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USE OF THE INTELLANAV STABLEPOINT™ ABLATION CATHETER IN THE CONTEXT OF RECURRENT ATRIAL FIBRILLATION: DOES THE COMBINED ASSESSMENT OF CONTACT FORCE AND LOCAL IMPEDANCE IMPROVE LESION FORMATION?

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Introduction

As a result of the high rate of atrial fibrillation (AF) recurrence following radiofrequency (RF) ablation, patients may undergo a subsequent pulmonary vein isolation (PVI) procedure. These "re-do" procedures pose challenges and necessitate specific procedural requirements. An ultra-high density mapping system is required to precisely identify the reconnection sites within an abnormal electrophysiologic environment characterized by low voltage and heterogeneously scarred tissue. The physician must also assess the presence and the extent of pulmonary vein (PV) reconnection and/or other suitable targets via prognostic left atrial (LA) mapping prior to completing PVI with a minimal set of ablation lesions.

Given the importance of the ablation lesion set in outcomes, several approaches have been suggested to enhance lesion creation and quality, thereby, enhancing procedural efficacy. These approaches include monitoring contact force (CF), the use of surrogate indices such as the force time integral (FTI) and ablation index (AI) and the local impedance (LI) drop. A new ablation catheter, INTELLANAV STABLEPOINT™ featuring DIRECTSENSE™ Technology (Boston Scientific), provides information about both contact force (CF) and local impedance to improve tissue characterization and lesion prediction during RF ablation. The INTELLANAV STABLEPOINT™ Ablation Catheter is the only catheter available that can provide information on both the electrical and mechanical loads.

We present a case that underlines the capabilities of this new technology in the setting of a PVI procedure for recurrent AF.

Patient history

A 63-year-old, male patient was admitted to our hospital for AF recurrence following a PVI procedure performed four months previously.

Procedure

The procedure was performed under conscious sedation. A VIKING™ decapolar catheter (Boston Scientific) engaged the coronary sinus to obtain a stable reference for posterior mapping. Two transseptal punctures were performed following the standard workflow in our institution to cross the septum and prepare for LA mapping. After achieving an activated clotting time >300 sec, an INTELLAMAP ORION™ Mapping Catheter (Boston Scientific) was introduced into the LA through a ZURPAZ™ steerable sheath (Boston Scientific). An INTELLANAV STABLEPOINT™ catheter was introduced through a non-deflectable sheath. After insertion, the ablation catheter was warmed up in order to initialize the inductance off-set value used to measure the CF (Figure 1).

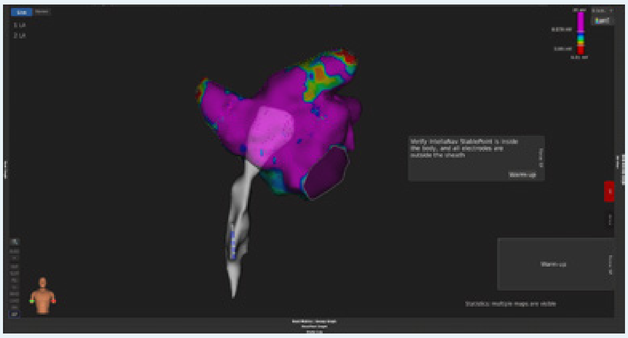

Figure 1. After the INTELLANAV STABLEPOINT™ catheter is inserted in the body, the user should allow the catheter to warm up by exposing the tip electrodes out of the sheath. The process takes a maximum of 2 minutes.

The CF sensor must then be calibrated to a zero value. During calibration, the catheter must be outside the sheath and free of contact with the heart chamber or any other catheter (Figures 2a-b). Signals displayed on the distal bipole and local impedance baseline values help guide the physician to the optimal position for setting the zero value.

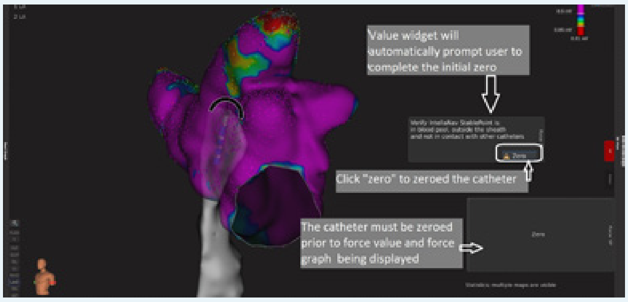

Figure 2a. Pressing the "Zero" button calibrates the INTELLANAV STABLEPOINT™ Ablation Catheter.

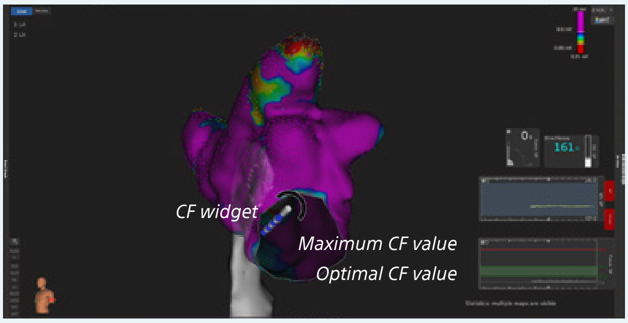

Figure 2b. After the INTELLANAV STABLEPOINT™ Ablation Catheter is zeroed, it is possible to see information about the CF. The graph shows the variation of the force as a function of time, and the number represents the CF value in grams. The green zone on the graph represents the optimal CF value (10-20 g). The red line represents the maximum CF value (50 g).

The widget with the numeric value of the CF can also display information about the angle created at the interface between the catheter and the tissue. The catheter tip visualization is now black. It will be colored based on the variation of the CF value. The graph of local impedance as a function of time and the numeric value of the local impedance in ohms has been added on the screen.

Mapping

The INTELLAMAP ORION™ catheter was used in combination with the RHYTHMIA HDx™ Mapping System (Boston Scientific) to create an ultra-high-resolution map of the LA in sinus rhythm. A total of 8,212 EGMs was collected in approximatively 17 minutes. The substrate, which had been influenced by previous ablation, was automatically analyzed through high resolution signals, propagation mapping and the LUMIPOINT™ Module (Figure 3). In this case, reconnections were found in 3 of the 4 PVs. The right inferior PV was disconnected (Figure 4).

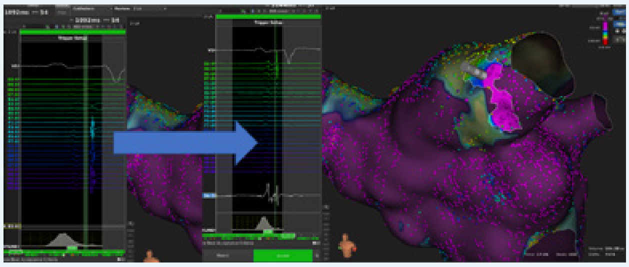

Figure 3. LUMIPOINT™ analysis can be performed by using the "simple activation" green window positioned between the atrial far field and PV potentials. "Complex activation" EGM filtering automatically highlights specific slow conduction gaps.

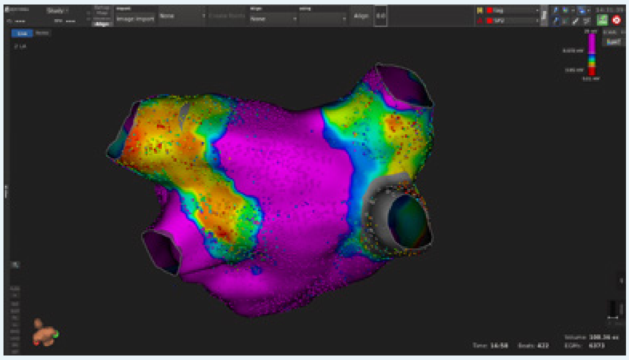

Figure 4. The voltage map (posterior-anterior view, 0.5-0.05 mV) shows reconnections in the left superior (LS), right superior (RS) and left inferior (LI) PVs; the right inferior (RIPV) is electrically disconnected.

Ablation

We used the MAESTRO 4000™ RF generator (Boston Scientific) and METRIQ™ (Boston Scientific) irrigation pump to deliver RF using 35 W on the anterior wall and 30 W on the posterior wall. The METRIQ™ was set to deliver 2 ml/min, low flow, when RF was not being delivered and to automatically increase flow to 17 ml/min when power was ≤ 30W and to 30 ml/min when power was > 30 W.

We assessed appropriate mechanical contact and stability by viewing the CF using a target range of 10 to 20 g. Upon reaching the required CF value, the force number on the widget was green and the catheter tip visualization displayed four green indicators (Figure 5). At CF values > 20 g, the number in the display turned yellow and the catheter tip visualization displayed six yellow indicators (Figure 6). Note that at CF values >50 g, both indicators turn red to alert the physician of an excessive mechanical load on cardiac tissue. If the mechanical contact exceeded this upper limit, the screen turns completely red to alert the physician.

This high force value was never reached during the case currently under discussion. After the catheter was in a stable position with good mechanical contact, RF was initially delivered to the LSPV. During RF application, we looked for an acute decrease in local impedance >20 ohms combined with attenuation of the EGM on the distal tracing. In order to ensure effective transmural lesion creation, we also aimed to achieve stable and sufficient mechanical contact (Figures 7a-b).

If the decrease in local impedance was slow and/or <20 ohms and the mechanical contact was <6 g, RF delivery was interrupted and the catheter repositioned to improve the mechanical contact and tissue-catheter electrical coupling. RF delivery was terminated if the local impedance drop was >45 ohms to avoid potential steam pops.

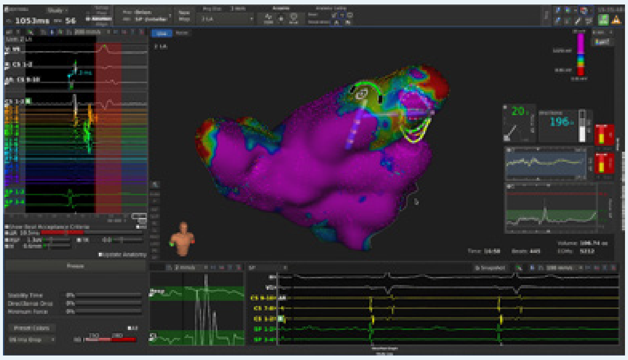

Figure 5. The CF reading and tip widget were green indicating that optimal force was applied (target range 10-20 g).

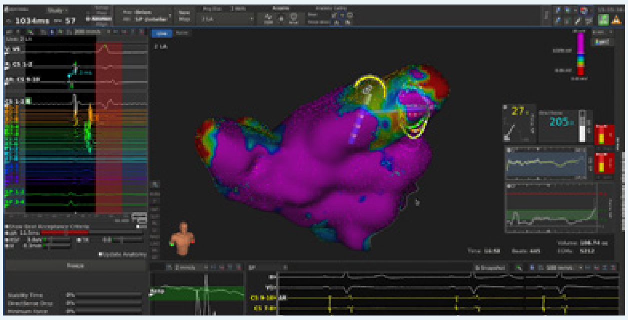

Figure 6. The Yellow CF and tip widgets indicating suboptimal force application (greater than the target range but less than maximum force).

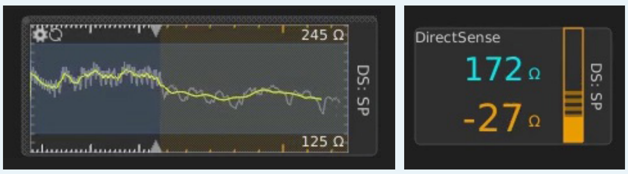

Figure 7a. Example of local impedance drop during RF application.

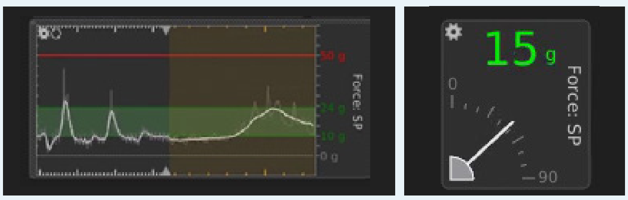

Figure 7b. Example of Contact Force interface in SW4.0.

We continued point-by-point ablation an inter-lesion distance ≤6 mm at the targeted locations where the gaps were identified. The tags were delivered automatically using the AutoTag™ module included in RHYTHMIA HDx™ SW4.0, which delivered a tag when the catheter stability, the minimum force and the minimum local impedance drop criteria were achieved. Tag coloring was based on the local impedance drop (Figure 8). A 3 mm tag radius was used in order to guarantee a correct inter-lesion distance of ≤6 mm. This same workflow was applied to LSPV, LIPV and RSPV that were found to have reconnected segments during mapping.

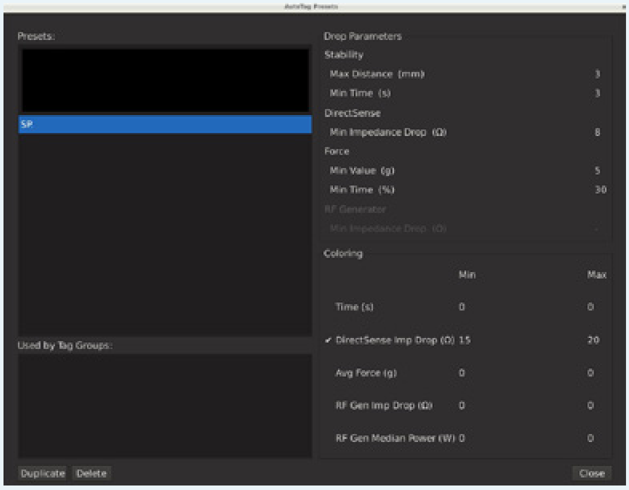

Figure 8. Example of Autotag™ presets. The parameters chosen for the tag drop were catheter stability, minimum local impedance drop and minimum force value. The tag coloring was based on the local impedance drop.

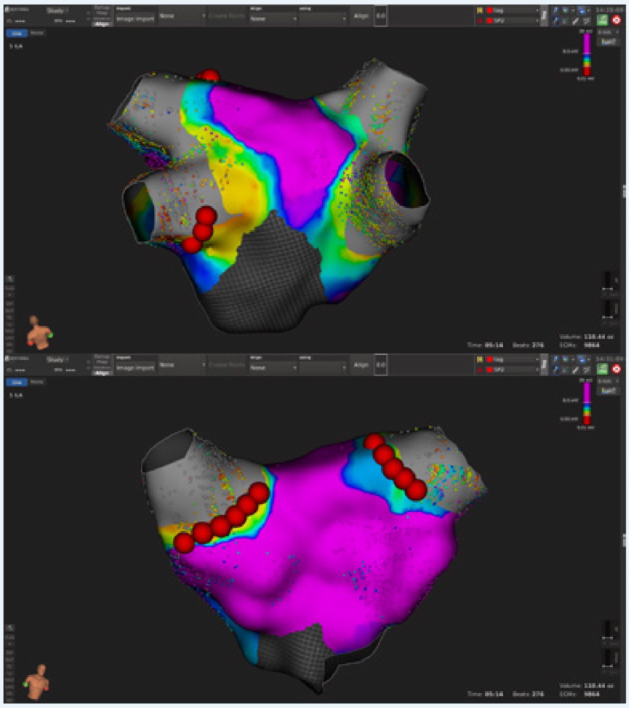

Figure 9. Final remap showing the lesion sets.

Conclusion

This case illustrates the use of the INTELLANAV STABLEPOINT™ Ablation Catheter featuring both local impedance and CF technology for recurrent AF. Re-do procedures present specific challenges in terms of mapping and lesion creation in areas of tissue heterogeneity. In this setting, this unique technology facilitated assessment of catheter stability, including appropriate mechanical stability and enabled optimal RF delivery at the targeted reconnection sites. Creation of point-by-point transmural lesions proceeded smoothly in a predictable and reproducible manner.

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