Fundamentals of EGM Interpretation and Rhythm Analysis

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Intracardiac Electrogram

- Electrodes record the **local** electrical activity:
  - Sequence activation and timing

- Normal tissue will show high frequency and amplitude signals (e.g. 10 to 250 Hz)

- Diseased tissue may show low amplitude fractionated signals
- Catheter curve
- Electrode spacing: 2mm, 5mm, 10mm, 2-10-2mm
How Are Electrograms Generated?
Band Pass Filter (Bipolar recordings)

- High pass filter - removes low frequency (Respiratory or motion oscillations) Eg. 30 Hz

- Low pass filter - removes high frequency (Excessive large high frequency signals) Eg. 500Hz

- Band pass - 30 to 500 Hz allows signals between 30 and 500 Hz to pass through

Intracardiac Electrogram

Morphology  Duration

Amplitude  Timing

Klitzner PACE 1990; 13:69-77
Intracardiac Electrogram

- High pass
- Low pass
- Electrode spacing

Morphology
Amplitude
Timing

Duration

Klitzner PACE 1990; 13:69-77
Intracardiac Electrogram

Klitzner PACE 1990; 13:69-77
Intracardiac Electrogram

- Wavefront moving towards positive electrode (unipolar) -> positive deflection

- Wavefront moving away positive electrode (unipolar) -> negative deflection

- Bipolar: Electrical potential difference between two exploring electrodes at a given point in time.

Intracardiac Electrogram

unipolar

bipolar
Mapping Considerations

Unipolar: Max negative slope (QS)
Bipolar: Initial peak

Directionality

Yes
No

Intracardiac Electrogram
Catheter positioned near the right atrial appendage may record a far field V wave in its EGM in addition to the A wave.
His Bundle Electrogram

- Catheter is straddled across the right atrial septum near the tricuspid valve

- Useful information on AV conduction (AV node, aberrant, pathway)

- 3 component electrogram:
  
  LRA  His  V
The coronary sinus opens into the right atrium. It may be approached from the SVC or from the IVC.

Depending on the take off from the left AV groove, the CS EGM may record only A wave or both A and V waves.
Approach ECG Analysis

- QRS morphology
- Rhythm regularity
- Rate
- P-QRS relationship
Approach EGM Analysis

- Basic Rhythm
- EGM Morphology
  A, His, V
- EGM Sequence of activation
- Regularity rhythm
  AV relationship
Strategies for Interpretation

Relationship

Antegrade conduction

How are the impulses from the atrium conducted to the ventricle?
Strategies for Interpretation

Relationship

Retrograde conduction

How are the impulses from the ventricle conducted to the atrium?
Ventricular pacing

Stimulus
Video 1: Baseline EGM and Ectopic Beats
Video 2: EGM Recognition During Pacing
Video 3: EGM Recognition During Mapping
Summary

- Use surface ECG and catheter position identified by fluoroscopy to help determine the electrogram waveforms.

- Use baseline IEGM to help identify electrogram waveforms during arrhythmia (Look back approach).

- Use the input/output approach to determine antegrade versus retrograde conduction.
Thank you