Electrograms 101

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Definition

• A graph of voltage over time





Definition

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- 12L ECG
- Intra-cardiac Electrograms

Definition

• A graph of voltage over time

- 12L ECG
- Intra-cardiac Electrograms

1. Basics of Electrograms

2. Electrograms in the EP lab

- Unipolar
- Bipolar
- Laplacian
- Monophasic action potentials

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Unipolar Recording mode

• Different electrode at the recording site

• Indifferent electrode at point of zero reference

Jacques M.T. de Bakker, and Fred H.M. Wittkampf Circ Arrhythm Electrophysiol. 2010;3:204-213

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- Unipolar
- Bipolar
- Laplacian
- Monophasic action potentials

Bipolar Recording mode

• Different Electrode and indifferent electrode close together

 Created by subtracting two unipolar electrograms

Direction dependence

Direction dependence

Direction dependence

Unipolar vs Bipolar recordings

- Unipolar recordings measure an amplified version of voltage at a single electrode and retain both near and far field signal components
- Bipolar recordings measure the amplified signal between two unipolar electrodes which reduces common-mode noise and far-field signal components

Unipolar

- Local + remote
- Catheter orientation independent
- Interference
- Directionality of propagation

Bipolar

- Local
- Catheter orientation dependant
- Reduces interference
- No directionality of propagation

• Times when a unipolar electrogram is useful

- Looking for points of earliest activation
 - Pathways
 - Focal AT/VT

Stevenson W, Soejima K ; J Cardiovasc Electrophysiol. 2005;16(9):1017-1022.

Issa ZF, Miller JM, Zipes DP; Clinical Arrhythmology and Electrophysiology

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• Times when a unipolar electrogram is useful

- Looking for points of earliest activation

 Pathways
 - -AT
- Examining farfield events

Recording Artefacts

Sources of Intracardiac Recording Artefact

Cause

Manifestation

Electrode Polarisation Excessive Contact Pressure Catheter motion Poor contact Contact with other catheters Repolarisation **Electromagnetic Interference** Poor Grounding

Electrogram Drift ST elevation Fractionation Low amplitude High-frequency signals Late or mid diastolic potentials High Frequency noise High Frequency noise

Filtering

- Filtering necessary
 - High/Low/Band pass filters
 - Notch Filters
- Can affect EGM
 - Amplitude
 - Timing
 - Morophology

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Complex Electrograms

- Double potentials
- Fractionated Potentials

Double potential

- Lines of functional block
- Lines of anatomical block
- Adjacent structures

Turn around point = End of a fixed or functional barrier such as scar tissue (fixed) or the crista terminalis (functional)

Fractionated electrograms

Where do they arise?

Where is the activation time?

Stim

fractionated electrogram

1. Basics of Electrograms

2. Electrograms in the EP lab

Electrograms

- Recording mode
- Sources of error
- Complex electrograms
- Multiple electrograms in different anatomical sites to interpret the EP study

Thank you