University Hospitals of North Midlands NHS
NHS Trust

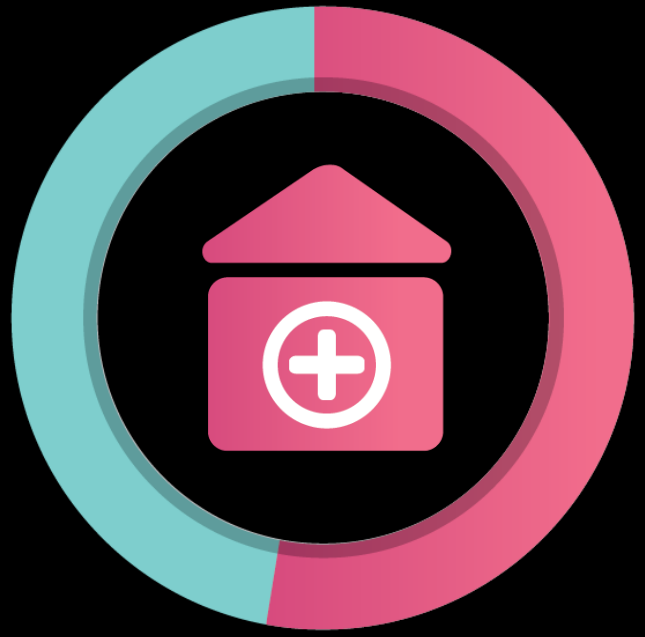
My CRT patient now has AF: what do I do? - pacing vs ablation strategies

Dr A Patwala
University Hospital of North Midlands

Heart Rhythm Congress
www.heartrhythmcongress.com

Cardiac Resynchronisation Therapy (CRT)

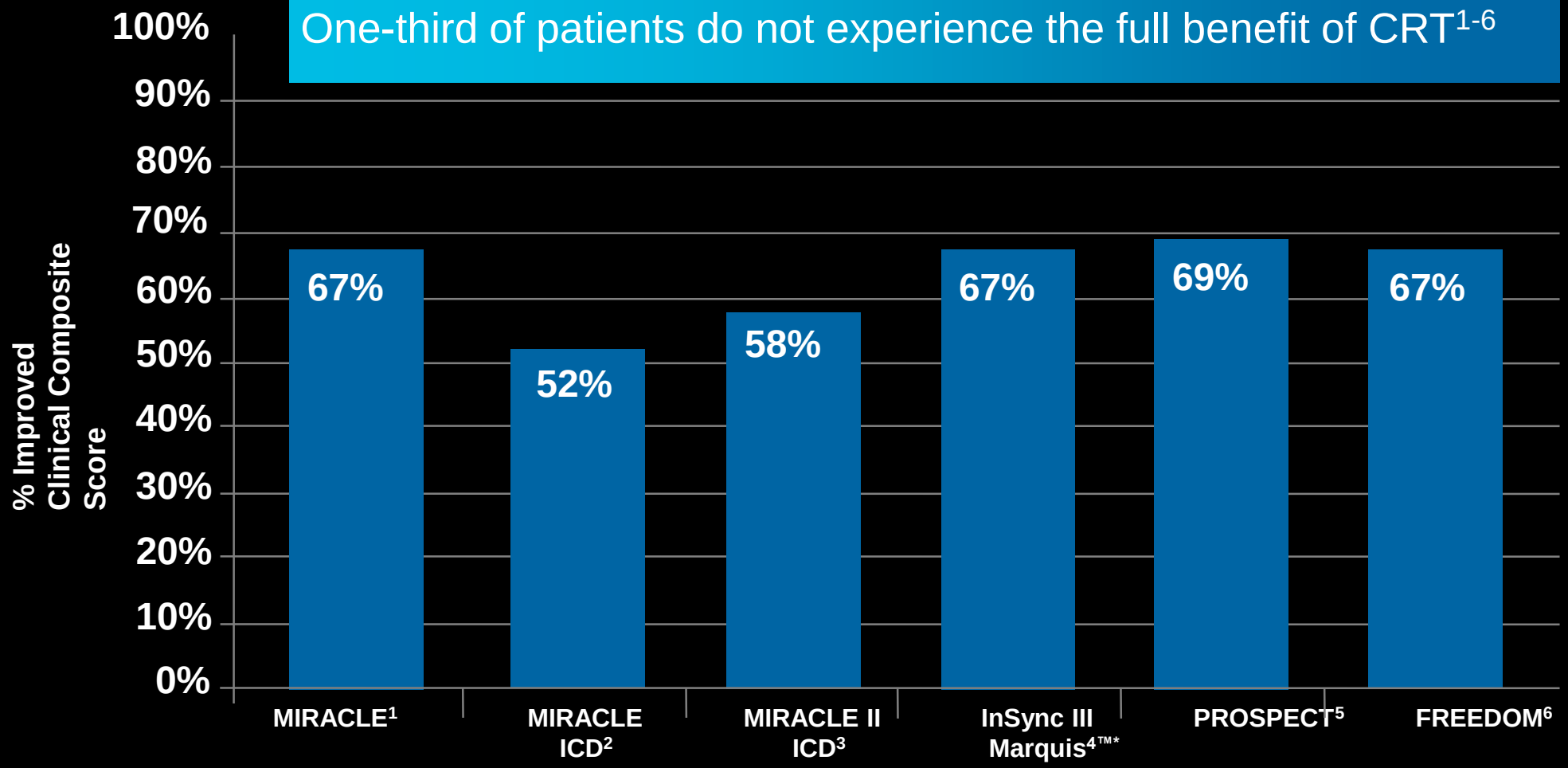
Reduces heart failure (HF) mortality by 40% on top of optimal medical therapy



Decreases HF-related hospitalisations by 52%

CRT Response Rate

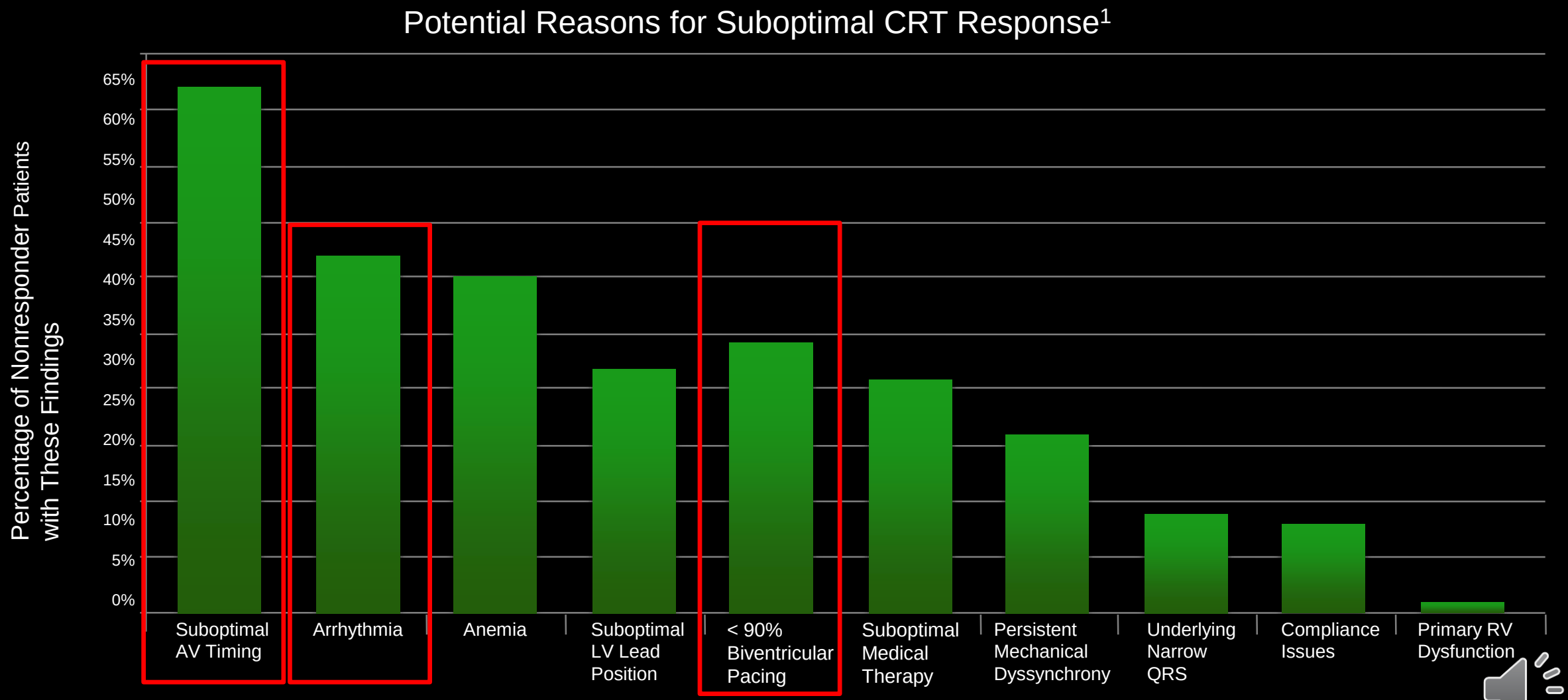
One-third of patients do not experience the full benefit of CRT[1-6]



[1] Abraham WT, et al. *N Engl J Med.* 2002;346:1845-1853.
[2] Young JB, et al. *JAMA*. 2003;289:2685-2694.
[3] Abraham WT, et al. *Circulation*. 2004;110:2864-2868.
[4] Chung ES, et al. *Circulation*. 2008;117:2608-2616.
[5] Abraham WT, et al. *Heart Rhythm*. 2005;2:S65.
[6] Abraham WT, et al. Late-Breaking Clinical Trials, HRS 2010. Denver, Colorado.

*AV optimized only

There are many drivers for CRT non responders



[1]Mullens W, et al. *JACC*. 2009;53:765-773.

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.

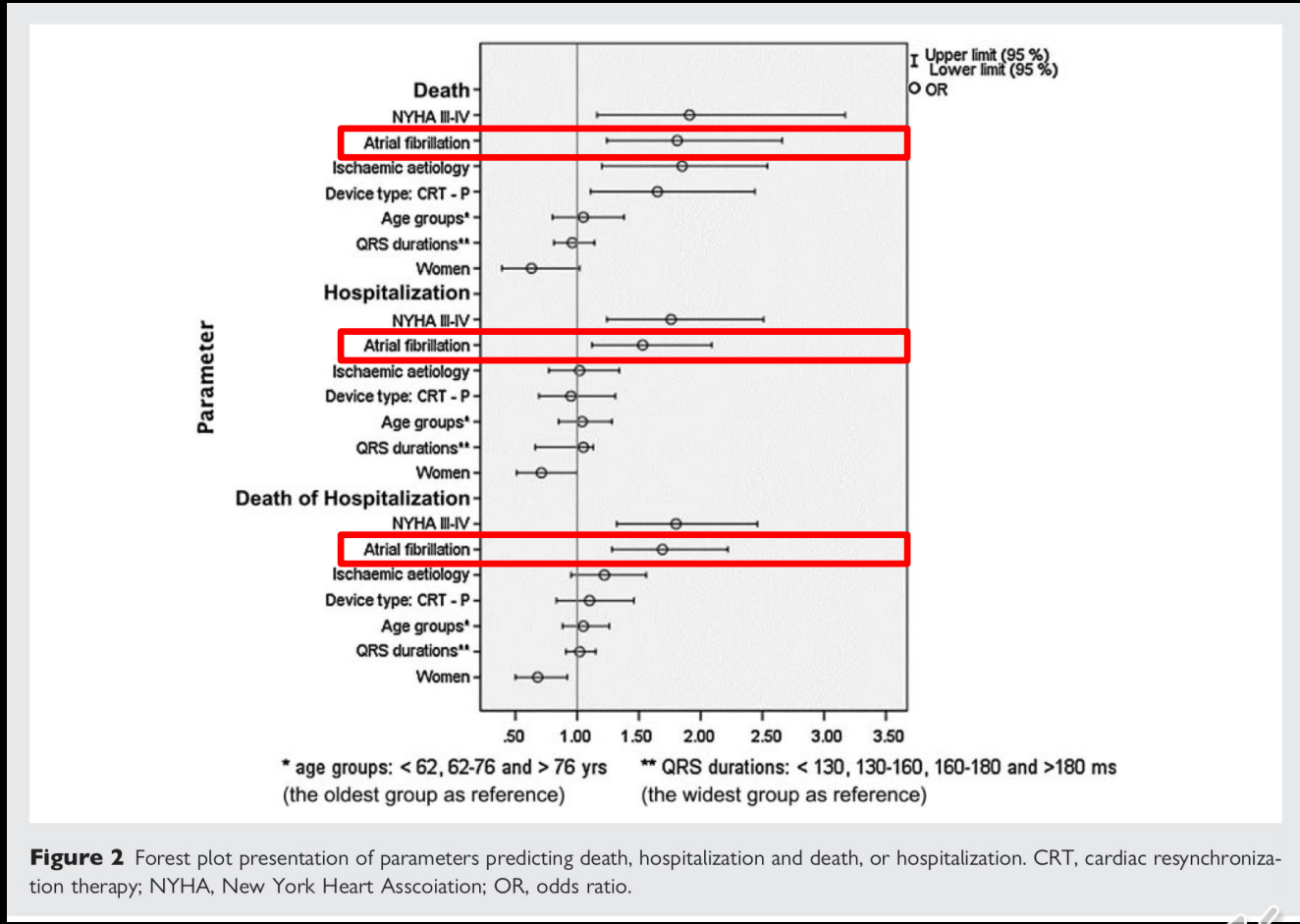


Figure 2 Forest plot presentation of parameters predicting death, hospitalization and death, or hospitalization. CRT, cardiac resynchronization therapy; NYHA, New York Heart Asscoiation; OR, odds ratio.

Bogale N, et al The european crt survey: 1 year (9-15 months) follow-up results. Eur J Heart Fail. 2012;14:61-73

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 ≤60 beats per minute and ≤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

RAFT AF sub study results

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

	ICD, % (n=115)	CRT-ICD, % (n=114)	HR (95% CI)	*P* Value
Death or heart failure Hospitalization	42.6	48.2	0.96 (0.65–1.41)	0.82
Death	30.4	36.8	1.04 (0.66–1.62)	0.88
Heart failure hospitalization	27.8	19.3	0.58 (0.38–1.01)	0.052
Cardiovascular death	20.0	22.8	0.97 (0.55–1.71)	0.91
All-cause hospitalization	53.9	65.8	1.37 (0.997–1.92)	0.067

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

- 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]

1. Healey et al. Circ Heart Fail. 2012 Sep 1;5(5):566-70
2. Kamath GS,et al. The utility of 12-lead Holter monitoring in patients with permanent atrial fibrillation for the identification of non- responders after cardiac resynchronization therapy. *J Am Coll Cardiol*. 2009;53:1050–1055.

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%.

1. Gasparini et al. J Am Coll Cardiol 2006;48:734 – 43
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.
3. Hayes DL, et al Cardiac resynchronization therapy and the relationship of percent biventricular pacing to symptoms and survival. Heart Rhythm. 2011;8:1469-1475

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.

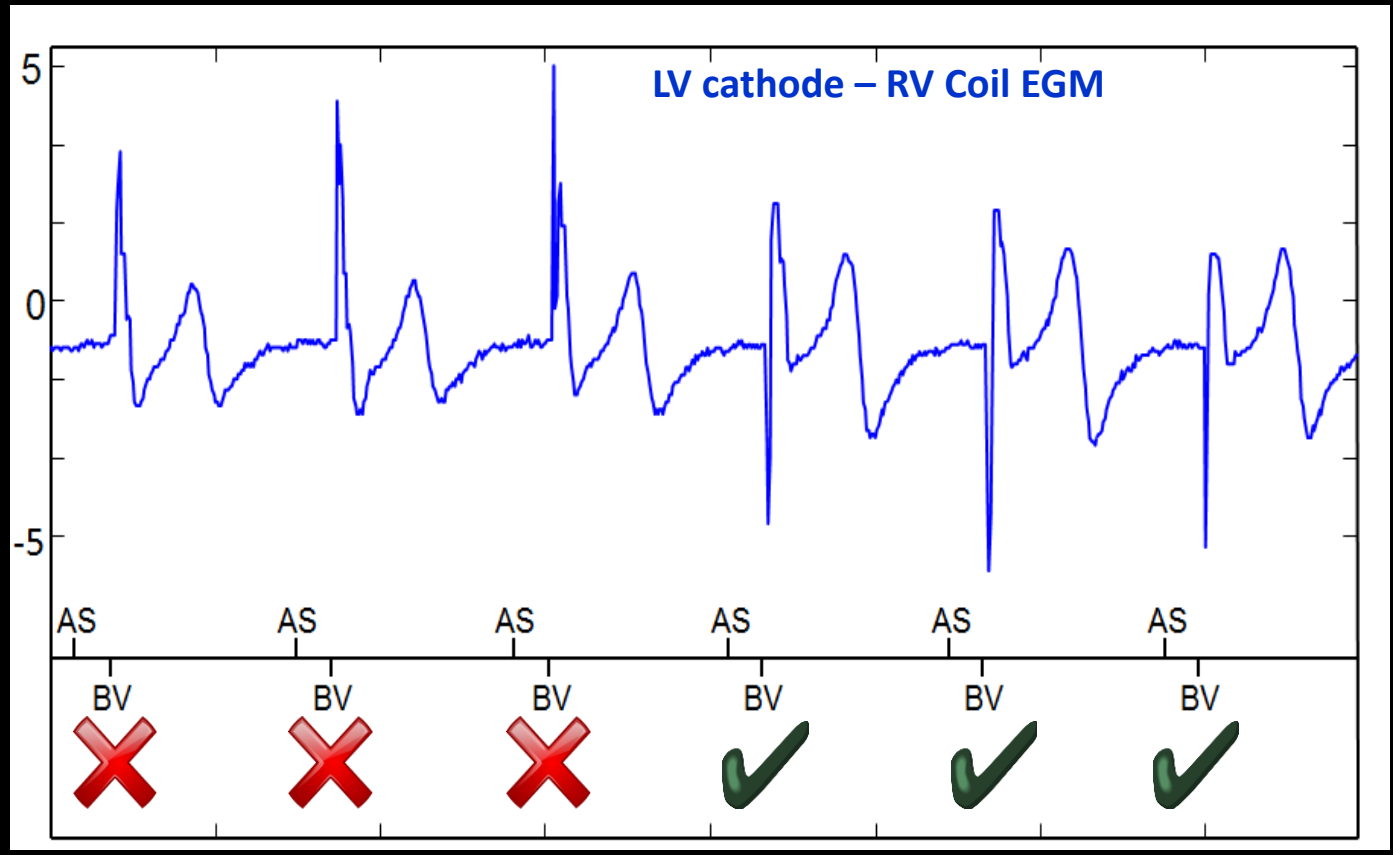
Options for AF patients

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

EffectivCRT

EffectivCRT Diagnostic

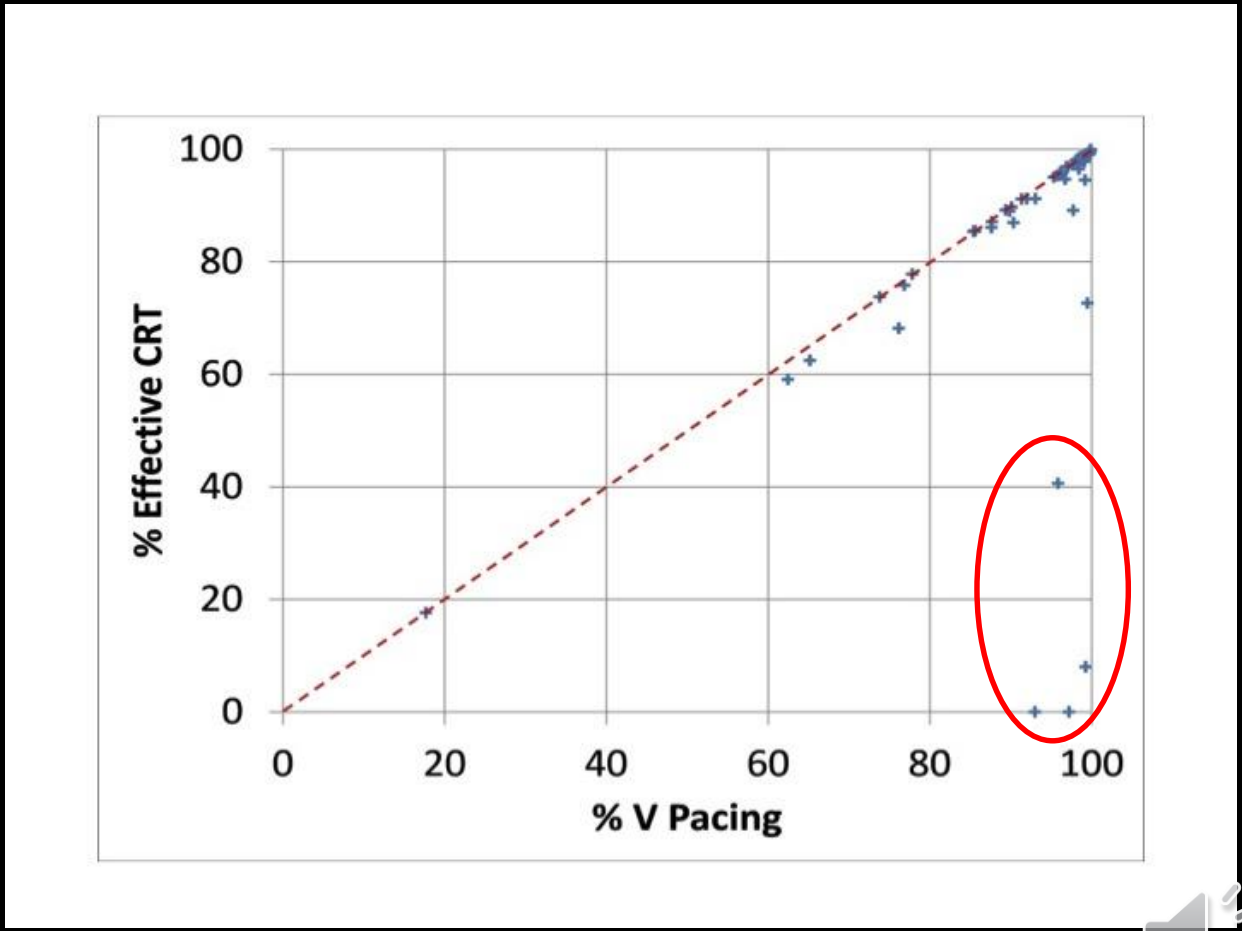
- Effective capture generates a negative EGM deflection measured from the pacing cathode (LV) to an indifferent electrode (RV coil)
- Acute data from 28 CRT pts. was used to validate the algorithm
- 98.2% sensitivity in determination of effective pacing vs surface ECG
  - Reported via Quick Look™ II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

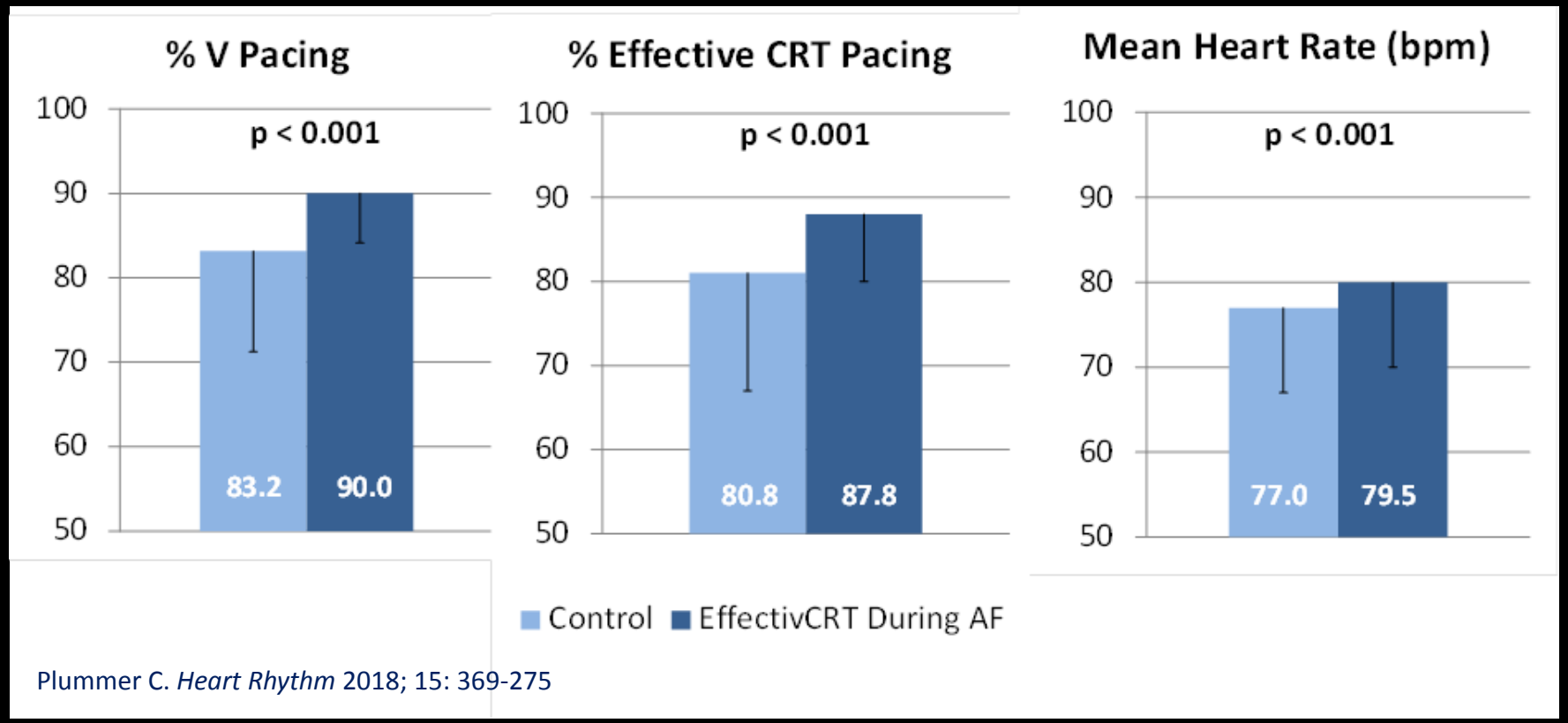
EffectivCRT during AF algorithm

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

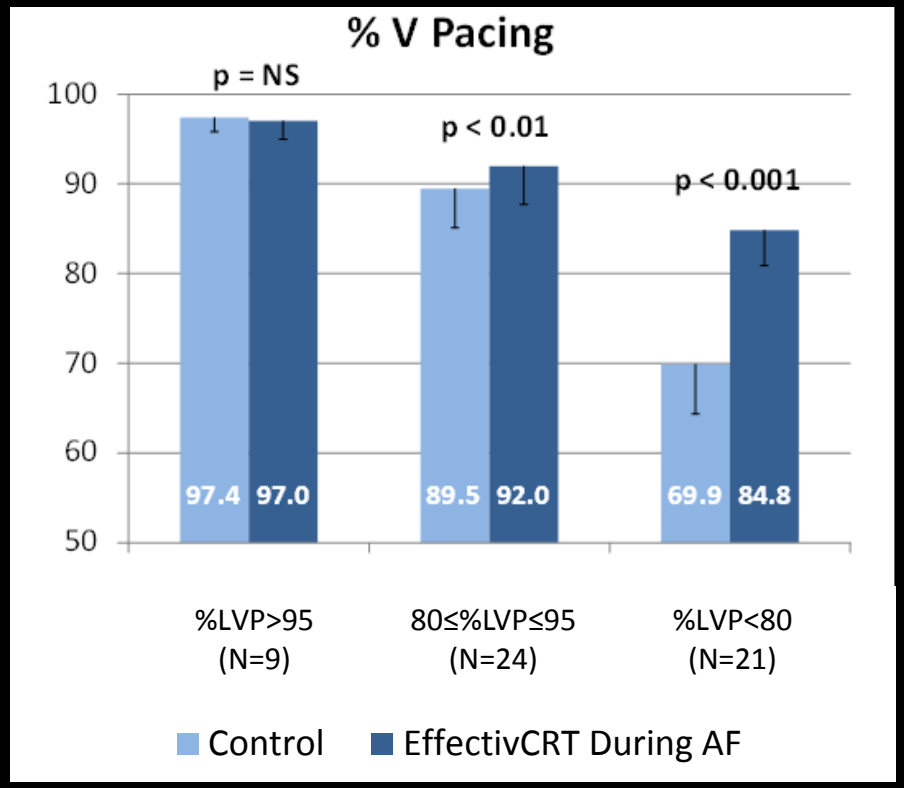
- Prospective, randomized crossover study to compare EffectivCRT during AF and Conducted AF Response (CAFR)
    - 54 pts. with ≥6 d with ≥4 h of AF/day had the algorithm downloaded
    - Increase in % effective CRT pacing; average rate increased by only 2.5 bpm

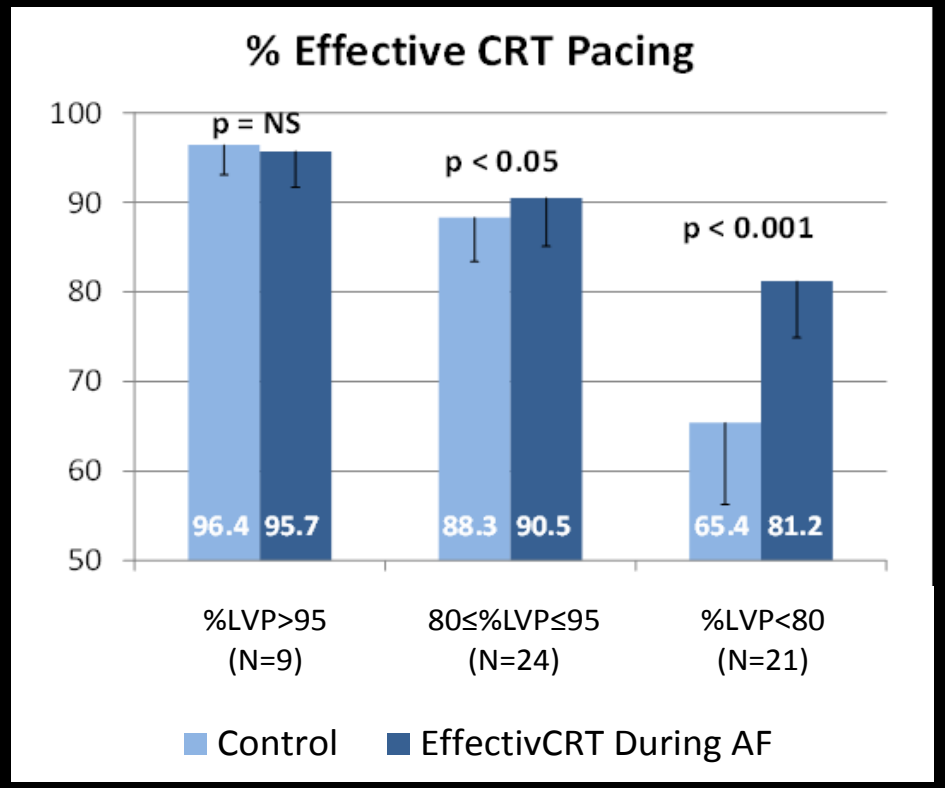


Plummer C. *Heart Rhythm* 2018; 15: 369-275

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





Plummer C. *Heart Rhythm* 2018; 15: 369-275

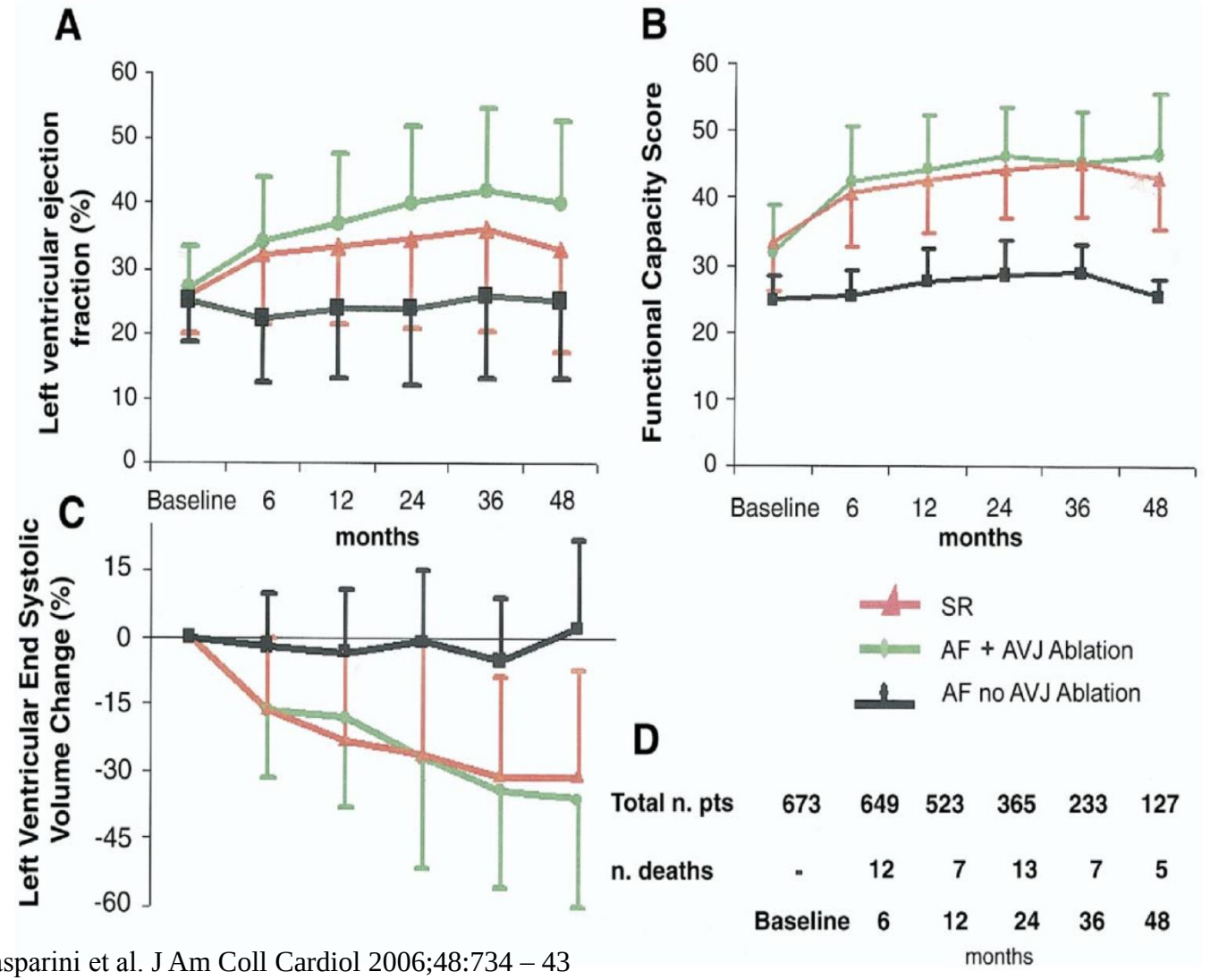
AV node ablation

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

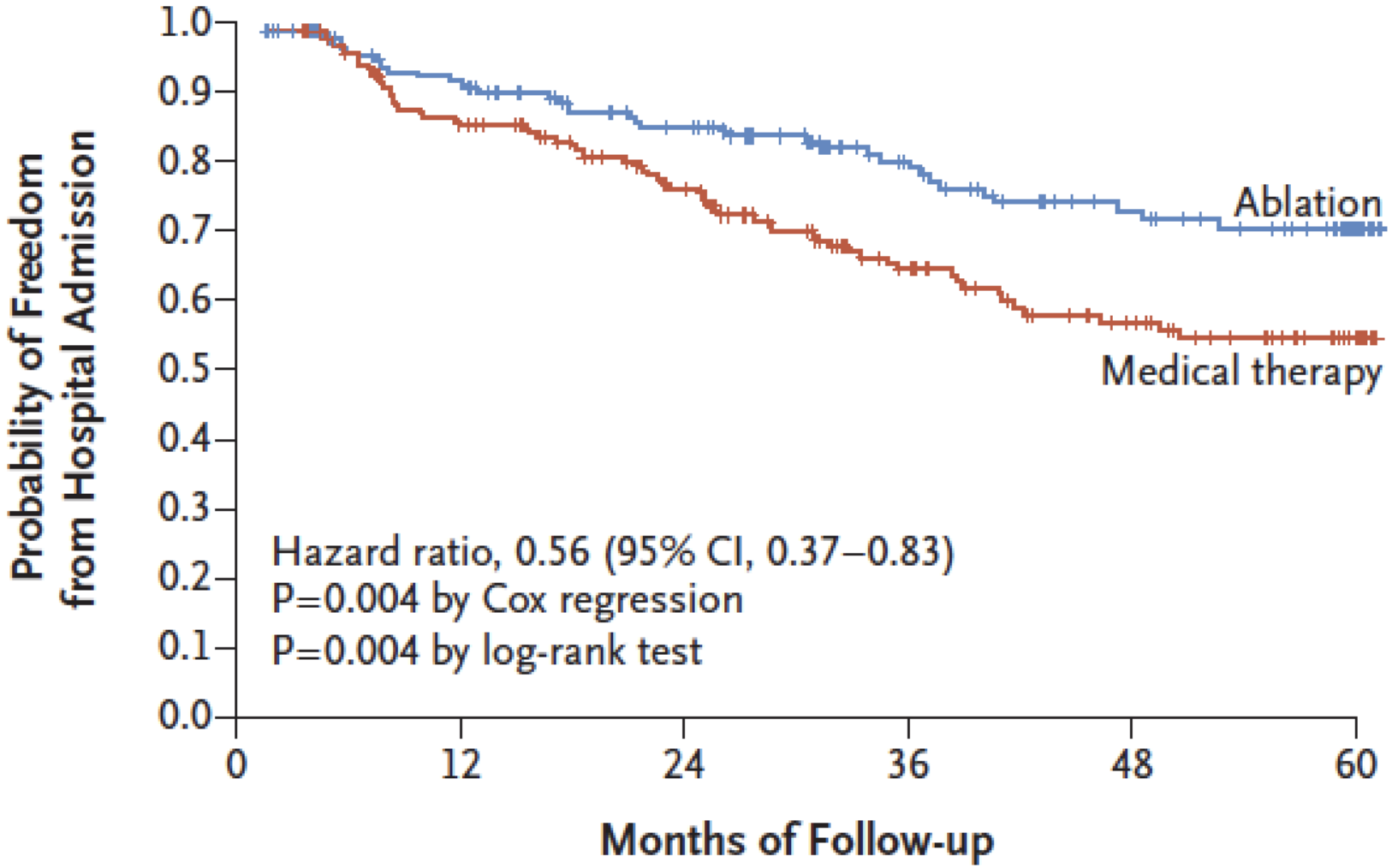
- Increasing focus on PVI , but limited data in CRT patients
- Advantages
  - If successful restores Sinus rhythm, and therefore AV synchroncy
  - Patient not pacing dependant
- Disadvantages
  - Longer more complex procedure with a lower single procedure success rate
  - Increased risk of peri-procedure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

Marrouche et al . N Engl J Med 2018;378:417-27.

C Hospitalization for Worsening Heart Failure



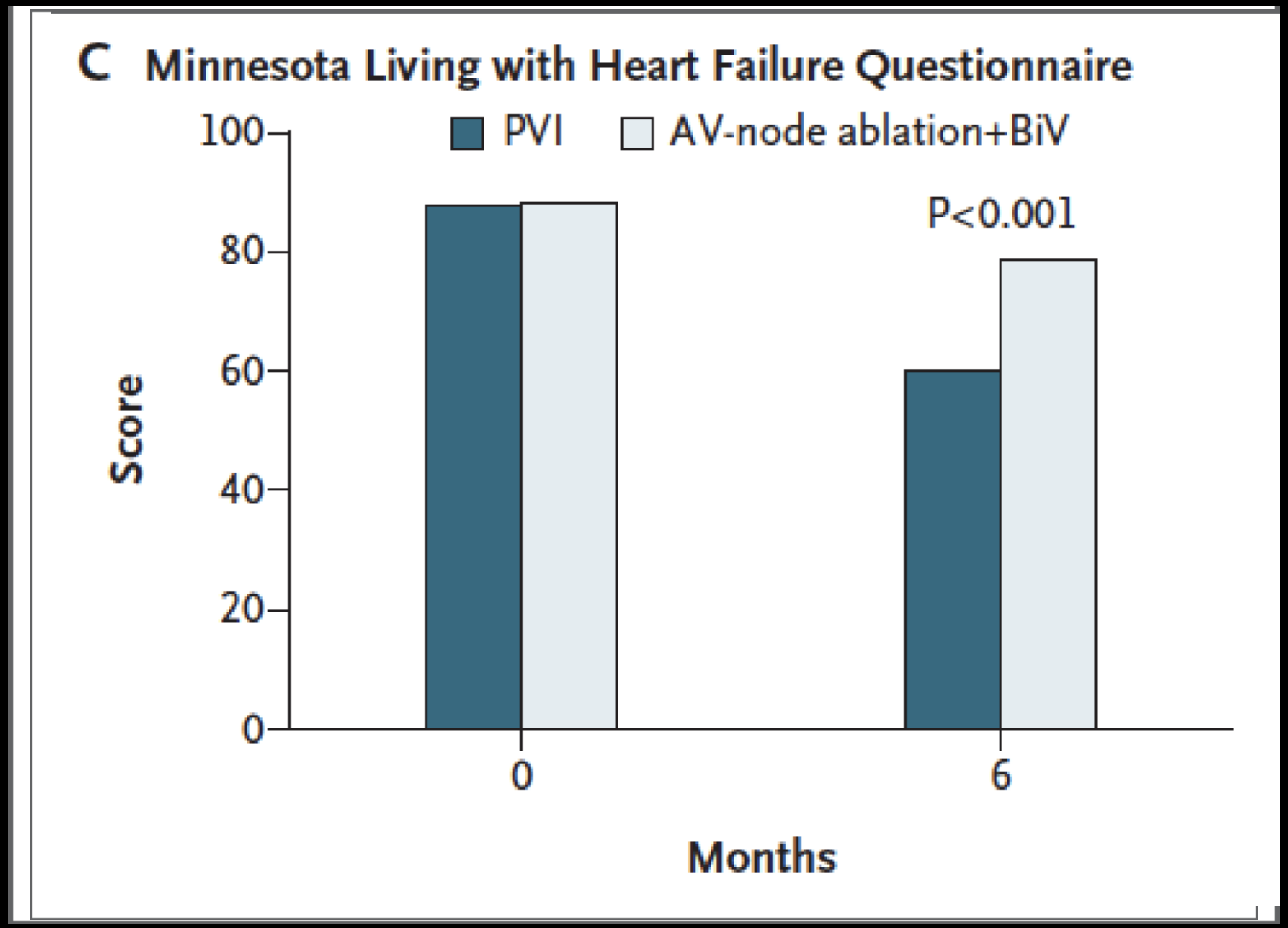
No. at Risk						
Ablation	179	141	114	76	58	22
Medical therapy	184	145	111	70	48	12

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 dimeter <5cm

Khan et al. N Engl J Med 2008;359:1778-85.

PABA CHF results



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