Assessment of Catheter Position above or below the Aortic Valve by Evaluation of Characteristics of the Local Electro gram: An Acute Canine Study

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Abstract

Background: Ablation in the sinuses of Valsalva (SoV) within the aorta is fraught with risk, owing to the proximity of the coronary arteries. Assessment of catheter tip position is not very easy at this location owing to complex local anatomy and poor images from available modalities.

Objectives: We propose the use of novel local unipolar electrogram characteristics using a new signal recording system to guide the assessment of catheter tip position in this region.

Methods: We recorded unipolar signals from above the SoV, within the coronaries and below the SoV using the PURE-EP™ (BioSig Technologies, MN) signal processing system in 2 anesthetized canines in the setting of an acute study. We used fluoroscopy, intracardiac echocardiography and angiography for confirmation of the position of the catheter tip. We recorded changes in the signals when transitioning between (1) the coronary arteries and the SoV and (2) the SoV and below the SoV.

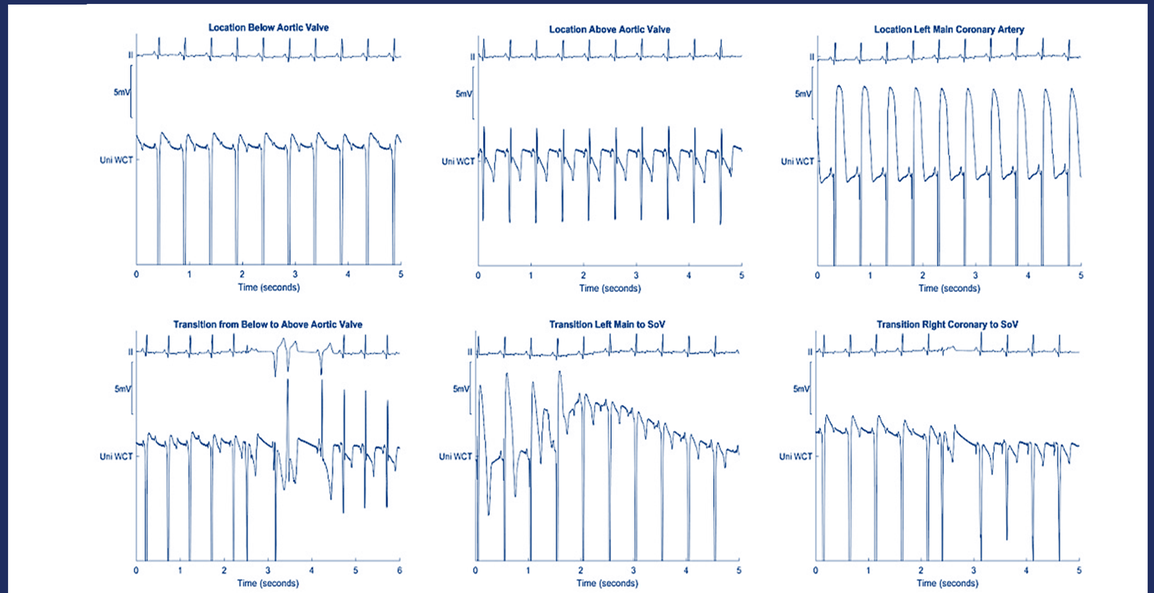
Results: The unipolar signal showed a negative current of injury (COI) when the catheter tip was present in the SoV, whereas within the coronary artery or below the SoV, the COI was positive. We propose that the difference in the distribution of ventricular muscle below and above the SoV is responsible for this phenomenon. These changes in the COI were noted immediately when transitioning from one location to another and were present reproducibly in both dogs. (Figure 1)

Conclusions: Analysis of the changes on the local electrogram can provide information about the location of the catheter tip thus increasing procedural safety.

System Comparison

	System A	Pure-EP ™
Bandwidth	0.05-500Hz (Based on 977s/s)	0.05-1000Hz
Sampling rate	977 samples/sec	2000 samples/sec
Dynamic Range	Not published	105dB
A.D converter	12-bit	24-bit
Minimum CMRR at 60Hz	100dB	110dB
Input impedance	>1GΩ	>0.5GΩ
Noise	Noise unknown	1μV RMS
Hardware gain	Programmable- (From 50-10,000 in 8 steps)	Fixed at 10

Figure



Results

- It is imperative to be able to distinguish catheter position above and below the aortic valve in order to avoid injury to the coronaries. Currently, no reproducible way to do that exists.
- Using the PURE EP™ system, distinctive changes in unipolar signal EGM morphology were noted when mapping above the valve compared with mapping below the valve or within the coronary artery .
- While recording these signals, we confirmed the catheter position and orientation using intracardiac echocardiography and fluoroscopy. We also used contrast to confirm the position of the catheter within the coronary artery.
- The PURE EP™ system allows for the display of signals with more than one filter at the same time, a feature not found in current systems. This allows for the ability to look at signals filtered in multiple ways for specific reasons.
- Further, the finding that we may be able to make a distinction between ventricularized signals within the coronary artery vs. contact EGMs above and below the valve is novel.

Conclusions

- The ability to predict the location of the catheter with PURE EP™ system can be used as an extra checkpoint along with intracardiac echocardiography and fluoroscopy prior to ablation.

Disclosures

D Padmanabhan, C Witt, N Naksuk, A M Killu, C DeSimone, A Sugrue, D Ladewig, S Suddendorf, J Powers - None

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K.L Venkatachalam - Compensation for Services; 1; BioSig Technologies. L - Intellectual Property Rights; 1; Mayo Clinic Ventures,

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