“The most important aspects for the performance of safe and valuable electrophysiology studies are the presence and participation of dedicated personnel”

Mark E. Josephson

Primary Objective:
Examine, beyond the basic EP study, the evaluation and treatment of several selected arrhythmias.

Specific Objectives:
- Examine the EP evaluation of bradyarrhythmias.
- Examine the EP evaluation of AVNRT and Accessory bypass-tract mediated tachycardias.
- Examine the mechanism of typical atrial flutter, the use of activation, 3-D mapping and ablation.
- Examine ablation for paroxysmal atrial fibrillation.

Basic to all (well, most) EP studies:
- Need a good His recording.
- When looking for SVT, start study with the ventricles.
- When looking for VT, start study with the atra.
- Learn and understand refractory periods.
- Know your patient and what you're looking for.

Pace, damn it, pace!!

EP evaluation of bradyarrhythmias:
- BORING!!
- EP studies began with the discovery of the His electrogram for bradyarrhythmias.
- Once the principles of were revealed most brady problems could be solved without an EP study. (Best study for bradyarrhythmias is Holter)
- Electrophysiologists were then out of work and turned to tachy stuff just to survive.
Causes of bradyarrhythmias:

1. Failure of impulse formation in the SA node. SSS (most common cause – see below)
2. Failure to conduct impulse to the ventricles. (heart block)
   • Most common therapy for symptomatic bradycardia = permanent pacemaker.
   • Thoughts on SA node dysfunction:
     • Important cause of syncope.
     • SA node dysfunction can be related to automaticity or conduction or both.
     • Bradycardia-Tachycardia syndrome is the most common form of symptomatic SA node dysfunction and has the highest incidence of syncope. (see next slide)

Bradycardia-Tachycardia Syndrome

• Most common form of symptomatic SA node dysfunction.
• Associated with the highest incidence of syncope.
• Syncope associated with a marked pause which follows cessation of PSVT (usually atrial fib.)
• Drugs which treat a. fib. may make situation worse.
• Any prolonged pause implies impaired function of lower (nonsinus) pacemakers.

EP evaluation of the SA node:

• SNRT – Stress the SA node with pacing – called overdrive suppression.
  • First beat after pacing drive train should time out close to SR. (below)
    (TRT = time to return to BCL, > 2.5 secs. = abnormal)
  • > 1500 ms SNRT = abnormal
  • > 525 ms CSNRT = abnormal
  • > 160% (SNRT/BCL x 100%) = abnormal

SA node - continued

• SACT – indirectly calculates SA node conduction time. Not done much.
• EP evaluation of AV conduction disturbances:
  • Site of block important, since AV node block is most often benign but block in His-Purkinje system is potentially lethal. (tends to be chronic and progressive)
  • Degree of block only important because it is suggestive of the site and severity of block: 1st (not really block as conduction is 1 to 1), 2nd (two types), 2 to 1, high-degree and 3rd degree block.
Sites of AV block by degree:

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Two other types of block:
- 2-to-1: often associated with organic disease of the AV node.
- High-degree: Two or more consecutive drops beats with intermittent conduction from P-waves.

EP evaluation of AV conduction disturbances:
- Need a His!
- Baseline measures - AH and HV.
- AH - 50-120 ms.
- HV - 35-55 ms.
- Incremental atrial pacing = gradual increase in AH (HV should change little) until block. (like 2nd degree, Type I, this is normal!) Block usually happens < 400-450 ms.

EP - AV block:
- Extrastimulus technique: Pace atrium at 600 ms x 8 beats then bring in an extra atrial stimulus at progressively earlier cycle lengths.
- PR and AH gradually increase until block. Should be < 400 ms. This is ERP of the AV node. (watch for atrial refractoriness first)
- If there is a His but no V at block, this is infranodal block and this is not good but only at longer coupling intervals (600/500). See example next slide.

*Clear, damn it, clear!!*

Supraventricular Tachycardia:
- Originate in the atria or AV junction and utilize the normal AV conduction system (reentry).
- Usually not immediately life-threatening.
- Most often have a narrow QRS (except with aberrancy), versus VT’s which always have a wide QRS.
Types of SVT:
- AVNRT (AV Nodal Reentrant Tachycardia) (two AV Nodal pathways) - 60% of SVT.
- AVRT (AV Reciprocating Tachycardia) (accessory bypass tract) - another 30%.
- Ectopic Atrial Tachycardia (EAT) - 10%.
- Atrial flutter - Typical and atypical.

EP evaluation of SVT:
- Catheters: A, V, His & CS. Provides electrical information on all four heart chambers.
- Must initiate the tachycardia.
- And, for diagnosis you must answer the following four questions:...

Answer 4 questions:
- 1. What is the mode of initiation and termination of the tachycardia?
- 2. What are the patterns of antegrade and retrograde conduction in SR and tachycardia?
- 3. Are the atria and/or ventricles needed to sustain the tachycardia?
- 4. What are the effects of autonomic maneuvers and drugs on the tachycardia?

AVNRT
- Dual pathways - both involving AV nodal tissue - distinctive from an accessory bypass pathway.
- One pathway - fast (AV Node) with long refractory period, the other slow but with short refractory.
- Usually starts with a PAC.

AVNRT (features) - continued
- Starts and stops abruptly.
- Shows dual AV nodal pathways and retrograde conduction usually.
- Atria and ventricles not needed to continue the tachycardia.
- Autonomic maneuvers and AV nodal drugs may stop this tachycardia.
- Ablating the slow pathway cures this tachycardia.

AVRT - types of tachycardias:
- ORT - Orthodromic Reciprocating Tachycardia. Uses the AV Node antegrade and the pathway retrograde. (most common)
AVRT - continued
- Tracts can be located anywhere along the AV groove except in the space between the valves.
- Probably originate from birth. Most patients have a structural normal heart.
- Concealed pathways can be mapped using ventricular pacing and then ablated.
- Manifest pathways (WPW) can be mapped in sinus or with ventricular pacing.

Ectopic Atrial Tachycardia
- Represents an automatic focus, not a reentrant type of supraventricular tachycardia.
- Diagnosis is usually made when AV disassociation is seen. (more A's than V's)

EP maneuvers to differentiate SVTs:
- Timing of atrial activation (long vs. short PR, RP) on surface EKG can point toward certain SVTs.
- AV block (spontaneous or secondary to Adenosine) establishes a diagnosis of atrial tachycardia (r/o other SVTs).
- The effect of PVCs in tachycardia on atrial activation can diagnose an AVRT and exclude an atrial tachycardia.

Atrial Flutter Typical (counter-clockwise rotation).

Atrial Flutter
- Has been classified by a variety of terms, such as: “type I” and “type II”, “common” and “uncommon”, “typical”, “atypical” and “true atypical” and “clockwise” and “counterclockwise”.
- Two types of flutter - 1) One that uses the reentry pathway around the atrial septum and the right atrial free wall is the most common type and 2) All others that do not use the above mechanism.

Atrial flutter - continued
- New classification based on mechanism.
- Typical atrial flutter = Reentrant impulses travel up the atrial septum and down the right atrial free wall. (Previously called “counterclockwise”)
- Reverse typical atrial flutter = uses the same circuit but travels in the opposite direction. (Previously called “clockwise”)

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Atrial flutter - continued
  • Left atrial flutter = any reentrant circuit confined to the left atrium.
  • Incisional atrial reentry = reentry around an incisional line of block in the rate range of atrial flutter.
  • Atypical atrial flutter = any reentrant atrial rhythm in the rate range for atrial flutter not described above. (not much is known about this rhythm)

CARTO - BIOSENSE:

Atrial fibrillation
  • Irregular, disorganized, electrical activity of the atria.
  • Classified as: 1) paroxysmal, 2) persistent, 3) permanent.
  • Maze procedure (surgical) produces linear incisions across the atria which produce areas which are too small to sustain AF.
  • EP (via intracardiac catheters) Maze procedure can also be done but procedure time is very long and radiation exposure is substantial.

Atrial fibrillation - continued
  • Newer mapping systems such as CARTO may help by decreasing fluoro time.
  • Some AF is triggered by atrial ectopic foci. These foci can sometimes be mapped and ablated.
  • As much as 94% of these foci have been found within 2-4 cms. of the pulmonary veins.
  • Ablation which electrically isolates the PVs is highly successful in curing AF.

Atrial Fibrillation - continued
  • This procedure best done in patients who have AF which comes and goes.
  • As much as 70% of these patients have multiple foci.
  • Procedure requires access to the left atrium, lots of time and care not to ablate in the PVs which can cause stenosis.
  • Hybrid therapy = convert AF to atrial flutter with class Ic drugs or Amiodarone, then do a flutter ablation.

Questions??