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Deceptive intracardiac electrograms during an ICD interrogation. A clinical challenge



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ABSTRACT

We present a case of a patient with significant structural heart disease from previous cardiac surgeries who presented for an electrophysiology study and radiofrequency ablation. The case highlights the significance of intra-atrial conduction delays in such patients and potential pitfalls it can present while interpreting intra-cardiac electrograms especially during implantable cardioverter defibrillator (ICD) interrogations.

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1. Case report

71-year-old female presented to the electrophysiology laboratory for an elective electrophysiology study (EPS) and radiofrequency ablation for recurrent supraventricular tachycardia (SVT) resulting in inappropriate ICD shocks. Her past medical history is remarkable for non-ischemic cardiomyopathy, aortic valve replacement done twice (mechanical followed by tissue bioprosthesis for hemolysis), implantable cardioverter defibrillator (ICD) placed for primary prevention in March 2012. She presents initially in September and then again in December 2012 for multiple ICD shocks. ICD interrogation (Boston Scientific) confirmed it to be secondary to a SVT at the rate of 170 bpm.

During electrophysiology study, a narrow complex tachycardia was easily induced at a cycle length of 340 msec. Using entrainment and 3-D mapping (ESI) it was confirmed to be reverse typical slow isthmus dependent atrial flutter. A second slow atypical AVNRT was also induced.

Subsequent to a successful ablation of both the arrhythmias, the ICD was re-interrogated. The native intracardiac electrograms during ICD interrogation are shown in Fig. 1. From top to bottom, patient's native electrocardiogram, atrial and ventricular

electrograms, RV to SVC coil (far field) and marker channels are shown. As seen in Fig. 1, it appears that the atrial and ventricular electrograms are occurring simultaneously. Different diagnosis at this stage included a possible atrial lead dislodgement or possible junctional rhythm. However a quick fluoroscopy confirmed an intact atrial lead position and a closer look at the surface electrocardiogram (Fig. 1), confirmed presence of an atrial mechanism (ruling out a junctional rhythm). Furthermore, atrial capture threshold confirmed appropriate atrial pacing and ventricular sensing (Fig. 2).

What then, could be an explanation of this seemingly unusual occurrence? The explanation of this lies in analyzing the coronary sinus (CS) electrograms during her native rhythm (Fig. 3). As seen here, CS 1,2 precedes C 9,10 suggesting a left atrial rhythm. This is also confirmed by reviewing her EKG. Extensive scarring from the two previous cardiac surgeries resulted in a significant delay from the left atrial site of origin to the high right atrial sensing lead. This delay resulted in a simultaneous sensing of the RV activation and the HRA by the respective leads. An additional clue lies in comparing the far field ventricular sensing during atrial pacing (Fig. 2) and the terminal portion of the "apparent" (or fused) atrial electrogram during the native rhythm (Fig. 1), which appears to be identical.

2. Conclusion

Previous cardiac surgeries can often result in significant scarring of the atria. The conduction delays that sometimes occur as a result

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can cause a variety of electrophysiological mirages [1]. Our case demonstrates the need to be aware of these phenomena to avoid misdiagnosis in interpretation of ICD electrograms.

References

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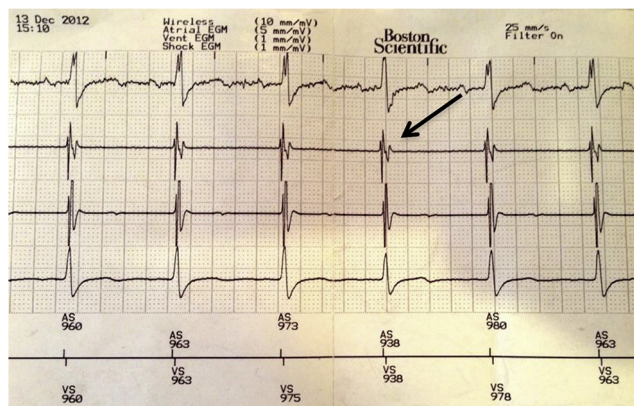


Fig. 1. Intracardiac EGMs during Intrinsic (native) rhythm. The arrow represents the fused (atrial and far-field ventricular) electrogram.

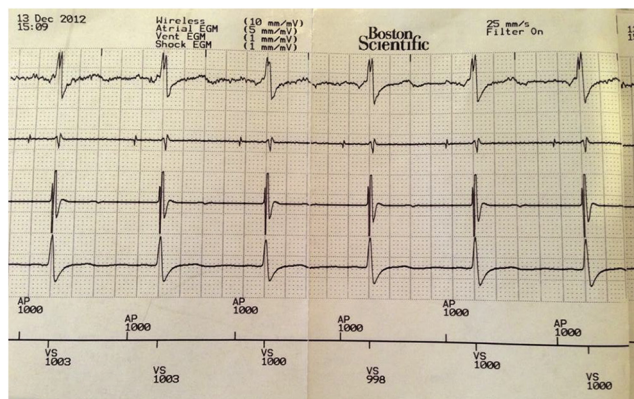


Fig. 2. Intra-cardiac EGMs during atrial pacing. Note the appropriate atrial capture as well as the presence of a distinct far-field ventricular egm on the atrial channel.

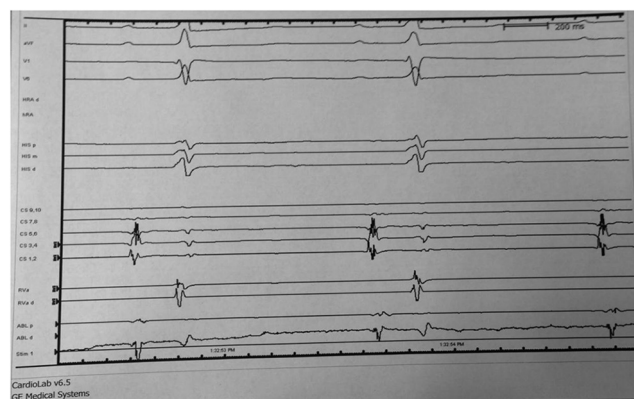


Fig. 3. Coronary Sinus EGMs during Native Rhythm. CS 1,2 precedes the proximal electrogram suggesting a very likely left atrial rhythm.