Arrhythmia mechanisms
a practical perspective

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Arrhythmia mechanisms

• Automatic
• Re-entrant
  – Micro
  – Macro

• Triggered automaticity
• Phase 4 re-entry
• Delayed after depolarisations
• Early after depolarisations
“Automatic” Arrhythmias

• Focal
• Atrial, ventricular (or rarely junctional)
• Usually start and stop spontaneously (not with programmed stimulation)
• May show “warm up”
• Typically catecholamine-dependent
• Respond to beta blockers
• Mapping techniques
  Earliest activation
  Pace map
Typical sites of "automatic" atrial tachycardia

(1) Pulmonary Vens
(2) Prox CS
(3) Tricuspid annulus
(4) Mitral annulus
(5) Atrial septum ("para-His")
Example 1

46 yr old woman, normal heart
Mitral Annular tachycardia – activation mapping
Example 2 16 year old girl referred for heart transplant
Tricuspid annular tach causing tachymyopathy
Distinctive P wave deeply negative V1-3
Example 3
19 yr old male

Left atrial appendage tachycardia (rare)
Example 4

2:1 AV block, early local atrial signal in coronary sinus
Example 4

Ligament of Marshall tachycardia
CS anatomy - no obvious Vein of Marshall

RAO

LAO
Mapping within coronary sinus and in left atrium
Termination of tachycardia during RFA within CS

Disappearance of sharp local signal
OBlique vein of L. atrium (Marshall)
GREAT cardiac vein
CIRCUMFLEX branch of L. coronary artery
CORONARY sinus
POSTERIOR vein of L. ventricle
MIDDLE cardiac vein

DIAPHRAGMATIC ASPECT
Automatic ventricular tachcardia from RVOT
Pace map RVOT ectopics

Paced

Spontaneous
Macro-reentry

• Involving specialised conduction system
  – AVNRT
  – AVRT
  – Bundle branch re-entry VT
• Involving myocardium
  – Atrial flutter
  – Scar related VT
Bundle-branch reentry

Usually occurs with diffuse conduction tissue disease (DCM or IHD)
Long H-V
Macro-reentry
Atrial flutter

Saw-tooth” pattern due to Continuous atrial activity
PPI = TCL

Atrial electrograms in RA cover >90% of Tachy CL (From His a to TV annulus)

Concealed entrainment from TV-IVC isthmus

Right atrial flutter
Macro-reentry

Ventricular Tachycardia around MV annulus (prev MI)
Micro-reentry

• Occurs due to local conduction block
  – Scar from ACHD, prev RFA
  – Anatomic - Crista Terminalis

• Often looks like focal tach on mapping system
Example of micro-reentry
LA flutter (prev LA RFA) – Map catheter inferior to LIPV
Diastolic atrial activity (consecutive cycles)

Low signal:noise ratio as gains turned up but some consistent activity throughout cardiac cycle

RF at this site terminated tach after 10 secs
Summary

From a practical perspective most arrhythmias can be categorised as:

- Automatic
- Re-entrant
  - Macro v Micro