Atrial fibrillation ablation techniques, imaging, complications, results
Definitions

• PVI – segmental ostial isolation of individual veins guided by activation on PV mapping catheter

• WACA – Wide area ablation to enclose veins as pairs (with/without ablation between veins). May be guided by PV mapping catheter
Paroxysmal AF

- Pulmonary vein triggers majority of PAF
- Non venous triggers
- Autonomic modification
- Fractionated potentials/substrate modification
Persistent AF

• PV isolation is not sufficient
Target PV trigger

LIMITED BY:
• Absence of spontaneous ectopy
• Multiple triggers

www.escardio.org/EHRA
Wide area circumferential ablation

Milan: 8mm 100W

www.escardio.org/EHRA
PVI vs WACA

• WACA with no assessment of isolation
  – Cheaper
  – Simpler
  – Quicker
  – ?As effective
Disadvantages of WACA without isolation

• No clear end point
• Dependent on operator experience and skill
• No definition of “WACA” varies
Wide encirclement without isolation

- Pappone 2002, n=72
  - 68% success (32 on drugs)
  - Overall complications (permanent and parox) 0.8% (2 tamponade)
  - Atachy not reported follow up by transtelephonic monitoring

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Sites of ganglionic plexi

The wider the line the greater the success rate
PVI vs WACA

- 8mm tip
- Ablation of signal within lines
- 50W
PVI vs WACA

- N=20
- No ablation within lines
- Veins isolated individually
- 45% isolated

Bipolar voltage map after anatomical ablation

Posterior-anterior projection

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Hocini Eur H J 2005
Results are not always easy to interpret

- WACA
- 65% on drug

Stabile et al Circ 2003
PVI vs WACA

- $N=100$
Wide encirclement with electrical isolation

- Double lasso technique
- $N=41$
- Recurrence 25%
- PV reconnection in all undergoing repeat procedure

Ouyang et al. Circ 2004
Segmental vs Wide encirclement - with electrical isolation

- Single PV cath – irrigated, same powers for both
- PAF and persistent
Sites resistant to isolation

- Resistance $2^\circ$
  - epicardial fibres?
  - thickened myocardium?

Kistler et al JCE 2006
Complications

• In theory:
  – Segmental isolation associated with:
    • PV stenosis
    • Wide encirclement
  – Oesophageal fistula
## Complications

<table>
<thead>
<tr>
<th>Condition</th>
<th>Segmental PVI</th>
<th>Wide encirclement</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV stenosis</td>
<td>1.5% (non clinical)</td>
<td>1.5% non-clinical</td>
</tr>
<tr>
<td>Tamponade</td>
<td>1.5%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Oesophageal Fistula</td>
<td>?</td>
<td>0.05-0.4%</td>
</tr>
<tr>
<td>Stroke</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Death</td>
<td>Unrelated to technique</td>
<td></td>
</tr>
</tbody>
</table>

Pappone et al, Circ 2004, Cappato, JACC 2009
How do we interpret these data?

- There is little proof that PVI or WACA are superior
- Recurrence with isolation is rare therefore:
  - Isolation seems to be important for success in many
  - Safer ablation is probably away from the vein
How do we do it in practice?

- On warfarin (INR 2-3.5)
- Single PV catheter
- Wide encirclement
Procedural Endpoints

1. Electrical isolation of all veins
2. Termination of AF during Ablation.
3. Verification of Linear Ablation sets important to prevent recurrence and LA flutter.
Goal of AF Ablation

• Trigger elimination

• Substrate Modification

• Minimum number of RF applications
Endpoints – electrical isolation of all veins

• Validated by PV catheter demonstrating:
  – Change in electrical signal – separation of local from far-field
  – Silent veins
  – Dissociated potential
  – PV pace capture without LA capture
Endpoint - isolation of all veins

- Change in electrical signal
  - Continuous monitoring helpful particularly in LUPV

[Graph showing ECG waves]
Endpoints – isolation of all veins

• Silent veins
  – Usually only RPV and sometimes LLPV
Electrical - isolation of all PVs

- Dissociated potentials
  - Usually decrease in frequency after PVI
  - Can be triggered by cath manipulation
Endpoint - isolation of all veins

- I've isolated the LLPV but didn't have my lasso in the LUPV – what do I do?
- LUPV signals after llpv isolation
Endpoints – isolation of all veins

- Pacing from map cath in Llpv with PV cath in LUPV
Endpoints – isolation of all 

caths

- Pacing from PV cath capturing local PV potential
Endpoints validation of lines

- Mitral isthmus line
  - Pacing from Lasso in LAA
Principal Procedural Endpoints

1. Termination of AF during Ablation –
   • Controversial probably similar recurrence because of PV reconnection but does indicate good ultimate prognosis

2. Verification of Ablation sets important to prevent recurrence and LA flutter.

3. Non-inducibility of AF following Ablation
   • Little evidence

4. Waiting/adenosine/isoprenaline
   • Some evidence

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Conclusions

• Wide encirclement is theoretically better
• Validation of PV isolation is critical
• Balancing success (power/temp) with safety is where the skill comes in
Question 1

- Catheters are in the standard positions what is the most likely diagnosis?
  
a) Typical AVNRT
b) AVRT with left sided pathway
c) AVRT with posteroseptal pathway
d) Pre-excited AVRT
e) AVRT with right sided accessory pathway
Catheters are in the standard positions the following is shown:

a) Orthodromic AVRT
b) Typical AVNRT
c) Atypical AVNRT
d) Antedromic AVRT with septal pathway
e) Antedromic AVRT with lateral pathway
Question 3

• The following is standard for ablation of AVRT:
  a) Power 30W, Temp 60°, Time 60s
  b) Cooled RF – Power 30W, Temp 45°, Time 60s
  c) Power 60W, Temp 60°, Time 60s
  d) Cryo for 2 minutes
  e) Cryo for 4 minutes
Question 4

The following are useful techniques for distinguishing AVNRT from AVRT:

a) His synchronous Ventricular premature beats advance A
b) A PPI-TCL of <115msecs
c) A preexcitation index of >85msec
d) All of the above
e) None of the above
Question 5

- Pathways with mahaim characteristics always:
  a) Connect nodofascicular
  b) Connected to the V at the AV annulus
  c) Decrement
  d) Block conduction with pressure
  e) Result in orthodromic tachycardia