Enhanced Electrophysiology Recording System

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***Abstract* - A novel electrophysiology recording system enables acquisition of high quality cardiac signals during electrophysiology studies. The performance assessment was conducted during three canine studies. The new system provides enhanced visualization of cardiac signals with the objective of improving outcomes of electrophysiology procedures.**

I. Introduction

Successful mapping and ablation in the electrophysiology (EP) laboratory is critically dependent on the recording system's ability to acquire and display multiple, low amplitude signals in the presence of numerous sources of electrical noise and interference. We have developed an EP recording platform (PURE EP) with significant improvements in noise cancellation coupled with a high sampling rate (SR) and dynamic range (DR).

II. Methods

Diagnostic quality 12 lead ECG signals require signal bandwidth of 0.05–150Hz while intracardiac signals can be acquired in either unipolar or bipolar mode with bandwidths of 0.5–500Hz and 30–500Hz respectively [1, 2, and 3].

The main characteristics of the new amplifier are very low noise (1 μV RMS), coupled with a minimum gain, and maximum bandwidth (1 KHz). Unique proprietary topology features high input impedance, high common mode rejection ratio (CMRR≥110dB@60Hz) and rejection of noise generated by an RF ablation generator. As clinical decisions are made in real-time, the emphasis was made on the system's capability of recording and displaying both small and large signals with similar resolution. This was achieved by using a high sampling rate (SR) of 2000 samples/second coupled with a high resolution A/D converter (24 bits) and an input voltage range of +/– 250mV.

We performed three acute canine studies comparing the PURE EP System to the traditional EP recording system (GE CardioLab). Unipolar and bipolar cardiac mapping was performed using a Boston Scientific EPT Blazer 4mm RF catheter. Signals were recorded simultaneously comparing PURE EP (0.05Hz–1KHz, 24 bit A/D conversion, SR=2000 samples/second) and GE CardioLab (0.05Hz–1KHz, 12 bit A/D conversion, SR=977 samples/second).

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III. Results

Precise Uninterrupted Real-time evaluation of Electrograms (PURE) EP System architecture is similar to a traditional EP recording system with two computer screens to provide independent real-time and review capabilities. Fig. 1 illustrates the system's ability to simultaneously display a unipolar signal (PUni) (0.05Hz–1KHz), PUniNotch (notch filter at 60Hz), proximal (PProx) and distal (PDist) (f=0.05Hz–1KHz), and filtered bipolar proximal (PProxHP30) and distal (PDistHP30) signal (f=30–500Hz); together with GE CardioLab unipolar (GUni, f=0.05Hz–1KHz) and filtered bipolar signals GProx and GDist (f=30–500Hz). There is more high frequency information on PDist compared to GDist and a noisier baseline on GUni, which could obscure fractionated potentials which are important targets during ablation.

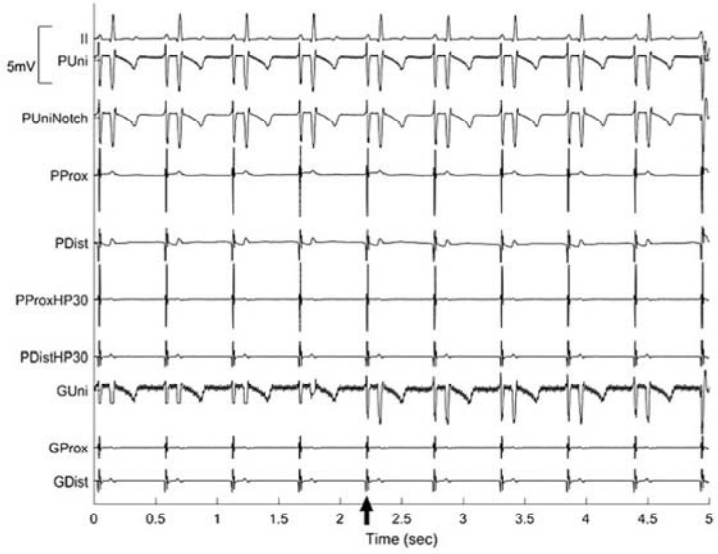

Figure 1. Recordings from left inferior pulmonary vein ostium. Arrow indicates that GE's gain was changed from 5000 to 500 to reduce clipping and provide better visualization

IV. Conclusion

PURE EP permits improved intracardiac signal recording. We intend to perform additional studies to quantify observed differences from a conventional system and assess relevance of these improvements in clinical practice.

References

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