Prediction of termination/conversion and subsequent second circuit of atrial tachycardia

Backgrounds: Ablation procedures, cardiac surgeries, and extensive fibrosis may create the substrate of complex ATs. In these ATs, to predict the impact of ablation and the subsequent circuit of the second tachycardia is sometimes difficult. We aimed to elucidate the simple algorithm to predict the behavior of AT during radiofrequency application from the primary activation map of high-density mapping system.

Methods: A simple algorithm for predicting termination/conversion of AT and the subsequent second AT circuit, associated with the ablation site, was developed from 71 index AT-activation map (retrospective phase) using high-density mapping system. The algorithm showed the sensitivity of 98.3% and the specificity of 83.3% to predict the termination/change of AT during ablation and the subsequent second AT circuit. This algorithm was subsequently tested prospectively in 188 consecutive ATs in 135 patients (Prospective phase).

Result: 13 focal ATs, 20 ATs without complete activation map, and 5 undiagnosed ATs with complete activation map was excluded from the study. Among 150 ATs, 115 ATs were predicted to be terminated, among which 5/115 (4.3%) was converted to another AT. Thirty-five ATs were predicted to be converted to another AT, among which 1/35 (2.9%) was terminated. The sensitivity and the specificity to predict termination/ conversion of AT during ablation was 99.1% and 87.2% in total, 100% and 80.0% in macroreentrant AT, 100% and 90.9% in non-macroreentrant ATs, and 91.7% and 92.3% in deal-loop AT, respectively. Five ATs which were supposed to be terminated but to convert to the second ATs used the other atrial chamber or the epicardial structure in the second AT circuit.

Conclusions: With the high-density mapping system, termination/conversion of the AT and the subsequent AT circuit was highly predictable from the index activation map.

High density to AVNRT, new insight

Background: Sinus impulse propagation and activation inside the Koch’s Triangle (KT) remains a controversial issue. The exact origin and significance of multicompontent potentials referred to as slow pathway (SP) potentials, are not perfectly known to date.

Purpose: Clearly define the propagation of the sinus impulse in the KT and the conduction path and the switch between the slow and the fast pathway during atrioventricular nodal reentrant tachycardia (AVNRT) in patients who underwent SP ablation.

Methods: The 3-D KT geometry was created both during sinus rhythm and tachycardia from the basket mapping catheter IntelliMap OrionTM and the RHYTHMIA Mapping System (Boston Scientific). The dual pathway physiology and the presence of collision between different wave-fronts inside the KT were confirmed through the propagation map. The collision points, joined by the line of collision (LOC), were tagged on the map. The basket catheter was then positioned at the site of LOC and the distribution and timing of all SP potentials in the KT were collected.

Results: 5 consecutive successful SP ablation cases of AVNRT were included. The mean acquired points of RA were 5800±600; 250±50 of these were acquired inside the KT. The mean time of a complete RA mapping was 17±2 minutes. The mean KT area was 30.6±29.9 mm² and the mean slow pathway area was 9.4±1.5 mm² resulting in a relative percentage of 30.6±2.6%. In all the cases the wave-front descends from the fast pathway (from the anterior limbus in an anteroposterior –superior to inferiordirection) and it rises through the slow pathway. A portion of the wave-front slides posteriorly to the coronary sinus and ascends around the tricuspid valve. Multicomponent potentials were identified inside KT in the majority of the patients and were invariably found on the line of collision between the wave-fronts activating the KT in opposite directions, specifically between the coronary sinus and the tricuspid valve. None of them were found outside the KT area. The mean distance of SP potential from the first activation was 13.8±1.6mm. After a mean of 1.2±0.4 RF ablations we obtained the abolition of the SP. The successful ablation was confirmed during sinus rhythm by looking at the junctional beats during RF delivery and performing additional conventional pacing maneuvers at the end of ablation.

Conclusions: Our findings could have practical implications for improving the traditional anatomy-guided approach within the triangle of Koch. The use of a propagation map-guided ablation technique for AVNRT ablation may result in faster selection of ablation site, reduction of RF delivery and shorter fluoroscopy time.