Case 1 **Left Atrial Tachycardia**

A 16 years old woman was referred to our institution because of recurrent episodes of palpitations and dizziness despite previous ablation procedure( 13 years ago) of postero-septal right accessory pathway . She remained asymptomatic until September 2009 when she started to complain palpitations which were short-lasting, self terminating and associated with emotional stress or physical activity. In the last 3 months, however, symptoms increased in frequency and duration.

Physical examination was unremarkable, baseline ECG and Echocardiogram were both normal. A 24 h ECG Holter showed rare episodes of self-limiting supraventricular tachycardia lasting no more than few minutes.

Informed consent was obtained for electrophysiological study and ablation.

In non-sedated, fasting state an EP study was performed. Four quadripolar catheters were introduced through left subclavian and right femoral veins and placed respectively in CS, His bundle region, high right atrium and right ventricle.

Baseline ventricular stimulation protocol showed ventricolo-atrial (VA) dissociation at very long drive cycles, during isoproterenol infusion there was no VA conduction at pacing cycles just under the spontaneous rhythm. This behavior ruled out the presence of an accessory pathway and excluded a diagnosis of an AVNRT (see fig.1)
Programmed atrial stimulation from the high right atrium repeatedly induced short runs of supraventricular tachycardia with 1:1 AV relationship (see fig.2). Isoproterenol infusion shortened the cycle length of this arrhythmia and made it sustained and easily inducible spontaneously or with atrial pacing. At this point a diagnosis of atrial tachycardia was straightforward.

Considering the short duration of P wave on surface ECG (partially covered by ventricular repolarization) and almost simultaneously atrial activation in HRA and His bundle region we decided to map the atrial septum. A very early atrial activation region (preceding of 35 msec. the electrogram on His catheter) was located on supero-posterior portion of the interatrial septum above and posteriorly the fossa ovalis.
Fig 2: Programmed atria stimulation from high right atrium with single extrastimulus (drive train 350 msec, S1 200 msec) induced supraventricular tachycardia with 1:1 AV relationship. Same tracings as in Fig. 1

Application of radiofrequency in this location determined speed up of the tachycardia and subsequently degeneration in atrial fibrillation. After sinus rhythm was restored by external cardioversion, the atrial tachycardia was still inducible with atrial pacing and isoproterenol infusion (see fig 3). Considering the location of earliest right atrial electrogram, we decided to map the left side of the interatrial septum and right pulmonary veins. We obtained left atrial access through a PFO. A well circumscribed region of fragmented atrial potentials with preserved voltage was found in ostial region of superior pulmonary vein. Application of a single pulse of RF resulted in AT acceleration rate and then sudden interruption, 2 RF applications in the same region were deployed targeting fragmented potentials. Subsequent atrial stimulation protocol during high dose of isoprenalin failed to induce any arrhythmias.
Fig. 3: From top to bottom are leads DI, DII, DIII, aVL, 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 coronary sinus (CS 3-4 and CS 1-2) and right ventricular apex (RV 1-2). Proximal and distal bipolar electrograms from mapping catheter (ABL d, ABL d) show very early activation (-35 msec from His bundle atrial electrogram, as reference for mapping).

Fig. 4: Application of radiofrequency on the site shown in figure 3 determined speed up of the
tachycardia and degeneration in atrial fibrillation. Same tracings as in figure 3

Fig 5 left atrial mapping through patent foramen ovale. The electrograms on the mapping catheter (ABLp, ABLd) are recorded from the ostial region of right superior pulmonary vein and show even earlier activation respect to the His bundle electrogram.

Discussion: According to medical history and age, our first thought in this case was to exclude the presence of an accessory pathway or AVNRT, being symptomatic atrial tachycardia uncommonly encountered. Ventricular pacing response even in absence of tachycardia clearly excluded rapid conduction through an accessory path and made quite low the probability of induce an AVNRT. Even though atrial tachycardias are better defined with 3D activation mapping, careful analysis of the electrograms morphology and timing allowed to target the site of origin in a small area. Considering the young age of this patient and the well localized area of complex electrograms we decided do not perform complete ostial PV isolation.