My CRT patient now has AF: what do I do? - pacing vs ablation strategies

Dr A Patwala
University Hospital of North Midlands
Cardiac Resynchronisation Therapy (CRT)

- Reduces heart failure (HF) mortality by 40% on top of optimal medical therapy
- Decreases HF-related hospitalisations by 52%
One-third of patients do not experience the full benefit of CRT\textsuperscript{1-6}
There are many drivers for CRT non-responders

Potential Reasons for Suboptimal CRT Response

- Suboptimal AV Timing (65%)
- Arrhythmia (60%)
- Anemia (55%)
- Suboptimal LV Lead Position (50%)
- < 90% Biventricular Pacing (45%)
- Suboptimal Medical Therapy (40%)
- Persistent Mechanical Dyssynchrony (35%)
- Underlying Narrow QRS (30%)
- Compliance Issues (25%)
- Primary RV Dysfunction (20%)

How often is AF an issue in CRT patients?

- AF is the most common arrhythmia in patients with HF. The EuroHeart Failure survey reported that up to 45% of patients with HF also had intermittent or permanent AF.

- AF is present in 20% of CRT recipients in Europe

- The outcomes from CRT in AF is worse than in sinus.

Patient with AF in CRT studies

- Significant under represented in the major randomised CRT studies
- Apart from the RAFT trial all the other CRT trials in total (over 2500 patients) only included 43 patients with AF!
- RAFT had 229 patients (CRT D in 114, ICD in 115)
- Patients with AF were required to have a resting heart rate of \( \leq 60 \) beats per minute and \( \leq 90 \) beats per minute after a 6-minute walk test to be eligible for the study

Healey et al. Circ Heart Fail. 2012 Sep 1;5(5):566-70
No significant difference between CRT and ICD

Only one third of CRT patients received ≥95% ventricular pacing during the first 6 months.¹

Even this may be an overestimate, because Holter monitoring studies have shown that, when device logs indicate ≥90% ventricular pacing in patients with permanent AF but without AV junction ablation, 53% of these paced beats are actually fusion or pseudofusion.²

---

**Table 2. Clinical Outcomes (With HR and 95% CI for CRT-ICD Versus ICD)**

<table>
<thead>
<tr>
<th></th>
<th>ICD, % (n=115)</th>
<th>CRT-ICD, % (n=114)</th>
<th>HR (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death or heart failure hospitalization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>42.6</td>
<td>48.2</td>
<td>0.96 (0.65–1.41)</td>
<td>0.82</td>
</tr>
<tr>
<td>Heart failure hospitalization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular death</td>
<td>20.0</td>
<td>22.8</td>
<td>0.97 (0.55–1.71)</td>
<td>0.91</td>
</tr>
<tr>
<td>All-cause hospitalization</td>
<td>53.9</td>
<td>65.8</td>
<td>1.37 (0.997–1.92)</td>
<td>0.067</td>
</tr>
</tbody>
</table>

HR indicates hazard ratio; CRT, cardiac resynchronization; ICD, implantable cardioverter defibrillator.

---

¹ Healey et al. Circ Heart Fail. 2012 Sep 1;5(5):566-70
How much Biv pacing is required?

- Initially, in 2006 Gasparini et al.\(^1\) set an arbitrary cut-off of 85% biventricular pacing to define CRT in AF patients as successful.

- In the MADIT-CRT trial (sinus rhythm patients) a biventricular pacing percentage ≥90% was needed to show CRT-D efficacy when compared to ICD-only and biventricular pacing ≥97% was associated with an even further decrease in the risk of HF events, as well as a significantly reduced risk of death.\(^2\)

- Hayes et al.\(^3\) in 2011 (35,000 patients on latitude) found
  - 98.5% to be the cut-off with the greatest magnitude of separation for total mortality.
  - Patients with AF had similar survival as sinus rhythm patients as long as they achieved biventricular pacing >98.5%.

---

2. Ruwald et al. The association between biventricular pacing and cardiac resynchronization therapy-defibrillator efficacy when compared with implantable cardioverter defibrillator on outcomes and reverse remodelling. Eur Heart J.
Guidelines

EHRA/HRS Expert Consensus Statement on CRT, 2012

• Clinical response to CRT depends on the proportion of effective biventricular capture during daily activity, and this cannot be assumed from a resting ECG.

• The percentage of biventricular pacing recorded by the device may be an inaccurate guide to QRS fusion: the presence of a pacing stimulus does not imply full capture.

ESC Guidelines on Cardiac Pacing and CRT, 2013

• Competing AF rhythm - by creating spontaneous, fusion or pseudo-fusion beats - may reduce the rate of real biventricular capture.

• A careful analysis of surface ECG is mandatory and in some cases a Holter recording could be useful, to assess the completeness of biventricular capture and to exclude pseudofusion, which the device algorithms might register as paced beats.
Options for AF patients

• Device based options (EffectivCRT)
• AV node ablation
• Pulmonary vein Isolation
EffectivCRT
EffectivCRT Diagnostic

- Effective capture generates a negative EGM deflection measured from the pacing cathode (LV) to an indifferent electrode (RV coil)
- Acute data from 28 CRT pts. was used to validate the algorithm
- 98.2% sensitivity in determination of effective pacing vs surface ECG
- Reported via Quick Look™ II Screen, Rate Histograms Report, Cardiac Compass™ Report, and New EffectivCRT Episodes

Ghosh S. Europace 2015; 17: 1555-1562
Effective Percentage of Vpacing

- Verification of effective CRT percentage in 57 CRT pts.

- Average %Vpacing was 94.8% while % effective CRT was 87.5% (p<0.001)

- CRT devices overestimate the real effective pacing percentage

Hernandez-Madrid A. Heart Rhythm 2017; 14: 541-547
EffectivCRT during AF algorithm:

- Improves percentage of time patients receive effective CRT by changing the pacing rate without substantially increasing the average heart rate
  - Increase of pacing rate if too much ineffective paced or sensed events
  - Decrease of pacing rate if sufficient effective pacing detected
- Maximum heart rate is programmable
EffectivCRT during AF

- Prospective, randomized crossover study to compare EffectivCRT during AF and Conducted AF Response (CAFR)
  - 54 pts. with ≥6 d with ≥4 h of AF/day had the algorithm downloaded
  - Increase in % effective CRT pacing; average rate increased by only 2.5 bpm

Plummer C. Heart Rhythm 2018; 15: 369-275
EffectivCRT during AF - Subgroups

- Pts. were divided into 3 subgroups based on the % V pacing
- Those with <80% V pacing had the greatest benefit (39% of pts.)
- 15% increase in effective CRT pacing
AV node ablation
AV node ablation

- Radio frequency ablation of AV node
- Advantages
  - Relatively simple and successful procedure
  - If successful then CRT pacing should be around 100%
- Disadvantages
  - Not reversible
  - Potentially renders the patient pacing dependant
AV node ablation data

- No large scale randomised trial
- Meta analysis of smaller trials has shown some benefit from AV node ablation vs rate control drugs

Gasparini et al. J Am Coll Cardiol 2006;48:734 – 43
Pulmonary Vein Isolation (PVI)
PVI

• Increasing focus on PVI, but limited data in CRT patients
• Advantages
  • If successful restores Sinus rhythm, and therefore AV synchrony
  • Patient not pacing dependant
• Disadvantages
  • Longer more complex procedure with a lower single procedure success rate
  • Increased risk of peri-procedure complications compared to AV node ablation
CASTLE AF

- Randomised multicentre trial of PVI vs medical treatment in ICD patients
- 398 patients (3000 patients screened)
  - 27% CRT D, 73% ICD
  - 90% Primary prevention
  - 70% Persistent AF
  - Mean LA <5cm

C Hospitalization for Worsening Heart Failure

- Probability of Freedom from Hospital Admission
- Hazard ratio, 0.56 (95% CI, 0.37–0.83)
- P=0.004 by Cox regression
- P=0.004 by log-rank test

<table>
<thead>
<tr>
<th>Months of Follow-up</th>
<th>Ablation</th>
<th>Medical therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>179</td>
<td>184</td>
</tr>
<tr>
<td>12</td>
<td>141</td>
<td>145</td>
</tr>
<tr>
<td>24</td>
<td>114</td>
<td>111</td>
</tr>
<tr>
<td>36</td>
<td>76</td>
<td>70</td>
</tr>
<tr>
<td>48</td>
<td>58</td>
<td>48</td>
</tr>
<tr>
<td>60</td>
<td>22</td>
<td>12</td>
</tr>
</tbody>
</table>
PABA CHF

• Randomised multicentre trial
• PVI vs AV node ablation +CRT
• Patients with AF, EF<40%, NYHA II-III
• 81 patients (177 screened)
• Mean LA diameter <5cm

PABA CHF results

**C Minnesota Living with Heart Failure Questionnaire**

- **Score**
  - 0 months: 80 (PVI), 80 (AV-node ablation+BiV)
  - 6 months: 60 (PVI), 50 (AV-node ablation+BiV)

- **P-value**: P<0.001
Conclusions

• CRT is an effective treatment.

• Biv Pacing percentages need to be above 98.5 for maximum benefit.

• EffectivCRT helps to highlight accurate BIV pacing numbers and may help to increase Pacing percentages.

• PVI or AV node ablation should be considered if Pacing <98%.

• PVI may be superior to AV node ablation if it’s a option.
Thank You