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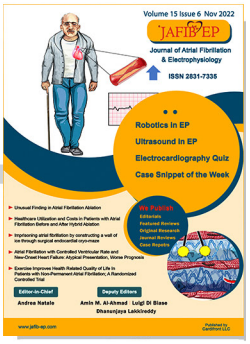

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Confirmation of Acute Pulmonary Vein Reconnection with The Utilization of PURE EP's High-Frequency Algorithm (HFA)

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Introduction

Patient is a 65-year-old pleasant lady with a medical history of symptomatic persistent atrial fibrillation associated with tachycardia induced cardiomyopathy. Her initial left ventricular function was 25% and she was started on short term amiodarone. After 3 months being on antiarrhythmic drug therapy, she was cardioverted and maintained sinus rhythm with recovery of her left ventricular function. Pulmonary vein isolation was performed under general anesthesia without interruption of her anticoagulation with Eliquis. Following dual transeptal access and heparinization with a target ACT of 350-400, an Advisor HD Grid™ mapping catheter (Abbott, MN) was advanced to the left atrium (LA) for reconstruction of the LA geometry. A D-F curve TactiCathSE™ contact force ablation catheter (Abbott, MN), was advanced to the LA and point by point ablation was performed with wide area circumferential ablation (WACA) of the pulmonary vein (PV) antrum with a target LSI of 5 anteriorly and 3.5 to 4 posteriorly near the esophagus at 40W. First pass isolation was noted from the left PV. Though first pass isolation was noted upon completion of the right pulmonary veins, early reconnection was noted. The location of the acute reconnection was identified by the Abbott EnSite Precision™ 3D mapping system utilizing the Advisor HD Grid™ catheter and EnSite LiveView™ software. Signals annotated within the 3D mapping system from the Advisor HD Grid™ placed the acute reconnection on the anterior/ inferior aspect of the RIPV demonstrated by the earliest activation which is white in color on EnSite LiveView™ displayed on the red spline of HD Grid D3-4 (Figure 1a and 1b). The annotation of signal data utilized the EnSite Precision™ absolute dv/dt algorithm. High density mapping data consistently suggested the anterior/inferior location of the gap, yet the High Frequency Algorithm (HFA) from the BioSig Technologies PureEp™ System suggested that the conduction gap existed in the region of the anterior carina on the blue spline of HD Grid A4-B4 & B4-C4 (Figure 1a and 1c). The difference between the location identified by the 3D map and HFA directed location of the reconnection was approximately 1cm. The real time HFA analysis of the signals from the Advisor HD Grid™ displayed early and consistent high frequency content across the entire atrial activation period and was selected as the primary target for ablation therapy. Placement of a single lesion within the area near electrode B4 as identified by HFA resulted in immediate isolation of the RIPV. The area identified by EnSite LiveView™ was not targeted for ablation as the PV remained isolated at the end of the case. The EnSite Precision™ mapping system may also utilize first deflection from baseline as a detection algorithm. Offline review with the first deflection algorithm upon completion of the case also was unable to detect the true gap location despite the use of the maximum available sensitivity setting.

Key Words

3D Mapping; Pulmonary Vein Isolation; Acute Reconnection; High Frequency Algorithm

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Discussion

Identification of ablation gaps during PVI can be challenging [1,2]. Annotation of traditional bipolar signal morphologies may not detect high frequency, low amplitude gap potentials (Figure 2a). Many mapping annotation algorithms base signal detection upon the absolute peak of the bipolar signal, peak negative dv/dt of the unipolar tracing [3], or in this case, a combination of absolute peak and slope on the bipolar channel (abs dv/dt). The Pure EP™ High Frequency Algorithm analyzes and displays pre-Fourier Transform frequency data between 200Hz and 1kHz from any bipolar channel. Higher frequency data collected by the bipolar pair results in a higher amplitude deflection on the HFA channel for the selected channel. HFA is designed to ignore low frequency data which falls below 200Hz and incorporates a brief blanking period to display discrete activation in the presence of fused electrograms. The presence of high frequency data can be seen clearly on the HFA channel assigned to each bipolar tracing (Figure 2b). This same high frequency content may not produce a high amplitude electrogram with a near-field appearance on the traditional bipolar

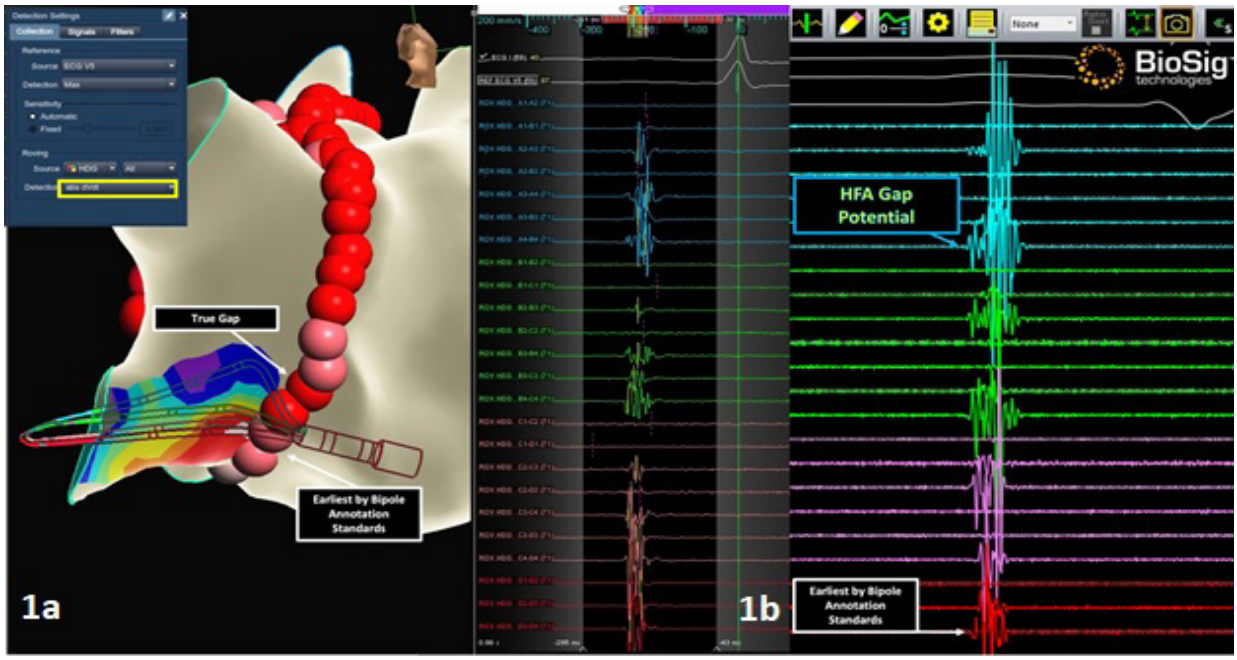

Figure 1: Figure 1a and b: Signals annotated within the 3D mapping system from the Advisor HD Grid™ demonstrating earliest activation which is white in color on EnSite LiveView™, noted on the red spline of HD Grid D3-D4 along the anterior inferior aspect of the right inferior pulmonary vein. Figure 1c: High Frequency Algorithm (HFA) from the BioSig Technologies PureEp™ System demonstrating earlier and consistent high frequency signal across the entire atrial activation period, suggesting the true conduction gap existing in the region of the anterior carina on the blue spline of HD Grid A4-B4 and B4-C4.

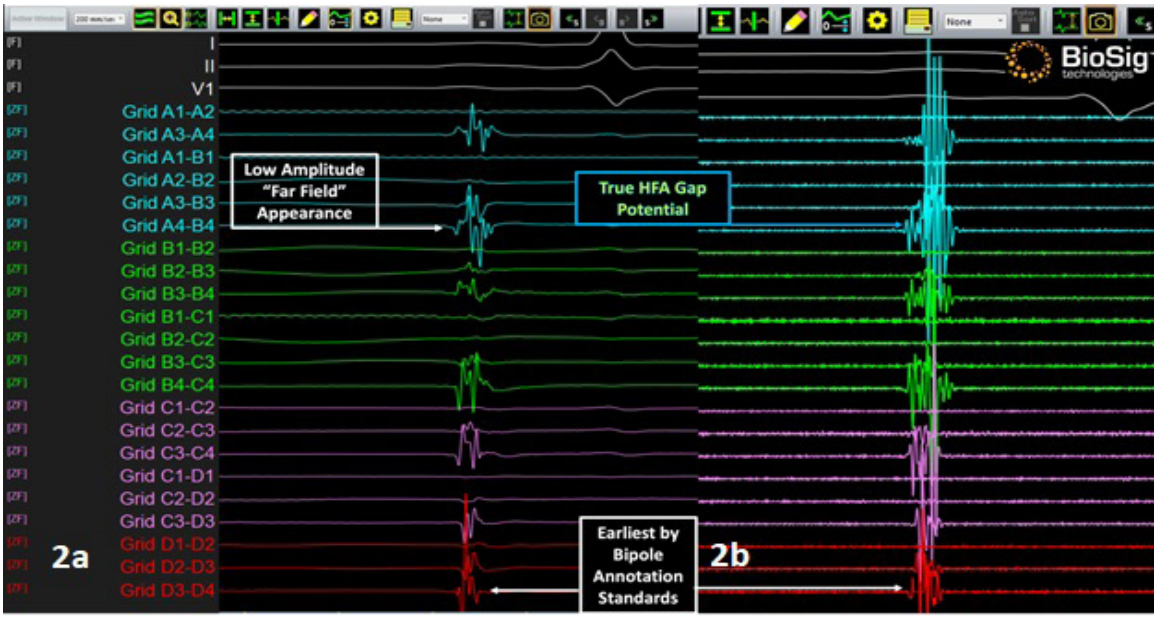

Figure 2: Figure 2a: Conventional mapping annotation algorithms often base signal detection upon the absolute peak of the bipolar signal or peak negative dv/dt of the unipolar tracing (3). In this case, a combination of absolute peak and slope on the bipolar channel (abs dv/dt) was selected for point timing annotation. In this setting, the data from HD Grid D3-D4 was continuously annotated as the gap location. Figure 2b: The High Frequency Algorithm analyzes data from each bipolar pair and displays a waveform when detected frequencies in the range of 200Hz-1kHz are present. High frequency content was present for pairs A4-B4 and B4-C4 that preceded detection on the traditional bipolar configuration for these electrodes.

tracing. The early and consistent high frequency content displayed by HFA was more sensitive in the identification of the pulmonary vein gap than the standard annotation of bipolar tracings.

Disclosures

Roy Chung - None
Zachary Koch - Clinical Director for BioSig Technologies.

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