Treating Atrial Fibrillation

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AF burden

• Framingham
  – Lifetime risk of developing AF = 25%
  – Mortality: SMR = 1.9 ♀ 1.5 ♂

• NHS audit
  – 1% of budget spent on AF - €688,000,000 in 2000

• ↓↓Quality of life
  – Symptoms of AF
  – Side effects of medication

ATRIAL FIBRILLATION
Incidence

Framingham Heart Study
Nice guidance for management of AF

- Issued on June 2006
- Aimed to give a UK based simple guidance on management of AF
- Attempts to be evidence based
- And applicable to the majority of patients
Key aims of management

- Diagnosis - everyone with irregular pulse gets ECG
- Identify secondary causes (thyroid, hypertension, valve disease)
- Treatment
  - Stroke prevention
  - Rate control
  - Rhythm control where appropriate
Diagnosis

- AF can only be diagnosed on an ECG recorded during symptoms/signs
- Even asymptomatic patients should have an ECG
- Consider 24 hour to 7 day Holter if intermittent (depending on frequency)
- Or ask patient to attend A+E during symptoms and get a copy of ECG
Investigation

- TFT
- Echo
  - If young
  - If rhythm control strategy
  - If unsure of stroke risk
  - If structural heart disease suspected
Stroke prevention

**High risk**
- Previous ischaemic stroke/TIA or thromboembolic event
- Age ≥75 with hypertension, diabetes or vascular disease
- Clinical evidence of valve disease or heart failure, or impaired LV function on echocardiography

**Moderate risk**
- Age ≥65 with no high risk factors
- Age <75 with hypertension, diabetes or vascular disease

**Low risk**
- Age <65 with no moderate or high risk factors

- **Warfarin (INR 2-3)**
- **Aspirin**
Rate control vs rhythm control

• RACE
  – Mortality 22.6% vs 17.2%
  – 39% vs 10% in SR

• AFFIRM
  – Mortality 23.8% vs 21.3%
  – ↑ hospitalisation
  – ↑ Side effects
  – SR has a prognostic benefit
Rhythm control - problem

• Cardioversion and drugs maintains SR in 42% at one year (amiodarone)
• Side effects require stopping amiodarone in 25%
• Anticoagulation stopped too early
Treatment decision tree

1. Confirmed diagnosis of AF
2. Further investigations and clinical assessment including risk stratification for stroke/thromboembolism
3. Paroxysmal AF
   - Rhythm-control
4. Persistent AF
   - Rhythm or rate?
     - Remains symptomatic
     - Failure of rhythm-control
   - Rate-control
5. Permanent AF
   - Rhythm or rate?
     - Remains symptomatic
     - Failure of rhythm-control
   - Rate-control
## Advantages of Warfarin over Aspirin

<table>
<thead>
<tr>
<th>Risk Stratification</th>
<th>Annual Stroke Rate with Aspirin Therapy</th>
<th>Treatment with Warfarin Instead of Aspirin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>Number Needed to Treat for 1 y To Prevent 1 Stroke</td>
</tr>
<tr>
<td></td>
<td></td>
<td>n</td>
</tr>
<tr>
<td>Primary prevention*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low risk</td>
<td>1</td>
<td>250</td>
</tr>
<tr>
<td>Moderate risk</td>
<td>3</td>
<td>83</td>
</tr>
<tr>
<td>High risk</td>
<td>6</td>
<td>42†</td>
</tr>
<tr>
<td>Secondary prevention</td>
<td>10</td>
<td>25†</td>
</tr>
</tbody>
</table>
Advantages of Warfarin over Aspirin
rhythm vs rate control

Try rhythm-control first for patients with persistent AF:
- who are symptomatic
- who are younger
- presenting for the first time with lone AF
- secondary to a treated or corrected precipitant
- with congestive heart failure.

Try rate-control first for patients with persistent AF:
- over 65
- with coronary artery disease
- with contraindications to antiarrhythmic drugs
- unsuitable for cardioversion\(^3\).
Persistent AF rate control

1. Administer appropriate thromboprophylaxis

2. Is rate-control therapy needed?
   - Yes

3. Beta-blocker or rate-limiting calcium antagonist
   - Yes (during normal activities)
     - Beta-blocker or rate-limiting calcium antagonist with digoxin
   - Yes (during exercise)
     - Rate-limiting calcium antagonist with digoxin
   - Is further rate-control therapy needed?

Specialist referral
Rhythm control

1. Administer appropriate thromboprophylaxis
2. Is ‘pill-in-the-pocket’ therapy appropriate?
   - Yes
     - ‘Pill-in-the-pocket’
   - No
     - Standard beta-blocker
     - Treatment failure?
       - Yes
         - Coronary artery disease (CAD) or LV dysfunction (LVD)?
           - Yes (CAD)
             - Sotalol
           - No (LVD)
             - Class Ic agent or sotalol
       - No
         - Treatment failure?
           - Yes
             - Amiodarone or referral
           - No
Rate control vs Rhythm control

- AF is dangerous
- SR is better and confers mortality benefit
- Conventional therapies are poor at maintaining SR
- The population is aging
What specialist treatments are available?

- Antiarrhythmic drugs
- Pacemaker
- Catheter ablation
- Surgical ablation
AV node ablation and pacing
AV node ablation and pacing

- “hides” the AF
- Easy to perform (99%) success
- No atrial transport (turbo)
- Pacing dependent (LBBB)
- No going back
- Refuge of the elderly and desperate
The first curative procedure
Maze

**Modified Maze**

<table>
<thead>
<tr>
<th>LAA</th>
<th>LSA</th>
<th>RSA</th>
<th>SVC</th>
<th>SN</th>
<th>cryoablation</th>
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</thead>
<tbody>
<tr>
<td>PSA</td>
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<td></td>
<td>IVC</td>
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</table>

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<td>IVC</td>
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</table>

**Cox's Maze 3**

<table>
<thead>
<tr>
<th>LAA</th>
<th>LSA</th>
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<th>SN</th>
<th>TV</th>
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<tbody>
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<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>IVC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Why does the maze work?
Radiofrequency Ablation Catheter

Convective Heat Loss to Blood Pool
Convective Heat Loss to Coronary Artery
Conductive Heat Transfer
Lesion cross-section
Endocardium
Resistive Heating
Catheter
Blood
How is RF energy applied
RFA Lesion - Macroscopic
Atrial fibrillation originates in the left atrium
Mechanisms for AF
Target PV trigger

LIMITED BY:
• Absence of spontaneous ectopy
• Multiple triggers
Focal AF: RFA to "disconnect" PV potential
Continuous circular lesions
Catheter ablation in permanent AF

31/41(76%) in SR at 8.4 mths

Earley et al. Heart 2005
The electroanatomical approach

- The anatomy is very stylised
- Accurate lesion location is very dependent on experience
CT integration

- True 3-dimensional anatomy with catheter localisation
Creating 3 landmark pairs
LPV locations of interest
LPV internal view
Does this have a clinical effect?
Isolation of LPV’s during AF
Practicalities of curative AF ablation

- Pre op - CT few weeks pre-op
- TOE on day
- ACT >300 during procedure
- Procedure time 2-3 hours PAF/ 3-4 hours Persistent
- Post-op echo
- Warfarin loading on night of procedure
  - Continues for 3 months if low risk
- Enoxaparin day after until INR>2
Case Control Study of 3-D mapping vs CT integration

- 105 patients
- 6 month follow up
- 7 day holter at 3 months
- Similar operator profile and experience
# AF ablation results

<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>3D mapping (n = 52)</th>
<th>CT integration (n = 53)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>54 ± 11</td>
<td>58 ± 9</td>
<td>NS</td>
</tr>
<tr>
<td>Paroxysmal/Permanent AF</td>
<td>23/29</td>
<td>25/28</td>
<td>NS</td>
</tr>
<tr>
<td>AF duration (years)</td>
<td>5.3 ± 5.5</td>
<td>6.7 ± 5.7</td>
<td>NS</td>
</tr>
<tr>
<td>Number of failed meds</td>
<td>2.8 ± 0.6</td>
<td>2.7 ± 1.1</td>
<td>NS</td>
</tr>
<tr>
<td>LA size (mm)</td>
<td>46 ± 6</td>
<td>44 ± 5</td>
<td>NS</td>
</tr>
<tr>
<td>LV end diastolic volumes</td>
<td>50 ± 3</td>
<td>52 ± 5</td>
<td>NS</td>
</tr>
</tbody>
</table>
Freedom from AT/AF off medication at 6 month follow up

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<thead>
<tr>
<th></th>
<th>3D mapping (n = 52)</th>
<th>CT integration (n = 53)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paroxysmal</td>
<td>71%</td>
<td>94%</td>
<td>0.17</td>
</tr>
<tr>
<td>Permanent</td>
<td>50%</td>
<td>73%</td>
<td>0.20</td>
</tr>
<tr>
<td>Overall</td>
<td>59%</td>
<td>82%</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Follow Up (weeks)</td>
<td>25 ± 11</td>
<td>25 ± 8</td>
<td>NS</td>
</tr>
</tbody>
</table>
Complications of AF ablation

- 2% pericardial effusion/tamponade
- 3% Femoral haematoma
- <0.5% stroke/TIA
- <0.5% PV stenosis
Recurrence

- Usually occurs <3 months (late recurrence is rare)
- May settle over a 3 to 6 month period
- Results in 28% to 40% of patients requiring redo
How does ablation compare to drugs?
### Controlled, randomized trials involving catheter ablation

<table>
<thead>
<tr>
<th>Author</th>
<th>Type of AFib</th>
<th>Ablation group</th>
<th>Comparator</th>
<th>n</th>
<th>AFib-free at 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wazni et al. 2005</td>
<td>symptomatic</td>
<td>PV isolation</td>
<td>AADs</td>
<td>70</td>
<td>87%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>37%</td>
</tr>
<tr>
<td>Stabile et al. 2006</td>
<td>drug-refractory</td>
<td>Ablation + AADs</td>
<td>AADs</td>
<td>137</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9%</td>
</tr>
<tr>
<td>Oral et al. 2006</td>
<td>chronic</td>
<td>Ablation + amiodarone*</td>
<td>amiodarone*</td>
<td>147</td>
<td>74%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4%</td>
</tr>
<tr>
<td>Pappone et al. 2006</td>
<td>paroxysmal</td>
<td>Circumferential PV ablation</td>
<td>AADs</td>
<td>198</td>
<td>84%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>24%</td>
</tr>
<tr>
<td>Jais et al. 2006</td>
<td>paroxysmal</td>
<td>Ostial PV isolation</td>
<td>AADs</td>
<td>112</td>
<td>75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7%</td>
</tr>
</tbody>
</table>

* Amiodarone was given only for the first 3 months
Does ablation improve prognosis?

**Ablation Group**

- Survival Probability (%)
- Days of Follow-up
- Observed log-rank test
  - Obs.: 31
  - Exp.: 31
  - Z: 0.597
  - P: 0.55

**Medical Group**

- Survival Probability (%)
- Days of Follow-up
- Observed log-rank test
  - Obs.: 79
  - Exp.: 34
  - Z: 7.07
  - P: <0.001

**Comparison**

<table>
<thead>
<tr>
<th></th>
<th>Ablation</th>
<th>Medical</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>589</td>
<td>582</td>
</tr>
<tr>
<td>Death</td>
<td>38</td>
<td>83</td>
</tr>
<tr>
<td>Adverse events</td>
<td>54</td>
<td>117</td>
</tr>
</tbody>
</table>

Pappone et al. *Circulation* 2001
Complications of AF ablation

Major complications with pulmonary vein ablation in 1049 patients

- Air emboli: n=5
- Bradycardia: n=3
- Tamponade: n=13
- TIA: n=8
- CVA: n=3
- PV stenosis: n=29
- Phrenic nerve: n=4
- PV dissect: n=4

(adapted from Packer et al. [28])
AF ablation is good for your garden
AF ablation for heart failure

• Patients with EF<45% and AF
• Randomised to medical therapy or med therapy and catheter ablation
• 21 patients enrolled so far
• 15 patients with at least 1 month FU
  – 7 Catheter Ablation
  – 8 Medical
Preliminary results

• 2 pts recurrence after ablation awaiting redo
• 6pts improved >1 NYHA
• 5% EF after 1 month
Who should have AF ablation

- Symptomatic (incl heart failure?)
- Persistent AF for <5 years
- Prepared to go through multiple procedures
- Prepared for the risks
Limitations of AF ablation

• High volume does make a difference
• Redo’s are common
• Tarrif does not reflect cost
• Serious complications are increasingly rare but do occur
• Team work is critical
Conclusion

• AF is common
• Priorities for treatment now clearly defined
• Cure is now possible but at a cost
• The “lost tribe” of AF sufferers now have hope
• The epidemic may have a solution

www.londonafcentre.com