sudden prolongation of AH interval > 100 msec with 10 msec reduction of S_1-S_2 coupling interval.
Therefore slow pathway ablation was performed utilizing the new open irrigated tip ablation catheter Therapy Cool Flex (St-Jude Medical). The slow pathway potential was used as target. Two pulse of RF (max. 40 W, 25 sec. 35 °C) were placed near CS os where a small amplitude, multicomponent atrial electrogram and a large ventricular electrogram were recorded on the ablator distal bipole (fig. 5). Application of RF energy on this site was associated to the induction of many giunctional beats (fig.6).

**Figure 5:** From top to bottom are leads DI, aVL,aVF, V1, V6 and electrograms from the high-right atrium (RA 1-2), proximal and distal His bundle area (HBE p and HBE d), proximal and distal CS (CS 3-4, CS 1-2), right ventricular apex (RV 1-2) and proximal and distal ablation catheter (ABL p and ABL d). Small amplitude, multicomponent atrial electrogram and a large ventricular electrogram are recorded on ABL d placed close to the CS os. Application of RF energy on this site was associated to the induction of many giunctional beats.
Figure 6: From top to bottom are leads DI, aVL, aVF, V1, V6 and electrograms from the high-right atrium (RA 1-2), proximal and distal His bundle area (HBE p and HBE d), proximal and distal CS (CS 3-4, CS 1-2), right ventricular apex (RV 1-2) and proximal and distal ablation catheter (ABL p and ABL d). Junctional beats were elicited during RF erosion close to the CS os.

After ablation programmed atrial stimulation did not induce any arrhythmia during the observation period of 30 min. Effective AV nodal refractory period was subsequently elicited at coupling interval of 300 msec (fig.7) and no change of AH interval was observed.
Figure 7: From top to bottom are leads DI, aVL, aVF, V₁, V₆ and electrograms from the high-right atrium (RA 1-2), proximal and distal His bundle area (HBE p and HBE d), proximal and distal CS (CS 3-4, CS 1-2), right ventricular apex (RV 1-2) and proximal and distal ablation catheter (ABL p and ABL d). Junctional beats were elicited during RF erosion close to the CS os.

Discussion: This report focuses on slow-pathway ablation utilizing a new tip flexible irrigated ablation catheter which allows to create a deeper lesion without increasing temperature at the interface between catheter-tissue interface. The catheter tip is capable of flexion upon tissue engaging a larger surface area and higher irrigation rate.