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CASE REPORT

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Utility of directional high-density mapping catheter (Advisor™ HD Grid) in complex scar-related atrial tachycardia

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Abstract

Mapping of scar-related atrial tachycardias (AT) can be challenging even with the use of high-density (HD) mapping catheter. Advisor™ HD Grid is the only directional HD mapping catheter which not only identify local electrical signal but more importantly capture the direction of wave front propagation especially in low voltage zone. Accordingly, we present a case of complex scar-related AT with the use of Advisor™ HD Grid which showed clear fractionated signal at isthmus area as compare to the absence of signal on ablation catheter at the same area despite adequate contact force. Ablation at this area terminated the tachycardia.

KEYWORDS

Advisor™ HD Grid high-density mapping catheter, atrial tachycardia, complex scar-related atrial tachycardia, directional high-density mapping catheter, low voltage zone

1 | INTRODUCTION

Catheter ablation is the cornerstone for treatment of symptomatic complex scar-related AT. However, the acute procedure success with termination (by ablation) of all ATs without the use of non-HD mapping catheter is low.[1] We present a case of complex scar-related AT with the use of Advisor™ HD Grid as HD mapping catheter.

2 | CASE REPORT

A 47-year-old man, ex-intravenous drug user, history of tricuspid valve infective endocarditis with severe tricuspid regurgitation treated with antibiotics followed by bioprosthetic tricuspid valve replacement 4 years ago. He first presented with symptomatic AT 3 years ago at another institution. ECG was suggestive of typical atrial flutter. He underwent cavotricuspid isthmus (CTI) line ablation. However, he had recurrent AT with a different ECG appearance and underwent redo ablation, eventually terminating with ablation at mid septal right atrial (RA) at the same institution. Both procedures were done without the use of HD mapping catheter. He presented to us with symptomatic recurrent AT and consented for repeat catheter ablation procedure.

The procedure was performed under conscious sedation with three catheters approach via right femoral vein. A decapolar catheter (Livewire 6 French decapolar catheter [Abbott Technologies]) was placed at coronary sinus (CS). Advisor™ HD Grid HD mapping catheter (Abbott Technologies) was used to create local activation timing (LAT) map and voltage map (a peak-to-peak bipolar voltage <0.05 mV and 0.05-0.5 mV were defined as scar and low voltage zone, LVZ, respectively) via Ensite Precision 3D mapping system (Abbott Technologies). Both bipolar (high-pass filter 30 Hz, low-pass filter 300 Hz, noise filter) and unipolar (high-pass filter 0.5 Hz, low-pass filter 100 Hz, and noise filter) filters were switched on.

The patient was in AT at cycle length (CL) of 290 milliseconds. Atrial activation was concentric. Entrainment from CS showed

shorter post pacing interval (PPI) minus tachycardia CL at proximal CS (PPI-TCL = 205milliseconds) compared to distal CS (PPI-TCL = 255 milliseconds) indicating right-sided AT. The CTI line remained blocked as a result of previous ablation. Accordingly, local activation time (LAT) mapping (activation window was set at 95% AT CL) was performed at RA which showed that the AT was a macro-reentrant tachycardia with the activation timing equal to tachycardia CL (Figures 1 and 2). The isthmus (isthmus width size: 11mm) was located at the mid posterior lateral wall (Figure 1). At this area, there was clear low-amplitude, high-frequency fractionated signal (amplitude: 0.07 mV) in mid-diastolic phase seen at Advisor™ HD Grid catheter (A2-B1). However, there was no signal seen on pressure sensing 3.5mm irrigated tip ablation catheter with 2-2-2 mm interelectrode spacing (Tacticath, Abbott Technologies) despite good contact force of 25 g at the similar position (Figure 1). Ablation at 30 watts resulted in the termination of tachycardia in 10 seconds. Further ablations were performed to create a line of block. Subsequent voltage mapping (Figure 2) during sinus rhythm showed

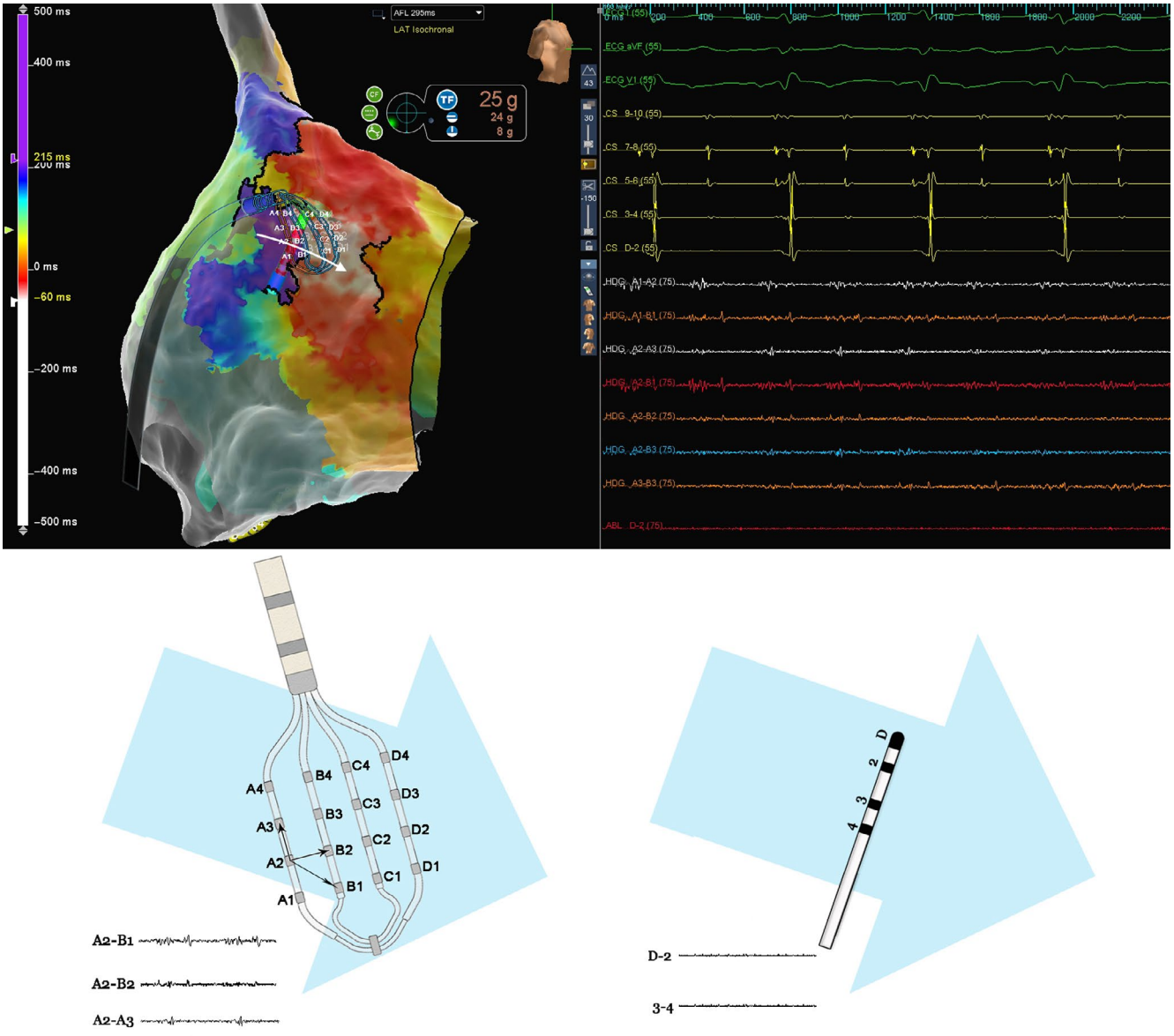

FIGURE 1 (Above) Local activation timing map (left) of right atrium showing position of Advisor™ HD Grid mapping catheter together with ablation catheter and wave front propagation (white arrow). The intracardiac electrogram is on the right. At the isthmus located at mid posterior lateral wall of right atrium, there was low-amplitude, high frequency fractionated signal (amplitude: 0.07 ms) at diastolic phase which was clearly seen at A2-B1 configuration, whereas no signal on ablation because of orientation of the ablation catheter that was prependicular to the wave front propagation. (Below) Advisor™ HD Grid mapping catheter (left) showing activation wave front that were registered at A2-B1 and A2-B2 configuration (parallel to the wave front activation). Quadripolar catheter (right) showing no electrical signal registered because of the activation wave front that travels perpendicular to the catheter position. The scale of the amplitude (set at 75 as opposed to 55 by default) of both HD grid and ablation catheter is the same as shown in the intracardiac electrogram on top right

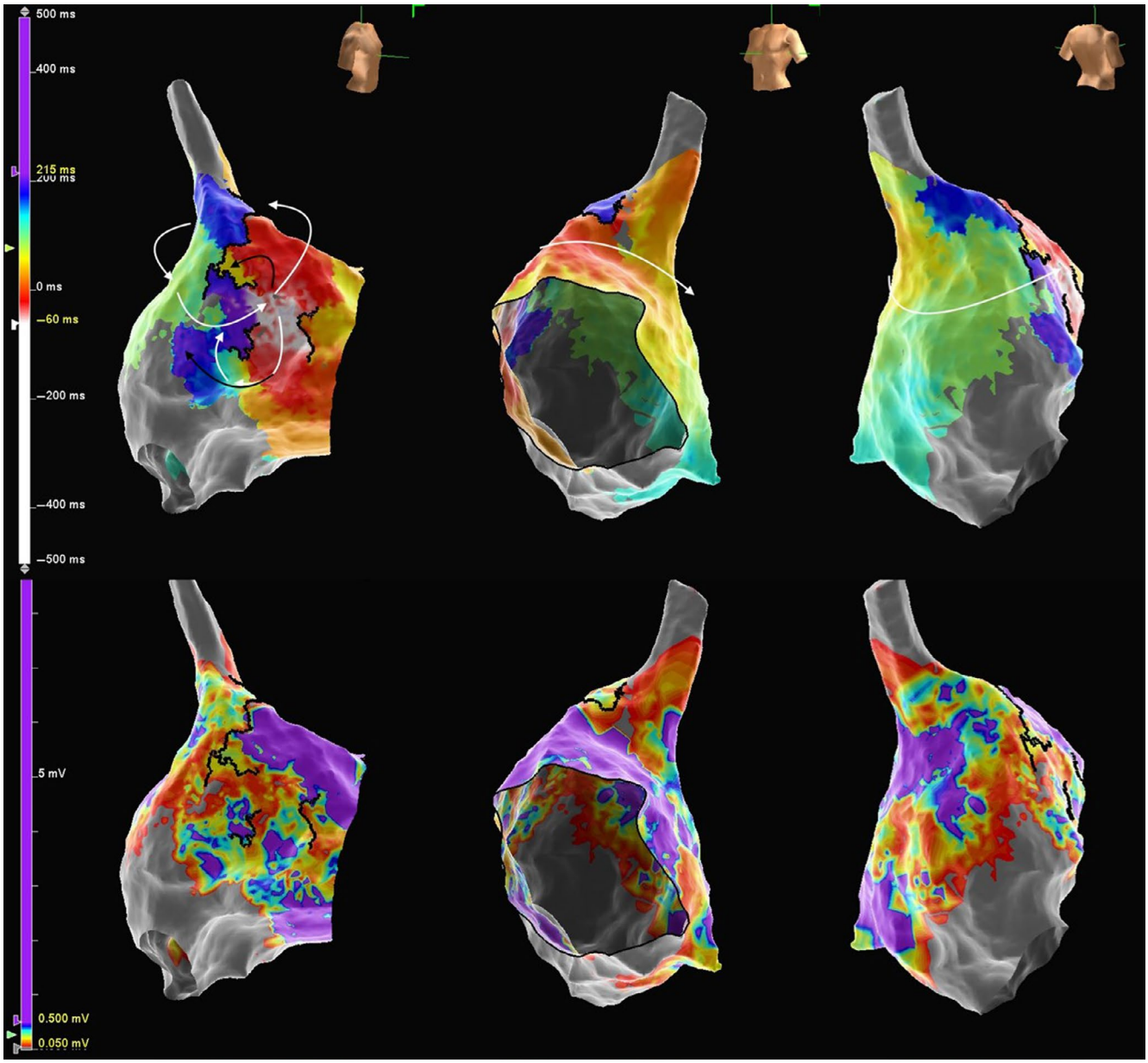

FIGURE 2 (Above): Local activation timing map in RAO 30° cranial 15° (left figure), LAO 45° (middle figure) and PA view (right figure) of right atrium. The white arrow showed direction of the activation wave front. The dark arrow showed the activation wave front ended in blind loop. (Below) Voltage mapping of right atrium during sinus rhythm showed extensive low voltage zone in the posterior lateral of right atrium corresponded to the isthmus area. A total of 107 200 points collected and 4720 points being utilized

the LVZ corresponded to the isthmus area. At the end of procedure, tachycardia was noninducible with or without isoprenaline as well as during isoprenaline wash-out and with atrial pacing down to 200ms. The total procedure time and radiation dose were 153 minutes and 24963 mGy/cm^2, respectively.

3 | DISCUSSION

Our case demonstrates the use of HD mapping catheter (Advisor^{TM} HD Grid) to facilitate the identification of not only small amplitude high frequency electrical impulses with anisotropic conduction but also the direction of impulse propagation at isthmus site. The Advisor^{TM} HD Grid is a rectangular shape HD mapping catheter consists of 16 electrodes that were equally distributed across four splines (4 electrodes [3 mm electrode] per spline with interelectrode distance of 3mm). The recording of electrical impulse is acquired along and across the splines between adjacent electrodes (Figure 1). Electrical signal with highest amplitude (parallel to the electrode) will be taken as a point and forming the direction of activation wave front. In our case, the fractionated signal was clearly seen in Advisor^{TM} HD Grid at A2-B1 configuration which was parallel to the wave front propagation (Figure 1). There was no signal recorded on ablation catheter which was perpendicular to the wave

front propagation (Figure 1). Recently, there were case reports using Advisor™ HD Grid in atrial fibrillation ablation procedure (either as first or redo procedure) by emphasizing the directionality of the catheter in identifying the gap.[2,3] Unlike other currently available HD mapping catheters (INTELLAMAP ORION high resolution mapping catheter, Boston Scientific; CARTO PENTARAY, Biosense Webster), the predictable electrodes spacing and orientation of Advisor™ HD Grid allows the directionality of conduction to be determined.

4 | CONCLUSIONS

Advisor™ HD Grid HD mapping catheter not only allows rapid assessment of voltage and activation but more importantly the directionality of conduction to facilitate the identification of the isthmus in complex scar-related AT.

CONFLICT OF INTEREST

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