Electrophysiological Studies and RF Ablation

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ELECTROPHYSIOLOGY PROCEDURES

• Atrial stimulation studies
• Ventricular Stimulation studies
• Diagnostic
ELECTROPHYSIOLOGY AND RF ABLATION PROCEDURES

• Atrial Tachycardia
• Ventricular Tachycardia
• AVRT (WPW Syndrome)
• AVNRT
• Atrial Flutter
• Atrial Fibrillation (His ABL)
PURPOSE OF THE ELECTROPHYSIOLOGIC STUDY

The clinical data collected from the EP study can be used to:

1. Determine whether patient symptoms are in fact related to a tachyarrhythmia
2. Assess the patient’s risk for potential lethal tachyarrhythmias
3. Develop and perform appropriate therapeutic procedures on the tachyarrhythmia and/or its mechanism
Electrophysiology Studies (EPS) are used to evaluate and treat patients with tachyarrhythmias.

The objective of the EP study is to characterise and assess the cardiac conduction system by recording the electrical activity at several sites within the heart and by stimulating the heart when appropriate via multipolar catheters.

Several important measurements are taken during an EPS that assist the electrophysiologist in evaluating complex conduction disorders and tachycardias.
TYPICAL EPS CATHETER PLACEMENT

- High right atrium (RA)
- His Bundle (HB)
- Right ventricle (RV)
- Coronary Sinus (CS)
- Other locations specific to arrhythmia present
VARIABLES IN THE RECORDING OF CARDIAC ELECTROGRAMS

1. Gain
2. Amplification
3. Filter settings
4. Paper speed
5. Recording electrode(s)
   - electrode setting
   - inter-electrode distance
   - electrode configuration in relation to the activation wavefront
RECORDING TECHNIQUES OF CARDIAC ELECTROGRAMS

UNIPOLAR RECORDINGS
Potential difference of a single electrode in direct contact with the endocardium and the so-called ‘reference electrode’, which is an electrode placed at a distance from the heart (IVC)

BIPOLAR RECORDINGS
Potential difference between two closely spaced electrodes in direct contact with the myocardium

BIPOLAR ELECTROGRAMS
The activation (ACT) time represents the highest/deepest deflection
ELECTROPHYSIOLOGY DEFINITIONS

INTRA ATRIAL CONDUCTION TIME

This is the earliest point of atrial activation in any lead to the low right atrium activation from the His Bundle electrogram.

It is a measure of conduction time from high RA to low RA.

25 – 55 ms
ELECTROPHYSIOLOGY DEFINITIONS

INTRA AV NODAL CONDUCTION TIME (AH INTERVAL)

This is the interval from the low right atrium to the His Bundle potential and reflects relative activation time of the His Bundle.

60 – 120 ms
ELECTROPHYSIOLOGY DEFINITIONS

INTRA VENTRICULAR CONDUCTION TIME
(HV INTERVAL)

This is the interval from the His potential to the earliest ventricular activation. It reflects conduction between the bundle of His to ventricular myocardium.

35 – 55 ms
BIOPHYSICS OF RF ABLATION
TEMPERATURE Vs POWER CONTROL
POSSIBLE DANGERS WITH POWER CONTROL MODE

1. Temperature exceeds boiling point of blood
2. Blood starts boiling and may form thrombus, which may pass to lungs or brain depending on the ablation side – right or left
3. Blood chars and covers the tip of the electrode
4. Tip charring causes electrical isolation and hence impedance rises which may cause a danger of sparking if no automatic impedance control emergency shutdown is performed
5. Catheter has to be removed from its position, cleaned and repositioned
ADVANTAGE OF TEMPERATURE MEASUREMENT

A fast temperature response during RF delivery is the only available predictor of sufficient catheter – tissue contact.

1. Shortening of procedure duration
2. Reduction of the number of inappropriate burns
DISADVANTAGE OF TEMPERATURE MEASUREMENT

1. No temperature sensor will measure the real ‘in-tissue’ temperature

2. Depending on the catheter position, different temperatures can be measured
   - catheter tip is in contact with tissue
   - catheter tip faces the tissue laterally

3. Heat can be transported elsewhere due to
   - cooling blood flow at catheter tip
   - inner tissue blood vessels (close to tip position)