A MINIMAL FLUOROSCOPIC APPROACH TO AVNRT ABLATION WITH RHYTHMIA HDx™

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Introduction

Catheter ablation is the treatment of choice for many supraventricular tachycardias (SVTs). Fluoroscopy has been the primary tool for visualizing catheter position while X-ray radiation can be a risk to both patients and medical staff in the cardiac catheter lab. In recent years several papers and case-reports have been published showing the feasibility and safety of a minimized fluoroscopic exposure using 3D-mapping systems principally to navigate catheters through the vessels and the heart chambers.

In our cardiac catheter lab, we have experience ablating SVTs under fluoroscopic guidance and using 3D-mapping systems. However, this report aims to present our method to ablate SVT and Atrial Flutter with minimal x-ray exposure using the RHYTHMIA HDx™ (Boston Scientific) mapping system and the navigation enabled low noise INTELLANAV™ ST and INTELLANAV™ MIFI™ XP (Boston Scientific) solid tip ablation catheters. This workflow has been developed and implemented successfully for 30 AVNRT, 7 AVRT and 12 RA flutter cases to date. These cases were performed by 4 different operators using INTELLANAV™ MIFI™ XP for atrial flutters and INTELLANAV™ ST for the AVNRT and AVRT procedures.

Clinical Experience

For the purpose of AVNRT ablation, in addition to the RHYTHMIA HDx™ mapping system, we use the following disposables:

- INTELLANAV™ ST standard or large curve ablation catheter (Boston Scientific).
- POLARIS™ decapolar coronary sinus (CS) catheter (Boston Scientific).
- VIKING™ Josephson 4 pole fixed curve diagnostic catheter (Boston Scientific).

Methodology

Our workflow has three phases, 1) "Patient Preparation" 2) "Anatomy and Field Map Acquisition " and 3)"Diagnostic Catheter Placement". Firstly, an additional external patch is connected to the patient as the field map reference. Then, the right atrial anatomy is mapped using the NAV-enabled INTELLANAV™ ST catheter. This also generates a field map which is used to navigate the two impedance-tracked diagnostic catheters; one in the CS and the other in the RV. Once the catheters are in position an EP study is performed, treatment strategy defined, and ablation delivered.

Phase 1: Patient Preparation

The patient is prepared using standard ECG electrodes and the RHYTHMIA HDx™ back patch (Figure 1). For the internal system reference, an external indifferent electrode is used. This patch is connected to pin-1 on the Box IN by using the MIFI filter box reference cable. This electrode is chosen as the impedance reference for the field map.

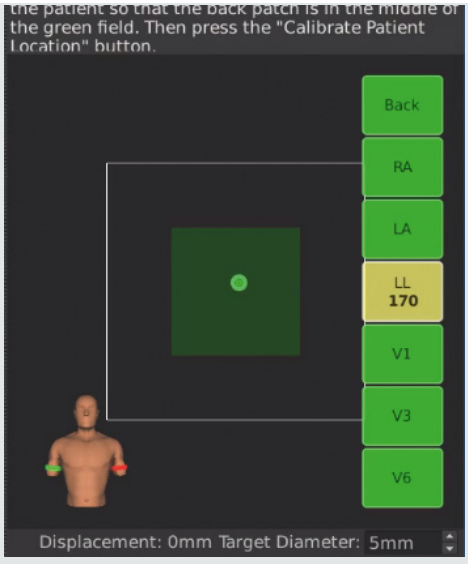

Figure 1: The back patch must be centered in the green square with an impedance reading under 170Ω to enable a high quality field map.

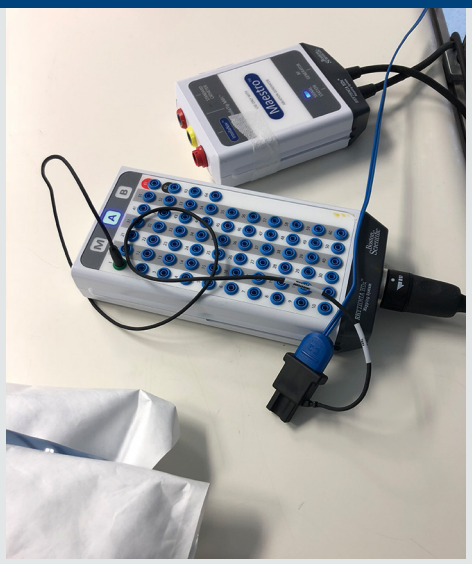

Figure 2: The external patient reference is connected into port A1 on Box IN on the RHYTHMIA HDx™ system.

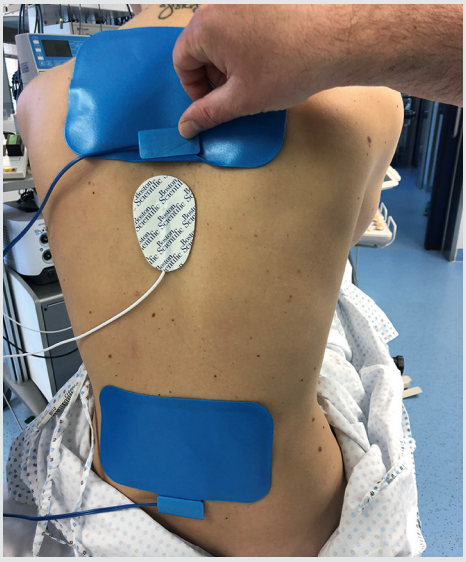

Figure 3: An indifferent electrode is placed on the upper back directly above the RHYTHMIA™ back patch. A separate indifferent electrode connected to the MAESTRO™ 4000 RF generator is placed on the lower back.

Phase 1: Anatomy and field map

Once the setup is complete, an anatomical map is created with manual setup using an ECG channel as the system timing reference, given that diagnostic catheters will be placed in phase 3 of set up. The INTELLANAV™ ST catheter is advanced through the femoral vein, up the inferior vena cava and into the RA. The magnetically tracked catheter can be visualized on RHYTHMIA HDx™ as soon as it is inserted into the femoral vein.

We continue to collect anatomy as the catheter is advanced, building geometry up into the RA.

To allow for optimal impedance tracking in the EP study the INTELLANAV ST™ catheter is moved within the RA chamber to create a geometry. We usually tag the His bundle and tricuspid valve positions as key reference markers within the right atrial geometry. By creating the field map, the RHYTHMIA HDx™ is now able to track all the catheters (Figure 4).

Phase 3: Diagnostic catheter placement

The POLARIS™ decapolar catheter is inserted through a femoral sheath and advanced up the IVC.

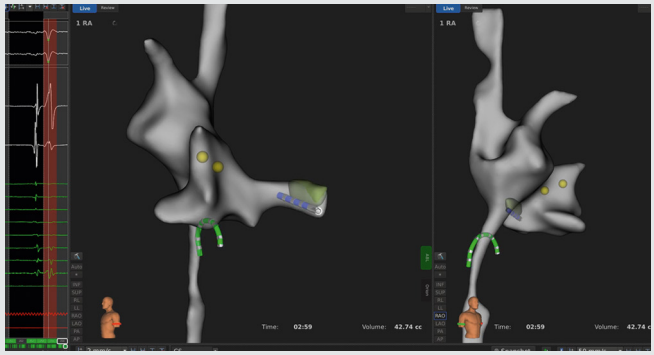

Figure 4:
The RA anatomical map created with INTELLANAV™ ST. The green catheter seen here is the decapolar catheter prior to its insertion into the CS ostium.

Once the RA anatomy is completed, the CS catheter is placed in a stable position within the CS. This catheter is well visualized within the RHYTHMIA™ map now (Figure 5).

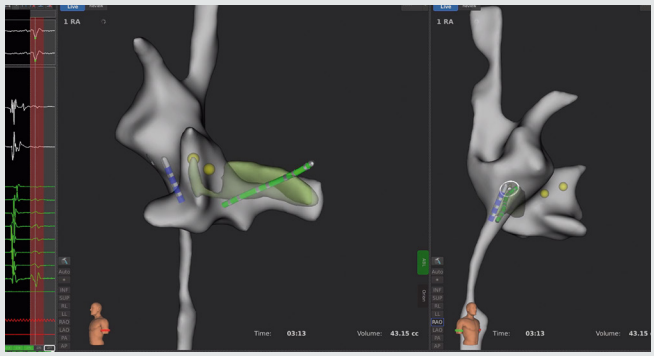

Figure 5:
CS catheter placement. The catheter is accurately displayed within the RHYTHMIA HDx™ field map created using the INTELLANAV™ ST which is referenced to the external patch. After the CS catheter is positioned, using impedance tracking, the VIKING™ 4 pole catheter is moved from the IVC into the right ventricular (RV) apex (figure 6).

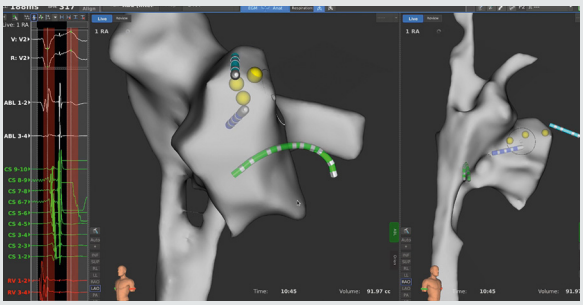

Figure 6: The field map enables visualization of additional catheters. Here a VIKING™ quadrapolar catheter is visualized in the RV. With the geometry created and the catheters in position an EP study for AVNRT is performed.

EP Case Study

A retrograde stimulation from the RV was performed (drive of 600ms, decremental extra-stimulus from 480 ms) to ensure A-V dissociation and the absence of any accessory pathway. This maneuver was followed by a standard stimulation protocol using proximal CS electrodes (drive: 600 ms, decremental extra-stim: from 480ms). The AVNRT was inducible at 600/340 ms. After mapping the Koch triangle with the INTELLANAV ST™ catheter, a target potential was located on the slow pathway 12 mm below the His (figure 7).

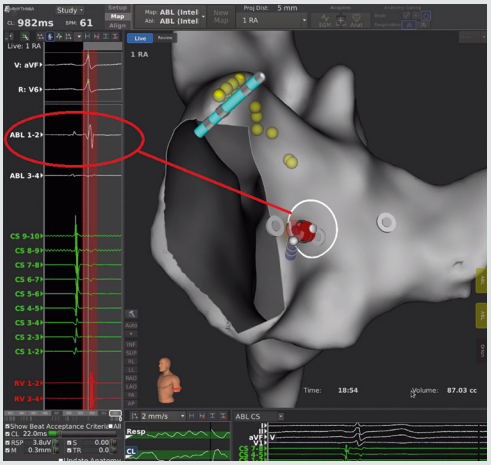

Figure 7: Slow pathway potential detected with the INTELLANAV ST™ catheter. The INTELLANAV ST™ was placed in a stable position on the target potential and RF energy was delivered in temperature control mode with the MAESTRO™ 4000 RF generator (Boston Scientific) using settings 50W/55°C. During the RF application junctional beats were seen (Figure 8). RF was applied for 180 seconds before checking the AVNRT was non-inducible using pacing maneuvers.

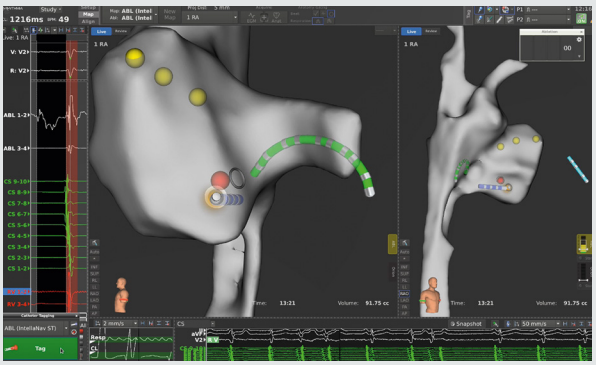

Figure 8: During ablation. junctional beats can be seen clearly. The INTELLANAV™ ST is accurately visualized in a stable position on the target area. Post ablation, the tachycardia could not be re-induced. The procedure was completed successfully in 40 mins, with a total ablation time of 180 seconds and without the use of fluoroscopy. The total procedure time included a 14-minute validation map to check success (Figure 9). We routinely perform right sided ablations such as this AVNRT under RHYTHMIA™ mapping guidance with minimal x-ray exposure.

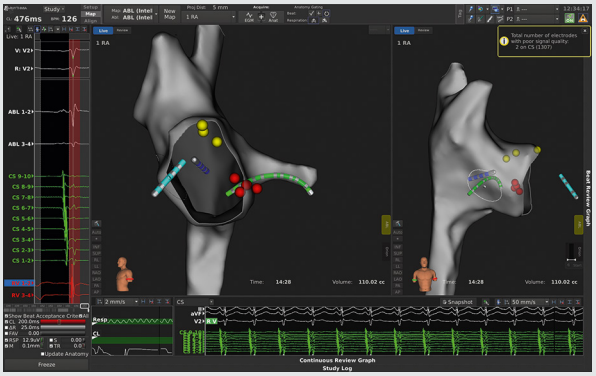

Figure 9: 3D anatomical map of RA post AVNRT ablation with INTELLANAV ST™ catheter.

Conclusions

This optimized workflow with RHYTHMIA HDx™ enables us to minimise X-ray usage for conventional AVNRT and other SVT procedures such as AVRT and Flutter. It supports well our clinical practice.

- The procedural time is comparable to that using fluoroscopic guidance only.
- The ablation strategy and RF applications are reliable when performed using the low-fluoro approach.
- This workflow significantly reduces X-ray exposure for patients and the lab staff.
- INTELLANAV™ catheters are tracked within RHYTHMIA™ with an accuracy of better than 1 mm (compared with < 2 mm accuracy with impedance only tracked catheters).
- INTELLANAV™ ST performs well in terms of maneuverability, signal clarity and RF delivery. The catheter handles most similarly to the Blazer platform.
- The additional cost associated with using NAV-enabled catheters and mapping patches is justified by the higher accuracy, reduced x-ray exposure, improved procedural outcomes and safety benefits of this low-fluoro approach.
- This workflow is fundamental for some patient groups presenting with 'simple' right atrial tachycardias such as: infants, children, pregnant women and breast feeding mothers where x-ray exposure should be minimal if not completely avoided.

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