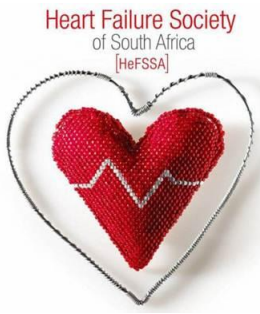


Program

- **Lecture 1:** Update on chronic heart failure –2012
ESC/HeFSSA guidelines
- **Lecture 2:** Update on acute heart failure –2012
ESC/HeFSSA guidelines
- **Lecture 3:** Update on the use of devices and end stage HF -2012 ESC/HeFSSA guidelines
- **Lecture 4:** Diagnosis and management of right heart failure





Program

Lecture 3 :

UPDATE ON THE USE OF DEVICES AND END STAGE HF

- Background Information and ESC Guidelines on chronic heart failure 2012

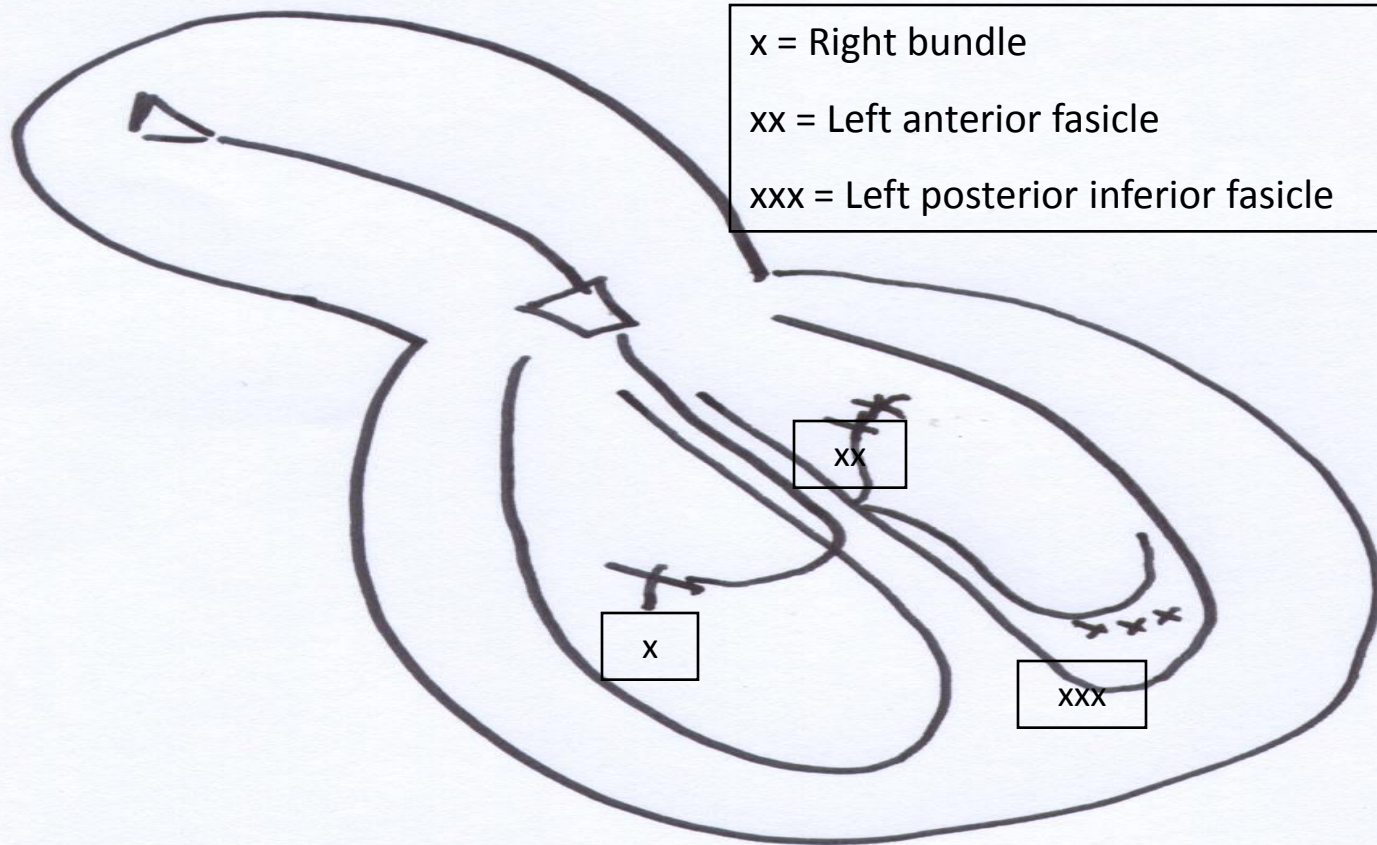




Determinants of Cardiac Synchrony

Interventricular Synchrony

Determinants: Bundle branches

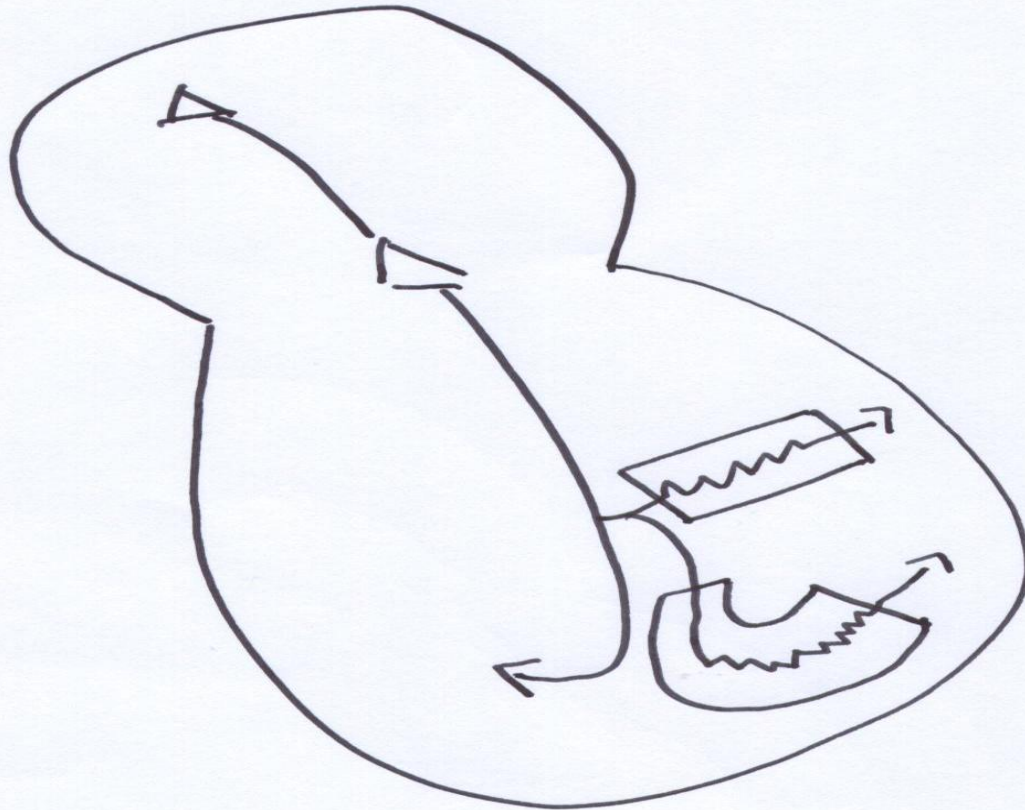




Determinants of Cardiac Synchrony

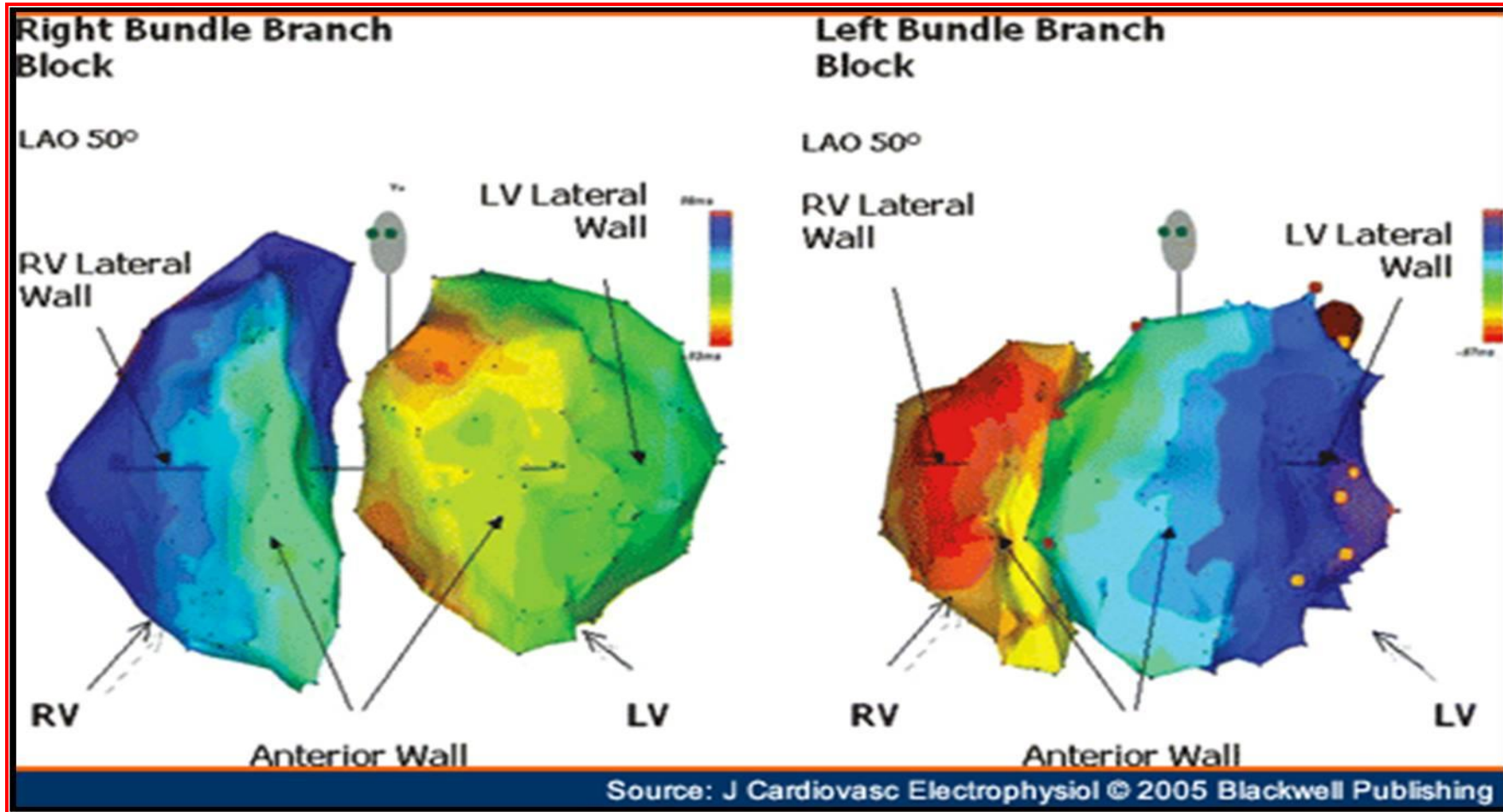
Interventricular Synchrony

Determinants: Mainly affects LV (scar etc)



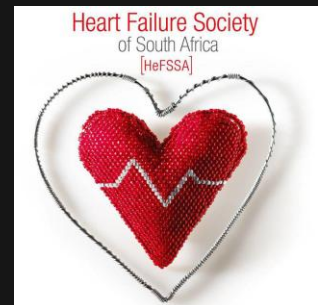
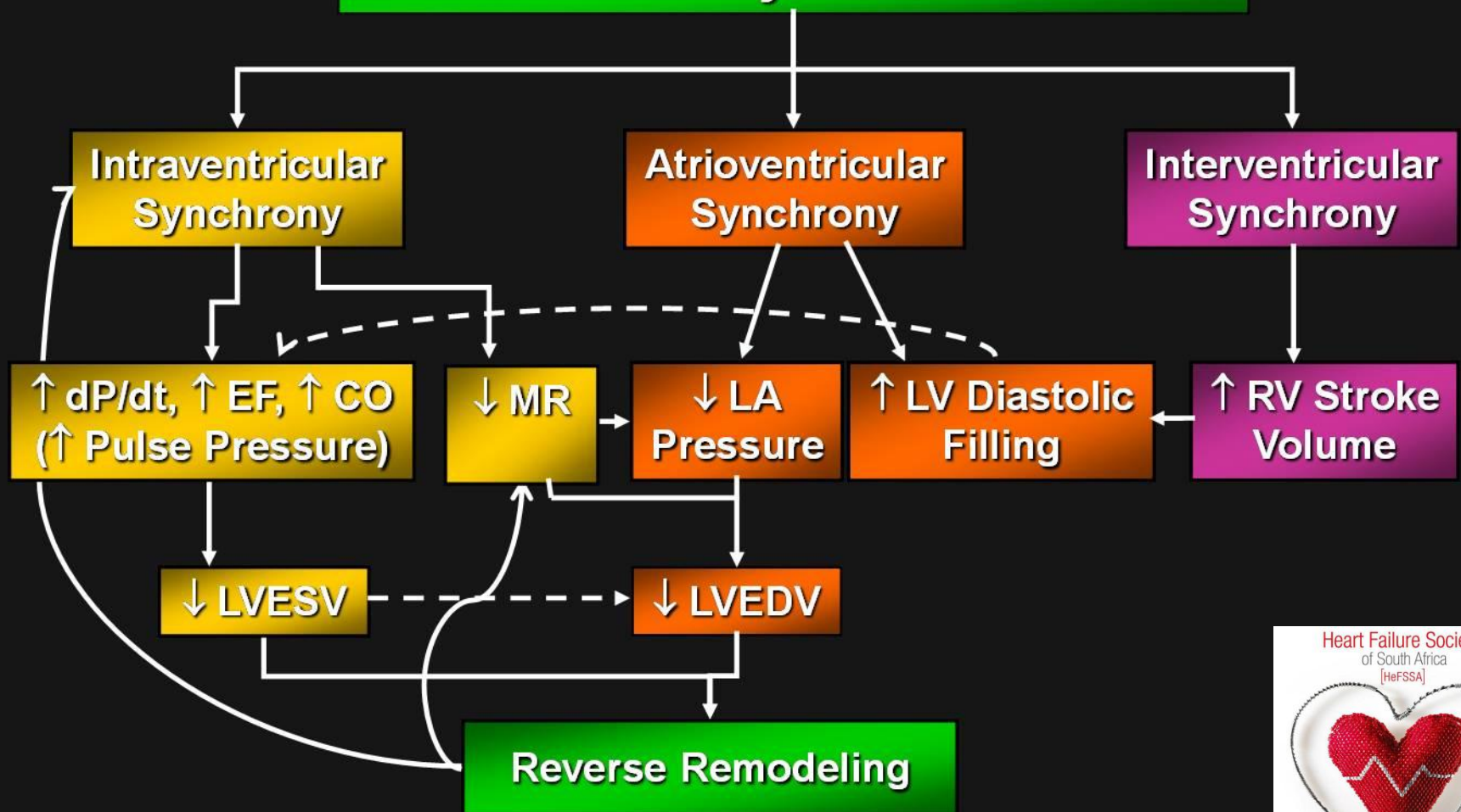


Bundle Branch Patterns of Activation



Summary of Proposed Mechanisms Therapy

Cardiac Resynchronization





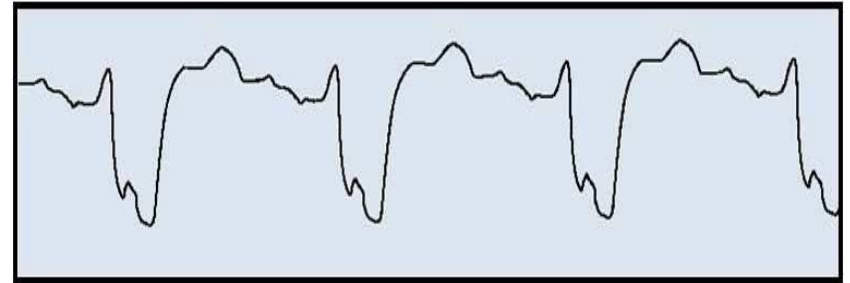
Ventricular Dysynchrony and Cardiac Resynchronization

Ventricular Dysynchrony¹

Electrical: Inter- or Intra-ventricular conduction delays typically manifested as left bundle branch block

Structural: disruption of myocardial collagen matrix impairing electrical conduction and mechanical efficiency

Mechanical: Regional wall motion abnormalities with increased workload and stress—compromising ventricular mechanics



Cardiac Resynchronization

Therapeutic intent of atrial synchronized biventricular pacing

Modification of interventricular, intra-ventricular and atrial-ventricular activation sequences in patients with ventricular dysynchrony.

Complement to optimal medical therapy



¹ Tavazzi L. *Eur Heart J* 2000;21:1211-1214

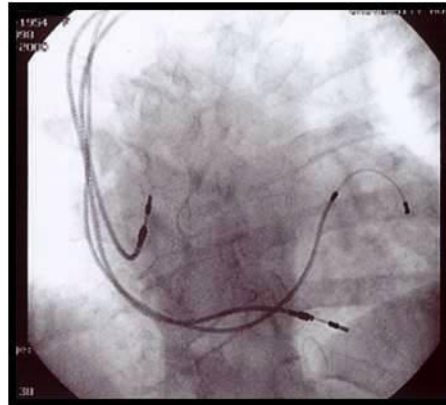
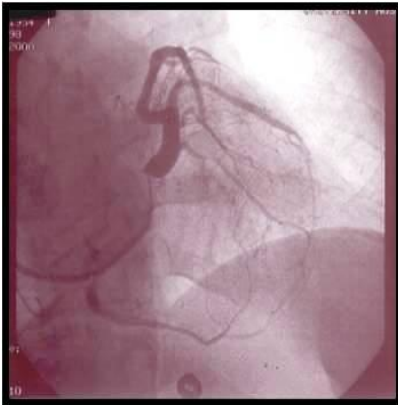
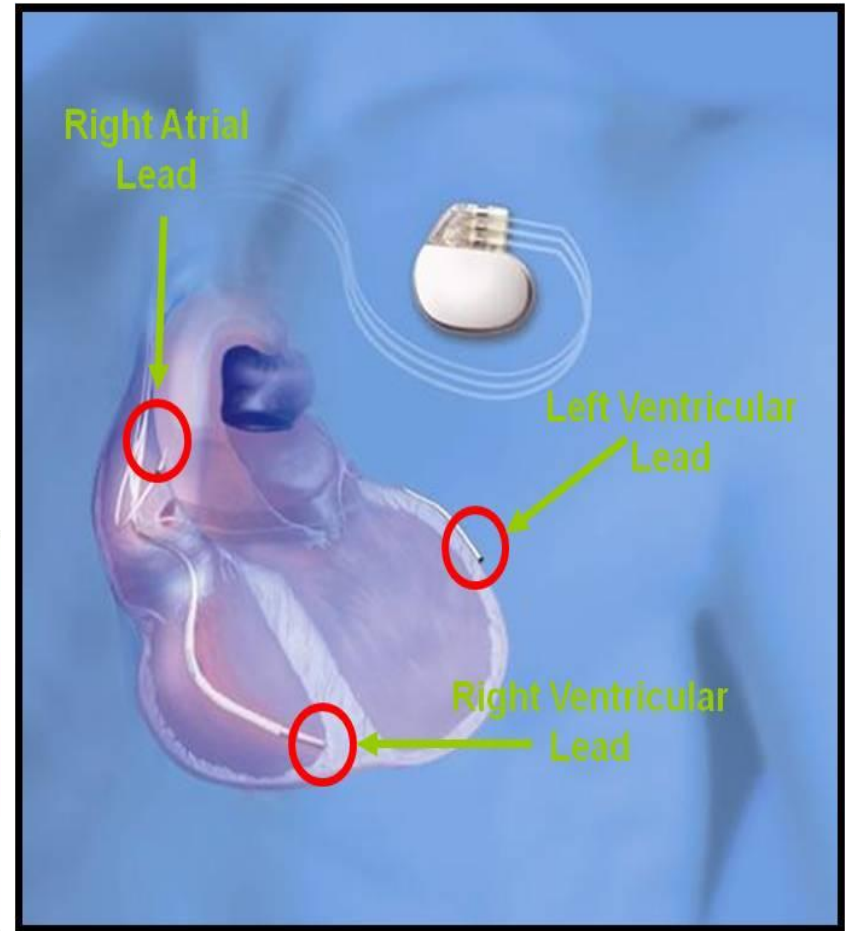


Achieving Cardiac Resynchronization

Goal: Atrial synchronous biventricular pacing

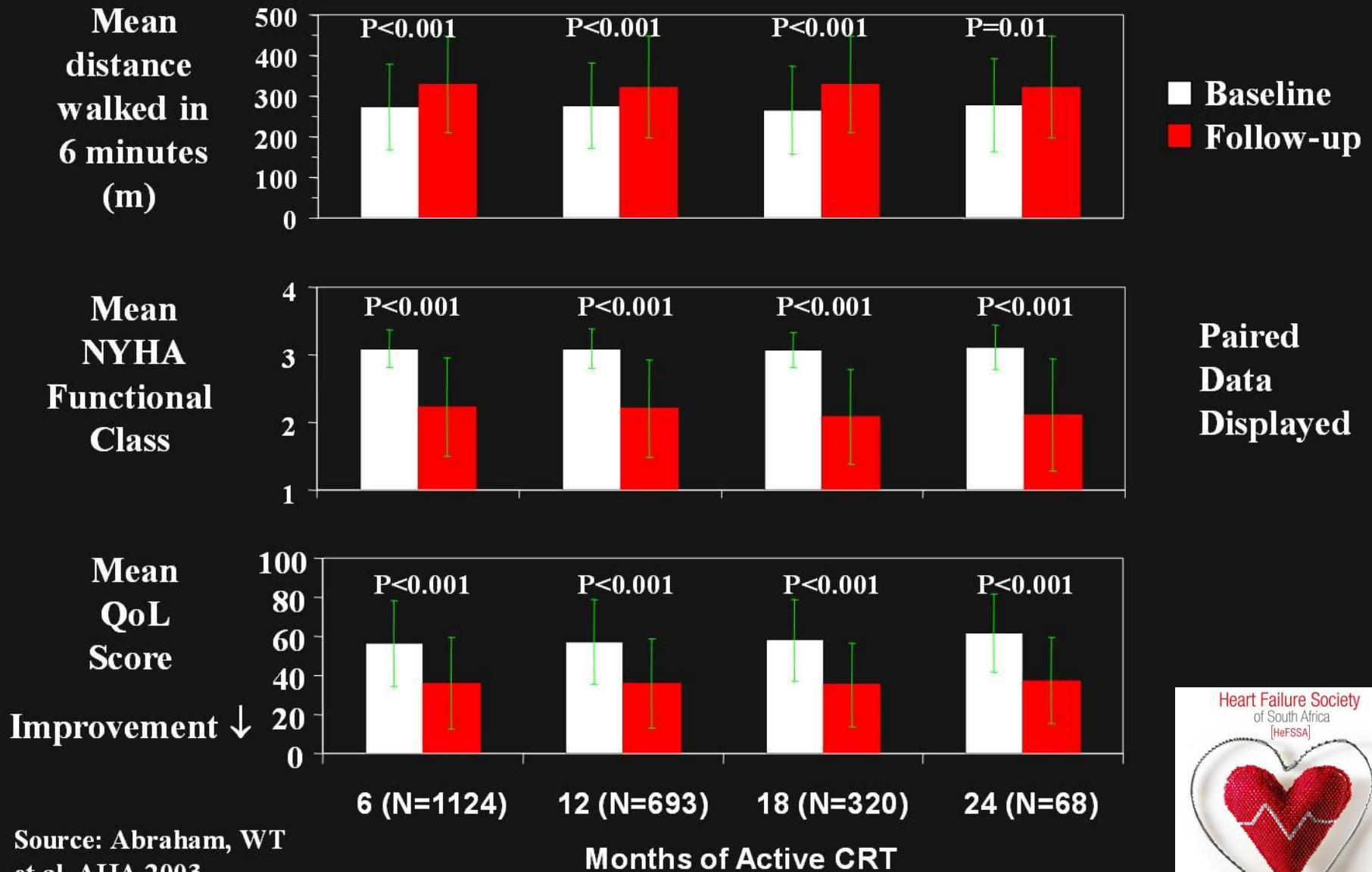
Transvenous approach for left ventricular lead via coronary sinus

Back-up epicardial approach

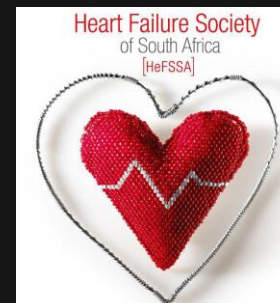


Benefits Sustained Through 2 Years

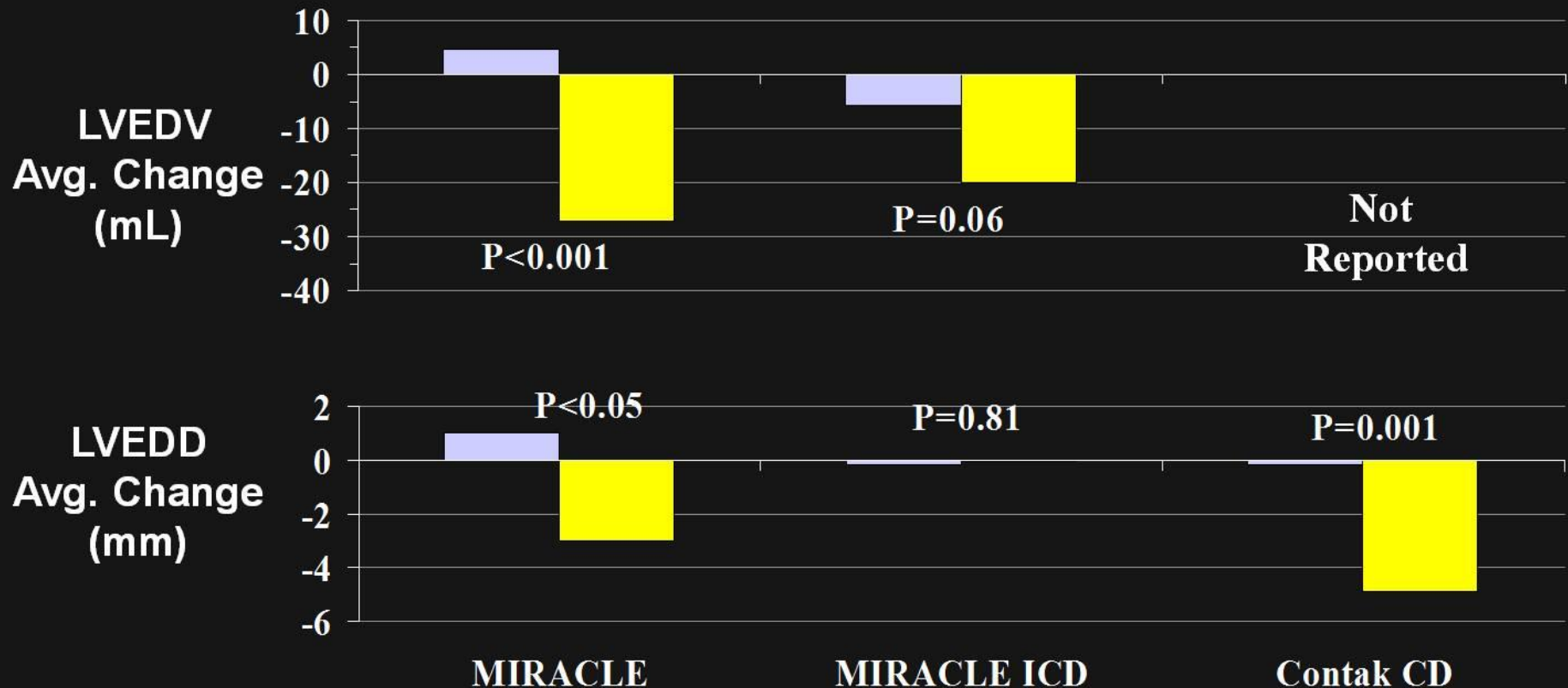
MIRACLE Study Program



Source: Abraham, WT
et al. AHA 2003



CRT Effect on LV Structure at 6 Months in Moderate to Severe Heart Failure

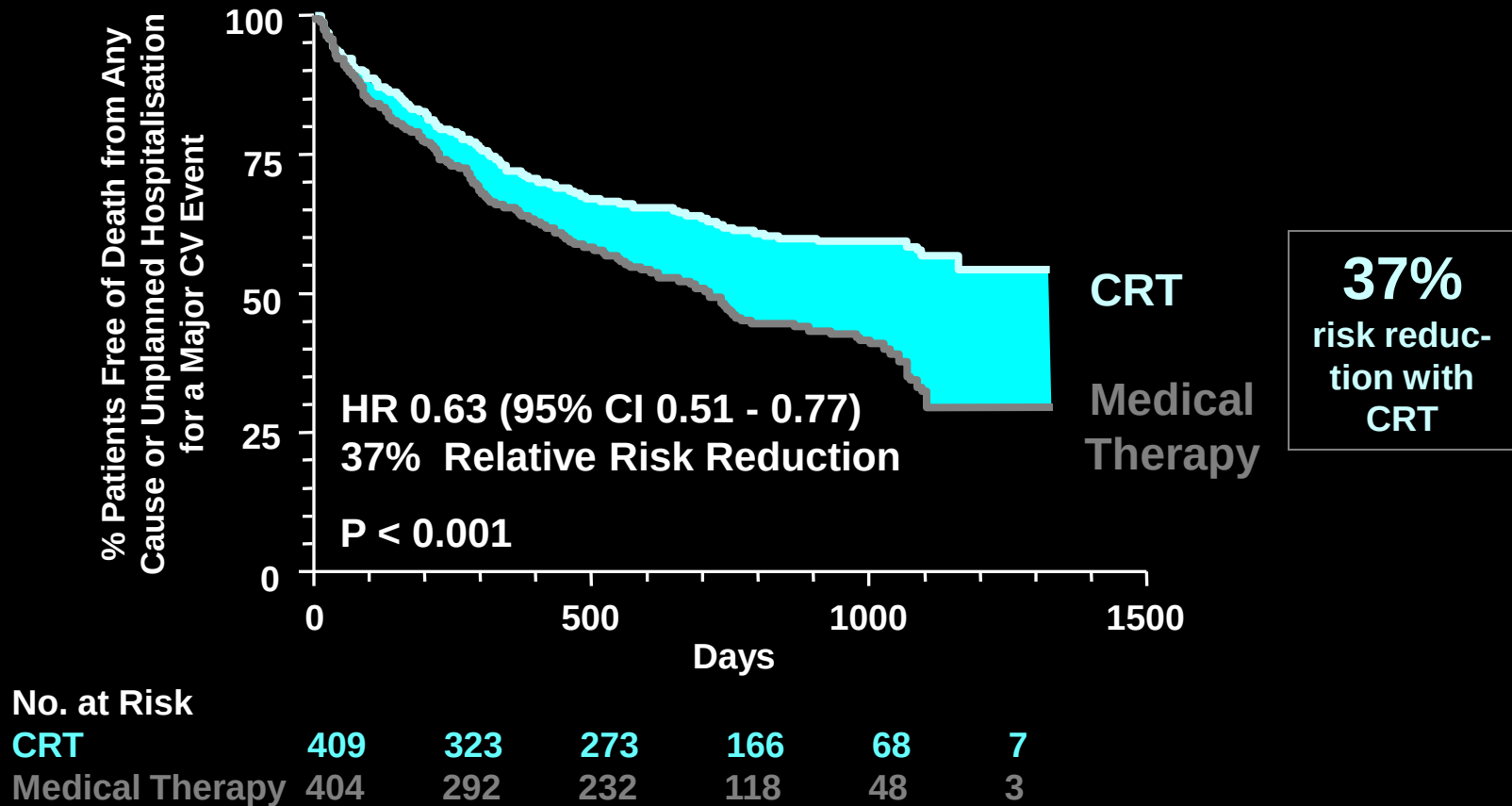


Data sources: MIRACLE: *Circulation* 2003;107:1985-1990
MIRACLE ICD: *JAMA* 2003;289:2685-2694
Contak CD: *J Am Coll Cardiol* 2003;2003;42:1454-1459

■ Control ■ CRT



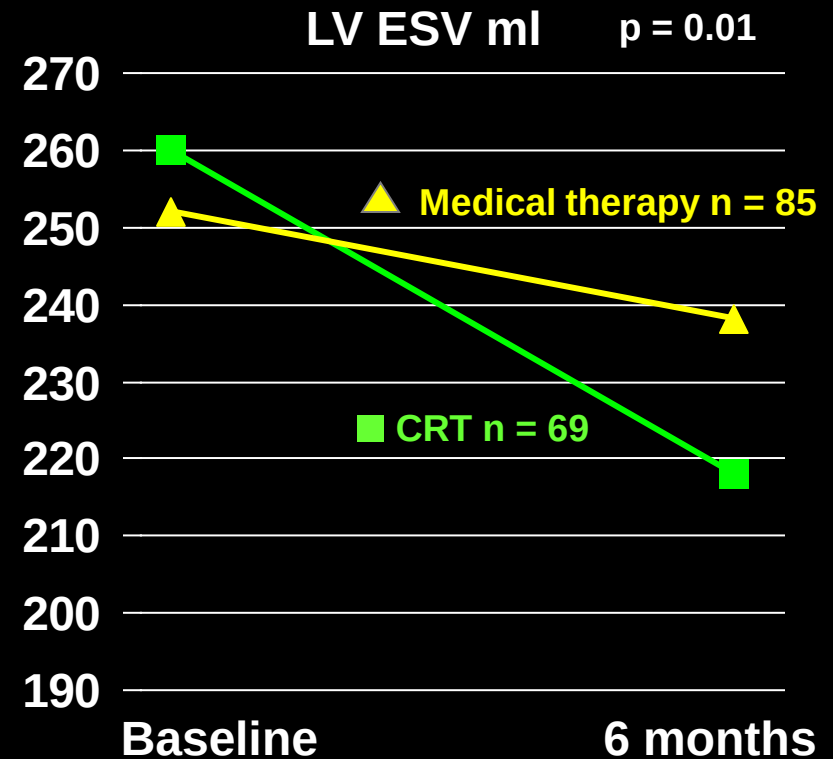
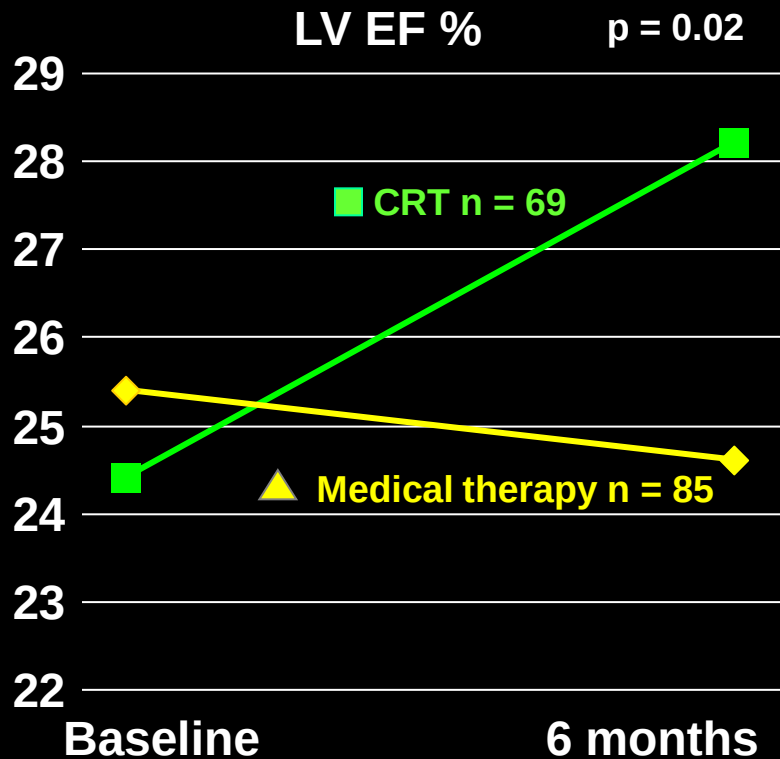
CARE-HF: CRT reduces death or unplanned hospitalisation for CV events in NYHA III/IV



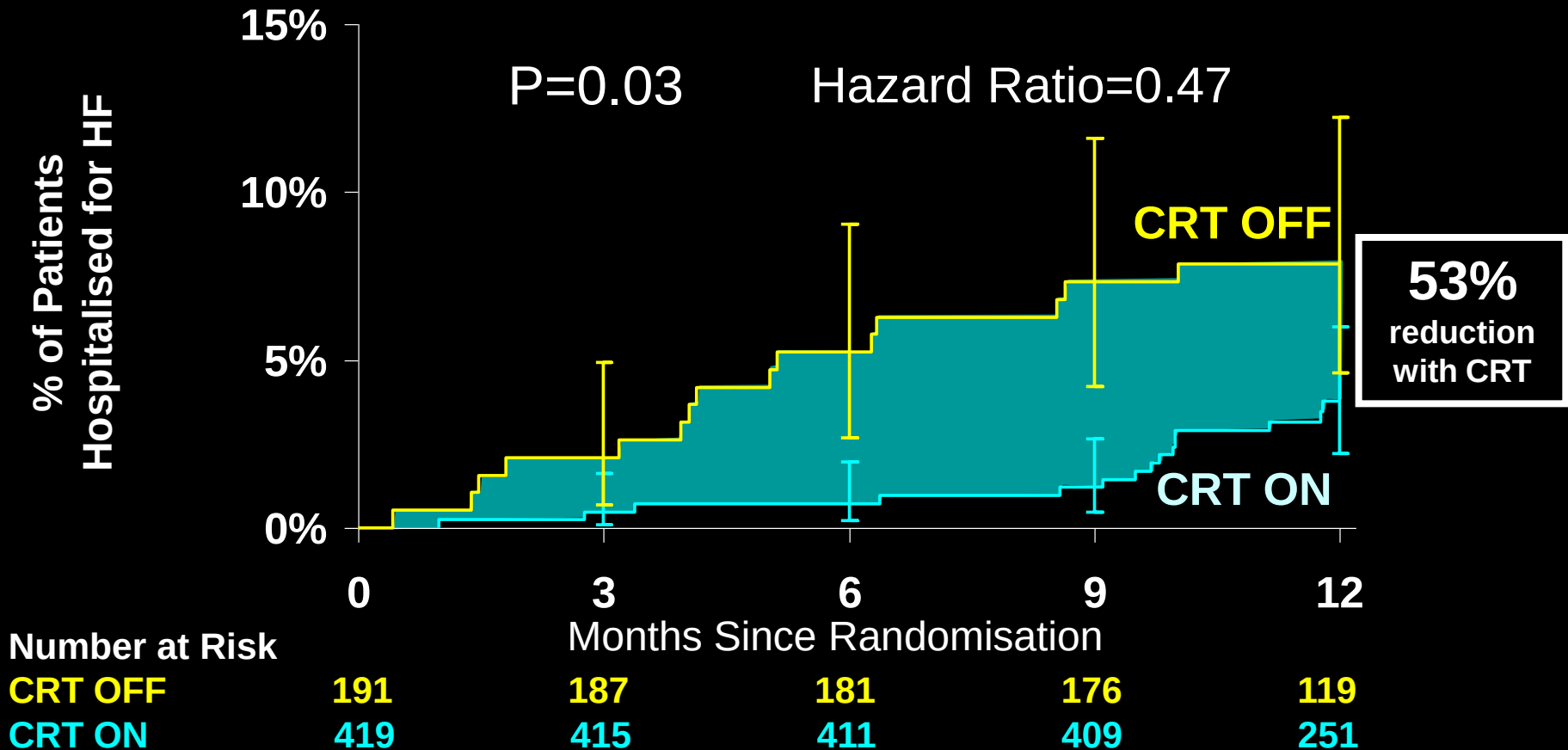
Cleland JGF. N Engl J Med. 2005;352:1539-1549.



MICD II: CRT therapy may reverse remodelling over 6 months in mild HF



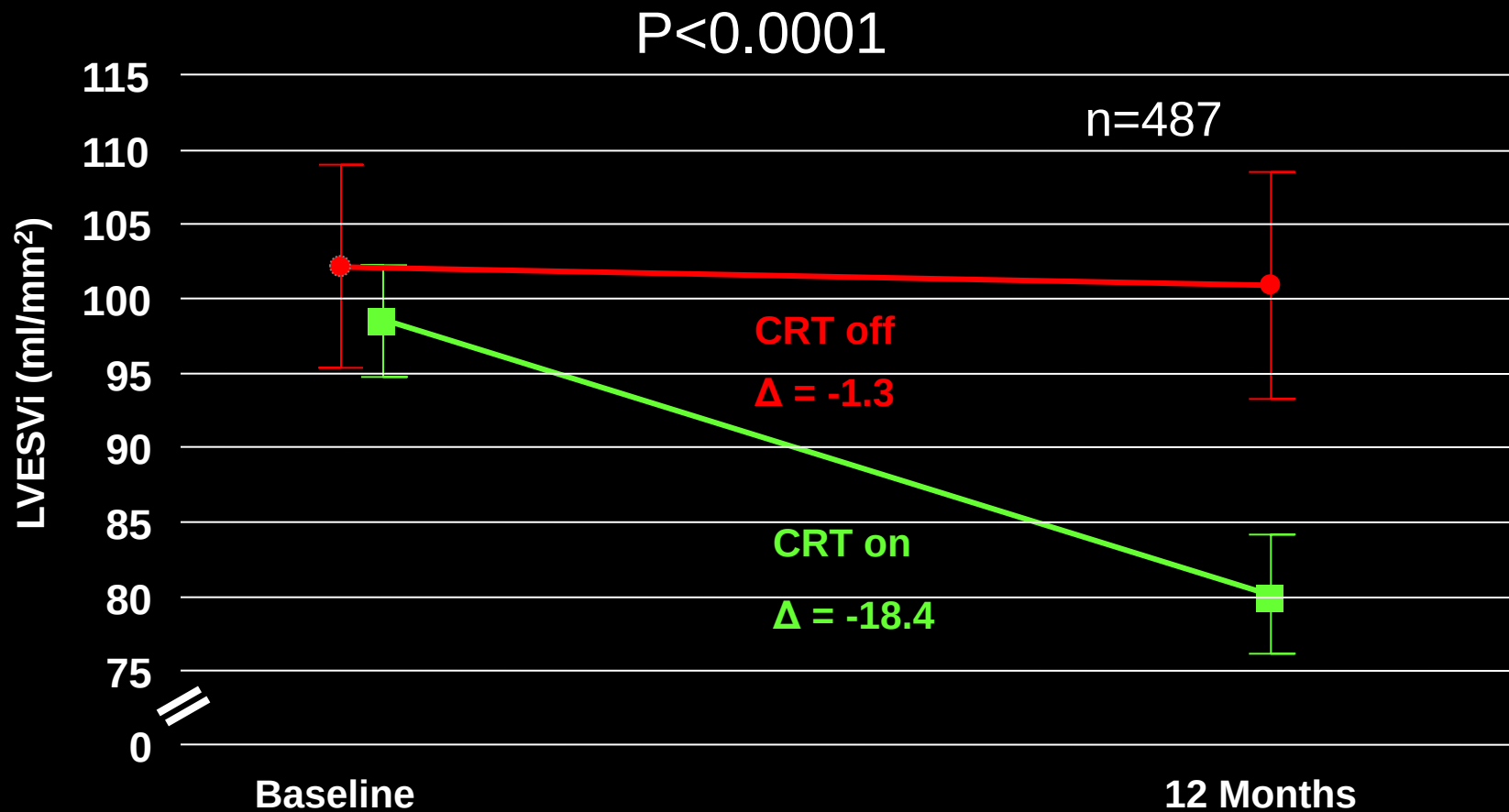
Grade II NYHA



Linde C, Abraham WT, Gold WR et al for REVERSE Study Group. J Am Coll Cardiol 2008 Dec 2;52(23):1834-43.

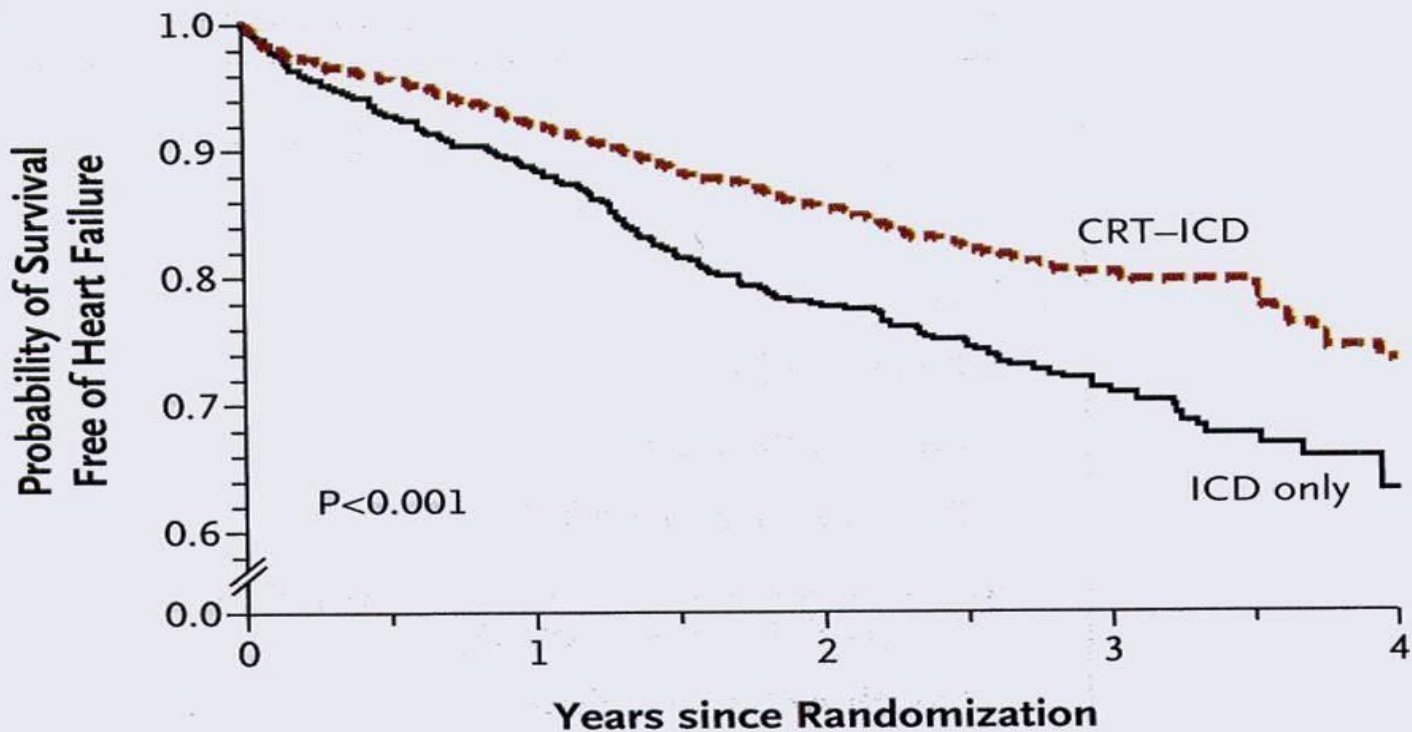


Grade II NYHA





Madit CRT

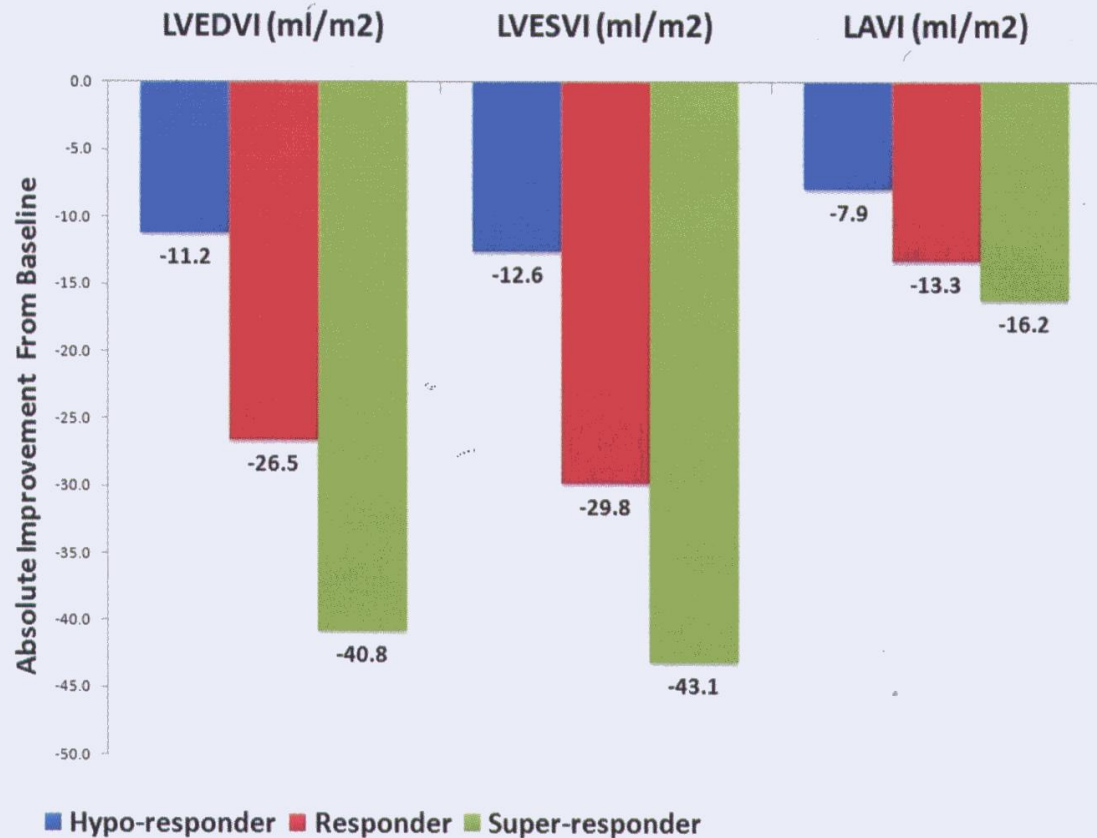
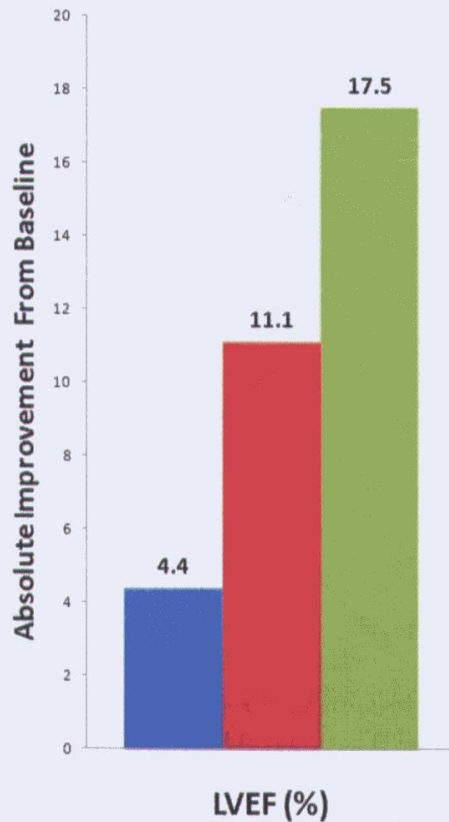


No. at Risk (Probability of Survival)

ICD only	731	621 (0.89)	379 (0.78)	173 (0.71)	43 (0.63)
CRT-ICD	1089	985 (0.92)	651 (0.86)	279 (0.80)	58 (0.73)



Changes in Echocardiographic Parameters

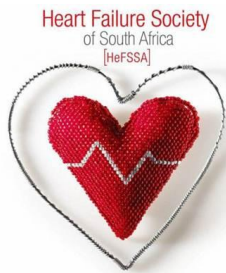




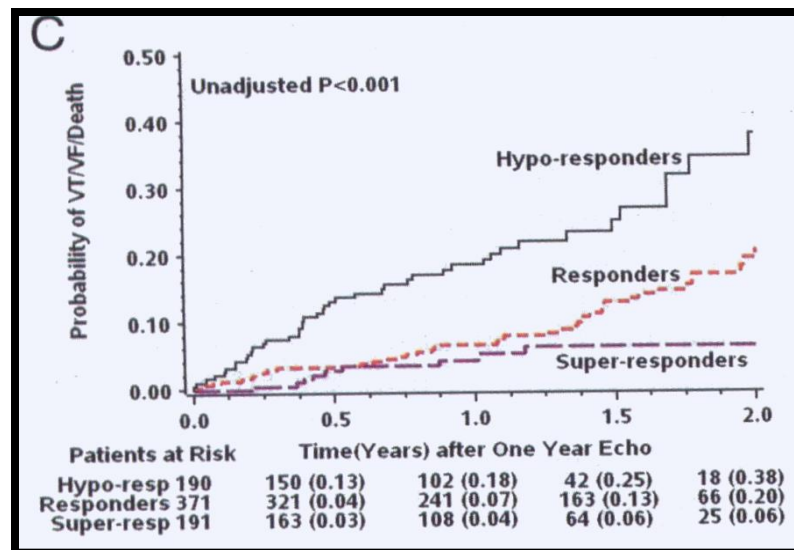
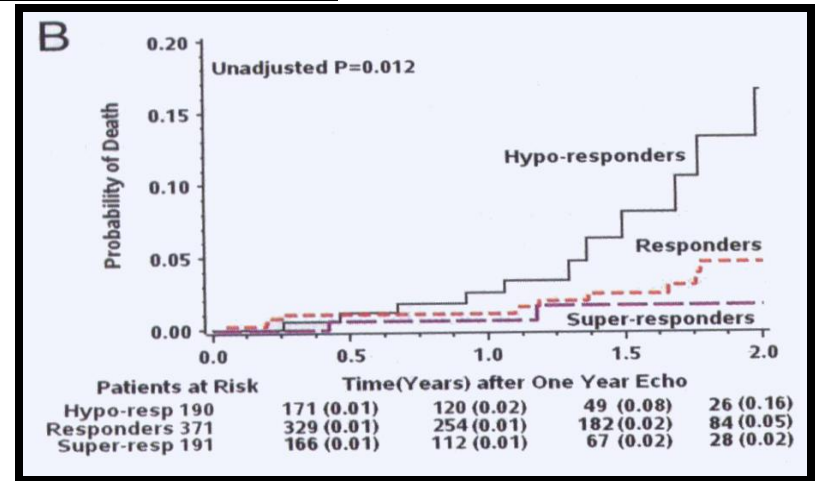
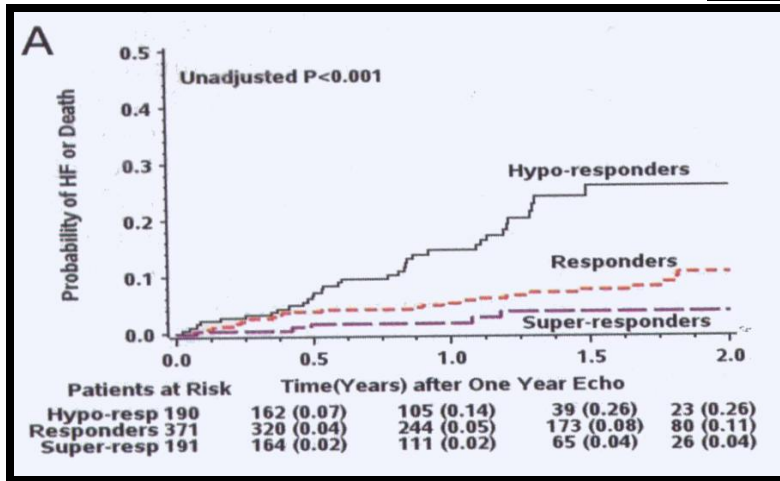
Predictors of LVEF Super-Response

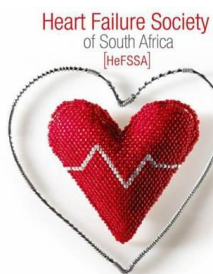
Variable	Odds Ratio	95% Confidence Interval	p Value
Female	1.96	1.32-2.90	0.001
QRS duration ≥ 150 ms	1.79	1.17-2.73	0.007
LBBB	2.05	1.24-3.40	0.006
Body mass index < 30 kg/m ²	1.51	1.03-2.20	0.035
No prior myocardial infarction	1.80	1.20-2.71	0.005
Left atrial volume index, SD*	1.47	1.21-1.79	< 0.001

*Per 1-U SD below mean.



Cumulative Probability of HF or Death, Death Alone and Death or ICD for VT/VF





Non-surgical device treatment of HF (CRT)

ESC Guidelines 2012 p.28

Recommendations for the use of CRT where the evidence is strong—patients in sinus rhythm with NYHA functional class III and ambulatory class IV heart failure and a persistently reduced ejection fraction, despite optimal pharmacological therapy

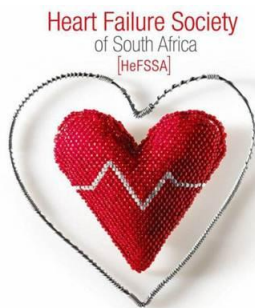
Recommendations	Class ^a	Level ^b	Ref ^c
LBBB QRS morphology CRT-P/CRT-D is recommended in patients in sinus rhythm with a QRS duration of ≥ 120 ms, LBBB QRS morphology, and an EF $\leq 35\%$, who are expected to survive with good functional status for >1 year, to reduce the risk of HF hospitalization and the risk of premature death.	I	A	156, 157
Non-LBBB QRS morphology CRT-P/CRT-D should be considered in patients in sinus rhythm with a QRS duration of ≥ 150 ms, irrespective of QRS morphology, and an EF $\leq 35\%$, who are expected to survive with good functional status for >1 year, to reduce the risk of HF hospitalization and the risk of premature death.	IIa	A	156, 157

CRT-D = cardiac resynchronization therapy defibrillator; CRT-P = cardiac resynchronization therapy pacemaker; EF = ejection fraction; HF = heart failure; LBBB = left bundle branch block; NYHA = New York Heart Association.

^aClass of recommendation.

^bLevel of evidence.

^cReferences.



Non-surgical device treatment of HF (CRT)

ESC Guidelines 2012 p.28

Recommendations for the use of CRT where the evidence is strong—patients in sinus rhythm with NYHA functional class II heart failure and a persistently reduced ejection fraction, despite optimal pharmacological therapy

Recommendations	Class ^a	Level ^b	Ref ^c
LBBB QRS morphology CRT, preferably CRT-D is recommended in patients in sinus rhythm with a QRS duration of ≥ 130 ms, LBBB QRS morphology, and an EF $\leq 30\%$, who are expected to survive for >1 year with good functional status, to reduce the risk of HF hospitalization and the risk of premature death.	I	A	154, 155
Non-LBBB QRS morphology CRT, preferably CRT-D should be considered in patients in sinus rhythm with a QRS duration of ≥ 150 ms, irrespective of QRS morphology, and an EF $\leq 30\%$, who are expected to survive for >1 year with good functional status, to reduce the risk of HF hospitalization and the risk of premature death.	IIa	A	154, 155

CRT-D = cardiac resynchronization therapy defibrillator; EF = ejection fraction; HF = heart failure; LBBB = left bundle branch block; NYHA = New York Heart Association.

^aClass of recommendation.

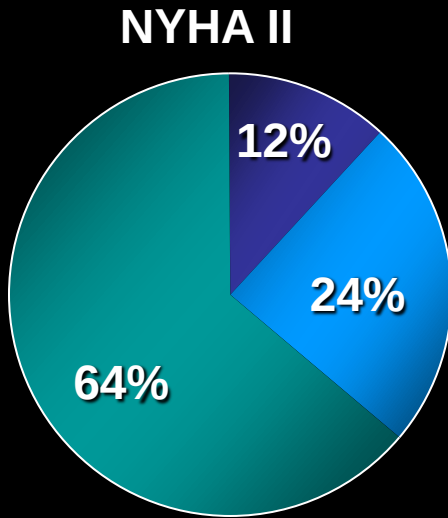
^bLevel of evidence.

^cReferences.



Severity of Heart Failure

Modes of Death

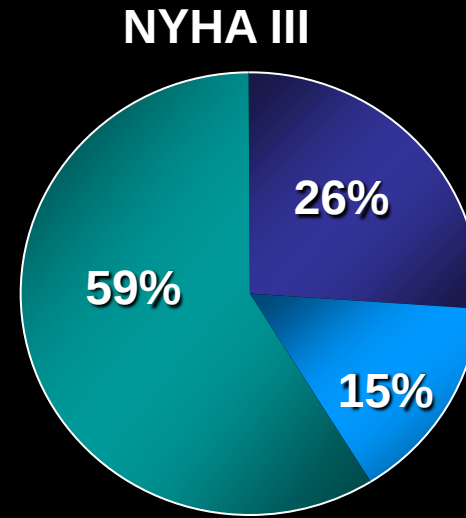


■ CHF

■ Other

■ Sudden Death

n = 103

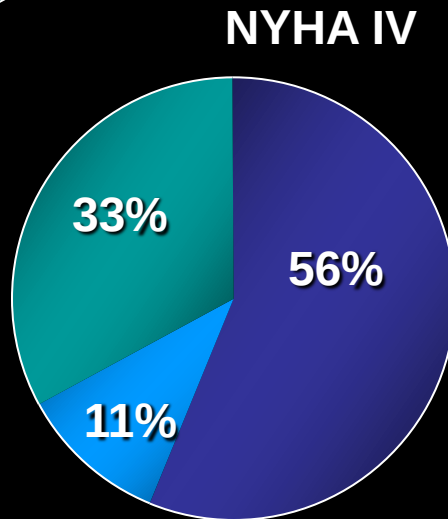


■ CHF

■ Other

■ Sudden Death

n = 103

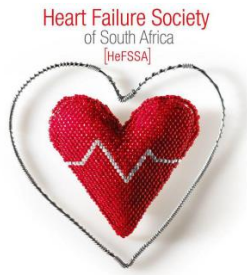


■ CHF

■ Other

■ Sudden Death

n = 27



Most Cardiac Arrests (70%-80%) Occur At Home

Cummins RO et al. *Circulation*, 1991: 83:832-847

Litwin PE et al. *Emerg Med*, 1987: 16:787-791



Prediction of Sudden Death from History Paris Study

Factors associated with sudden death during follow up (23 years):

- Resting heart rate.
- Systolic and diastolic blood pressure.
- Tobacco consumption.
- Body mass index.
- Diabetes.
- Serum cholesterol.
- Parental history of sudden death.



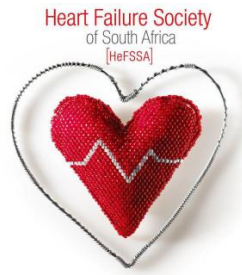
Inter-relationships between heart failure and arrhythmias

- This is a frequent occurrence
- Either can cause or aggravate the other
- **Arrhythmias can produce (or aggravate) heart failure by:**
 - Increasing heart rate (tachycardiomyopathy)
 - Uncontrollable atrial fibrillation, persistent SVT
 - Cause dyssynchronous contraction
- **Heart failure can produce or aggravate (or perpetuate) existing arrhythmias or be pro-arrhythmic**
 - Some antiarrhythmic drugs can produce or aggravate heart failure (or other arrhythmias) e.g. Sotalol and torsade des pointes, Flecainide etc.



Common Underlying Pathology for Arrhythmic Sudden Cardiac Death

- **With heart failure**
 - Ischaemic heart disease
 - Cardiomyopathy - dilated (NB: ARVC)
 - hypertrophic
 - Others (valvular disease, sarcoid, HIV etc)
- **Without heart failure**
 - Channelopathies (long QT, short QT, Brugada, early repolarisation syndrome)
 - Catecholaminergic polymorphic VT
 - Idiopathic ventricular fibrillation



Heart Failure and/or Decreased LV Function

- About one-half of all deaths in heart failure patients are characterized as sudden due to arrhythmias.
- The risk of SCA increases as left ventricular function deteriorates (low LVEF).
- Unexplained syncope has predicted SCA in patients in functional NYHA Class II - IV.

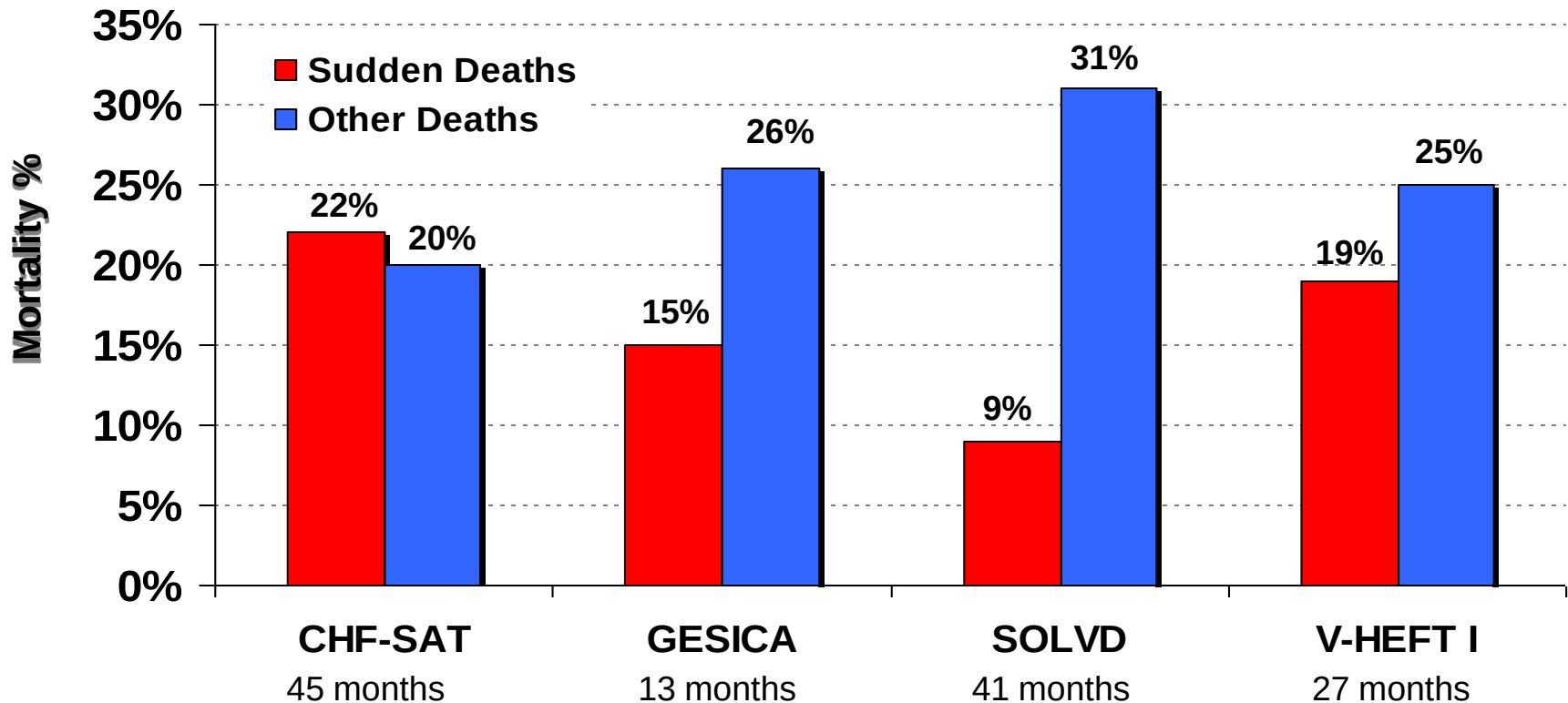
¹ Myerburg RJ. *Heart Disease, A Textbook of Cardiovascular Medicine*. 5th ed, Vol 1. Philadelphia: WB Saunders Co; 1997:ch 24.

² Middlekauf HR. *J Am Coll Cardiol*. 1993;21:110-116.

³ Stevenson WE. *Circulation*. 1993;88:2953-2961.



Mortality in Placebo Arms of CHF Trials

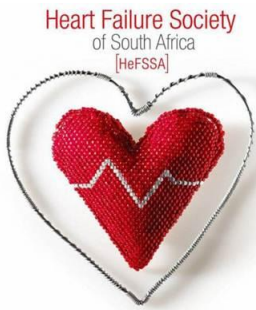


¹ Singh, SN. *N Engl J Med*. 1995.

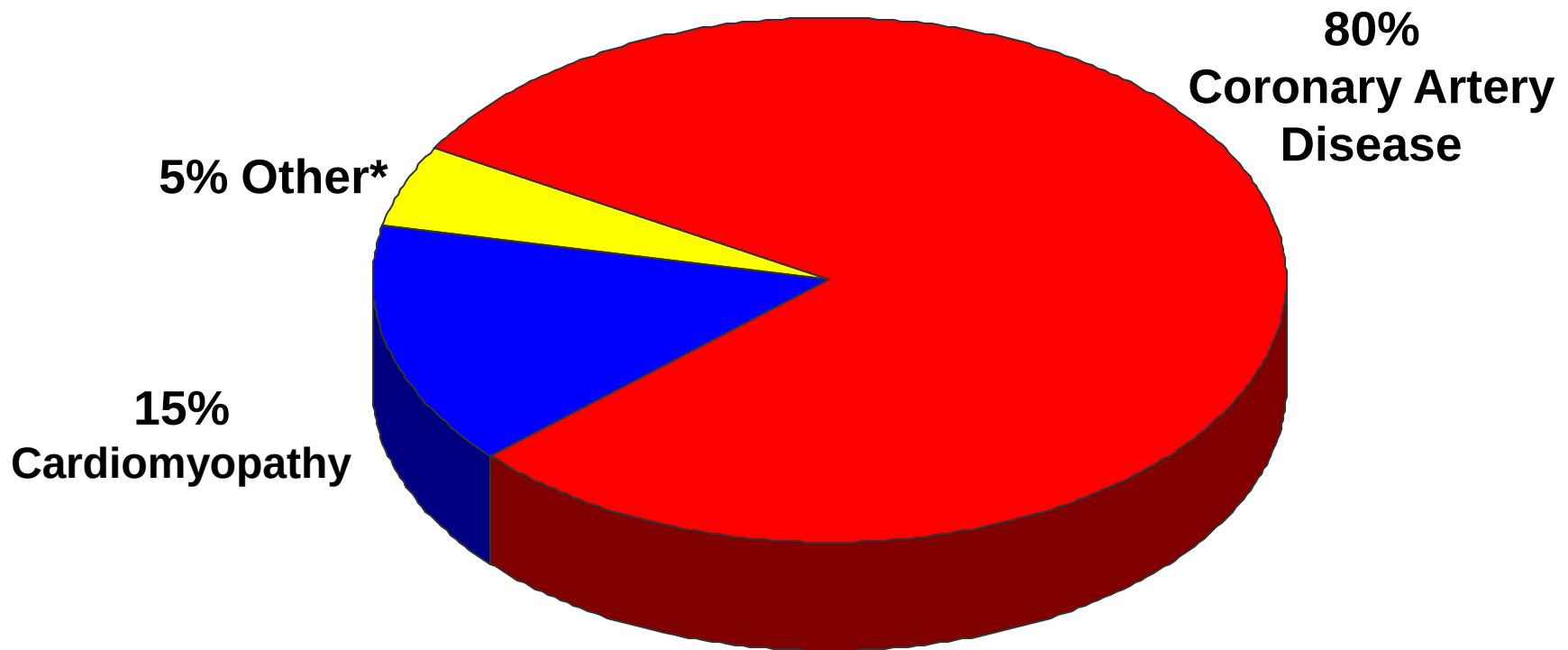
² Doval, HC. *Lancet*. 1994.

³ SOLVD Investigators. *N Engl J Med*. 1991.

⁴ Goldman, S. *Circulation*. 1993.



Underlying Causes of Fatal Arrhythmias

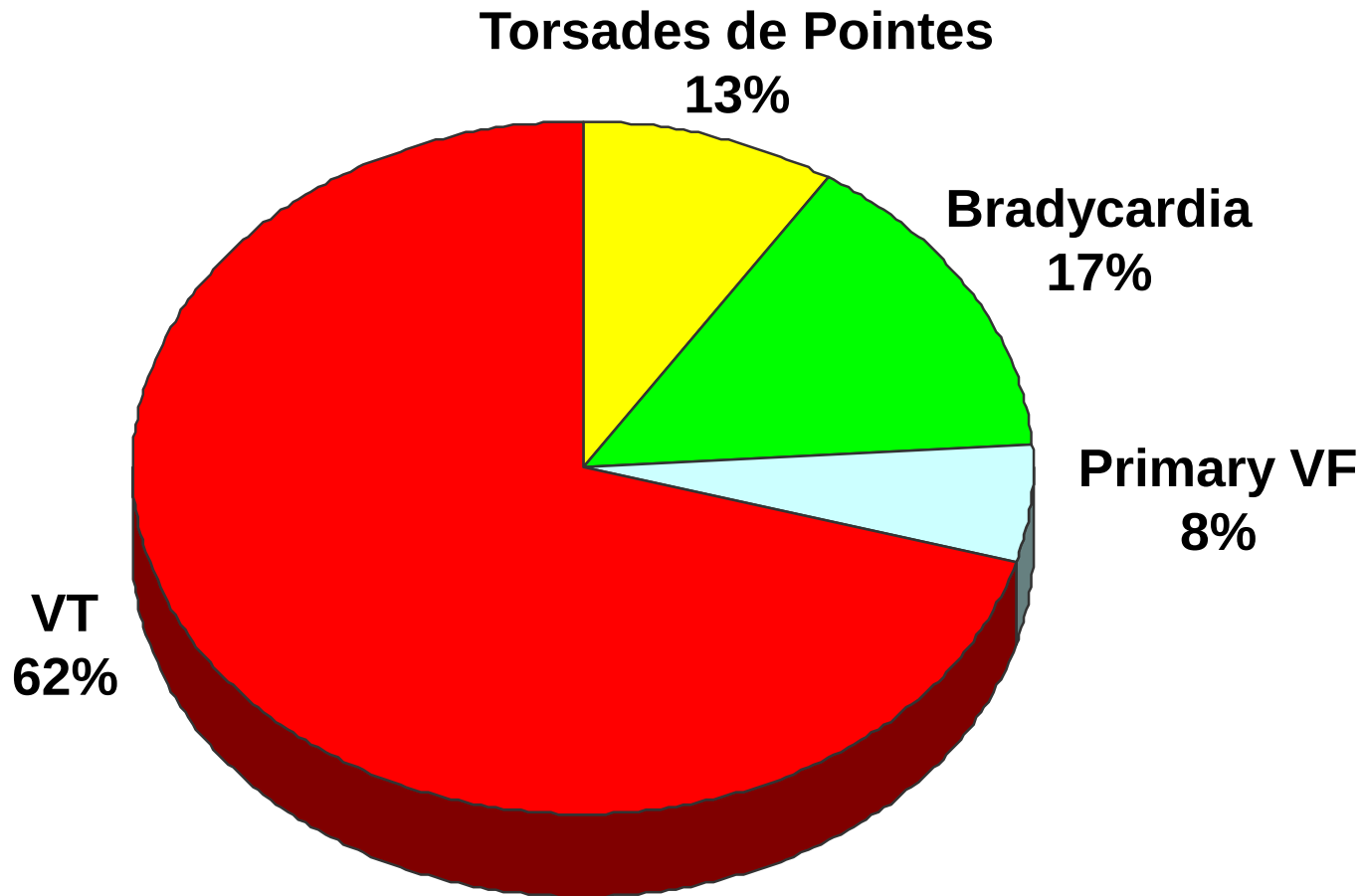


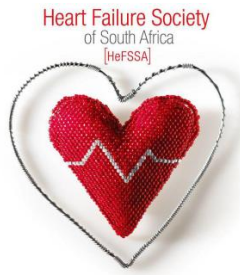
Adapted from Heikki et al. *N Engl J Med*, Vol. 345, No. 20, 2001.

* ion-channel abnormalities, valvular or congenital heart disease, other causes



Underlying Arrhythmias of SCA



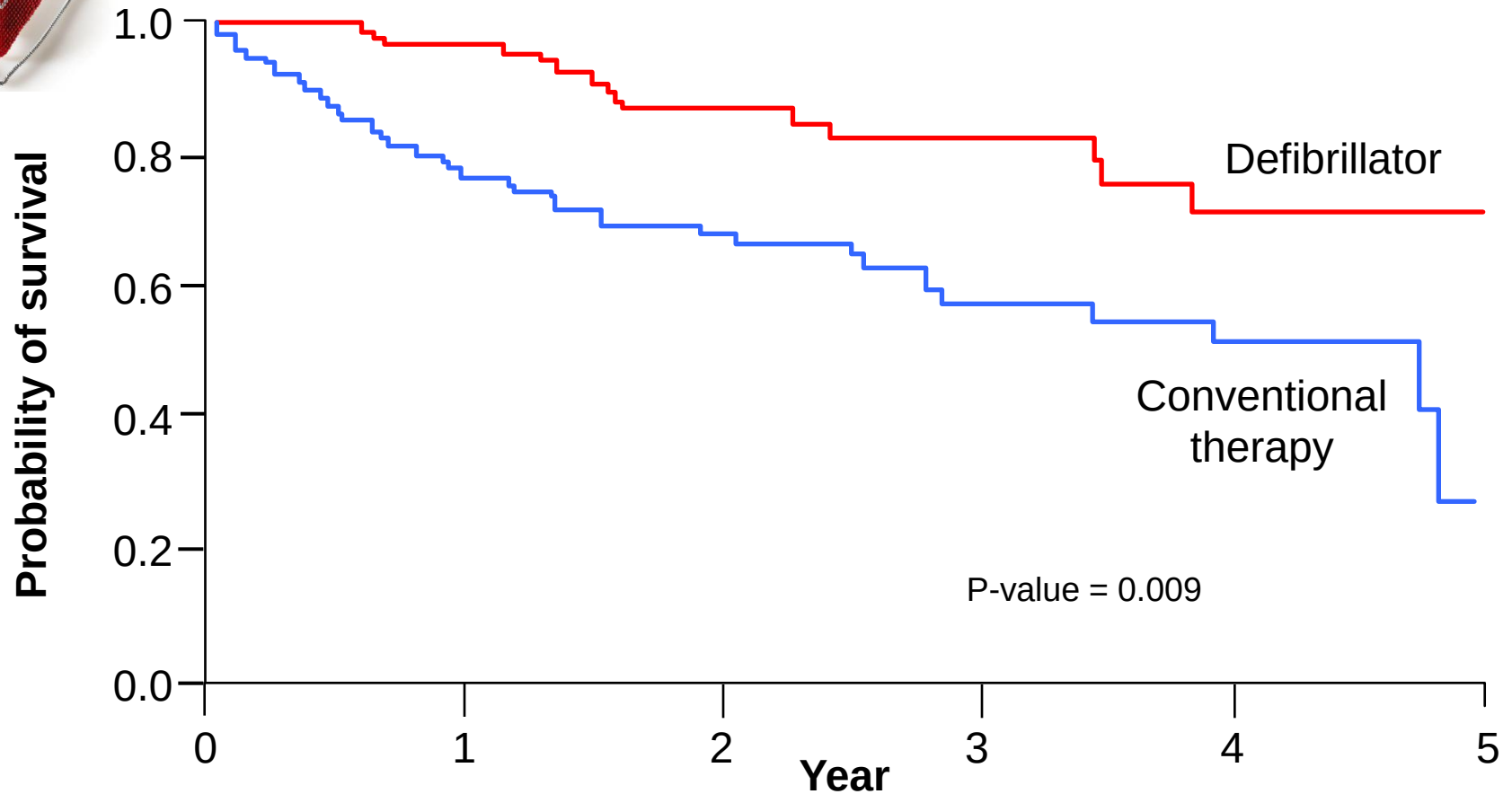


Conclusions on SCA

- Post-MI patients with a low left ventricular ejection fraction are at risk for SCA.
- SCA can be prevented if high-risk patients are identified and referred to an Electrophysiologist (EP).



MADIT Survival Results

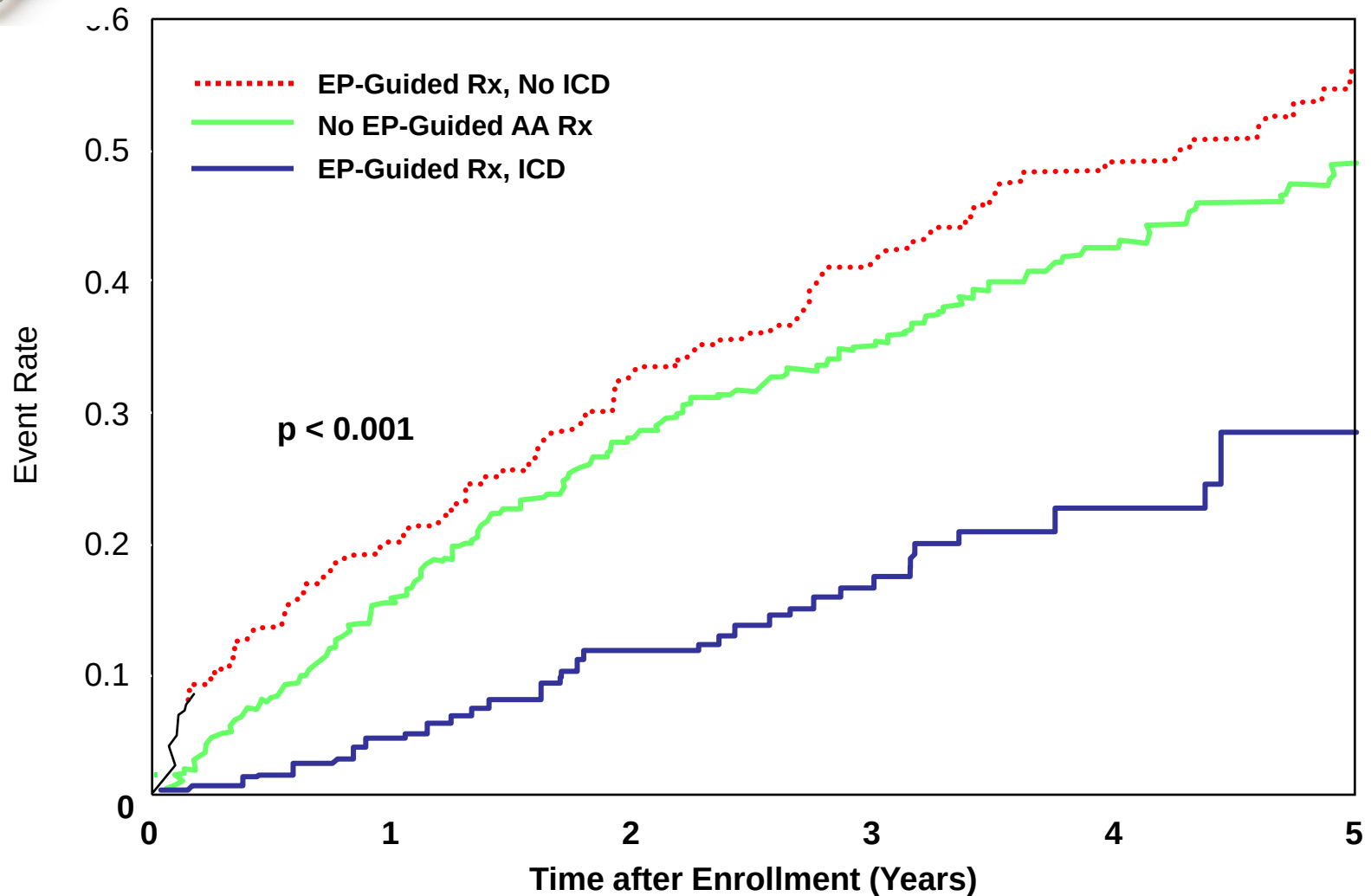


No. of patients

Defibrillator	95	80	53	31	17	3
Conventional therapy	101	67	48	29	17	0

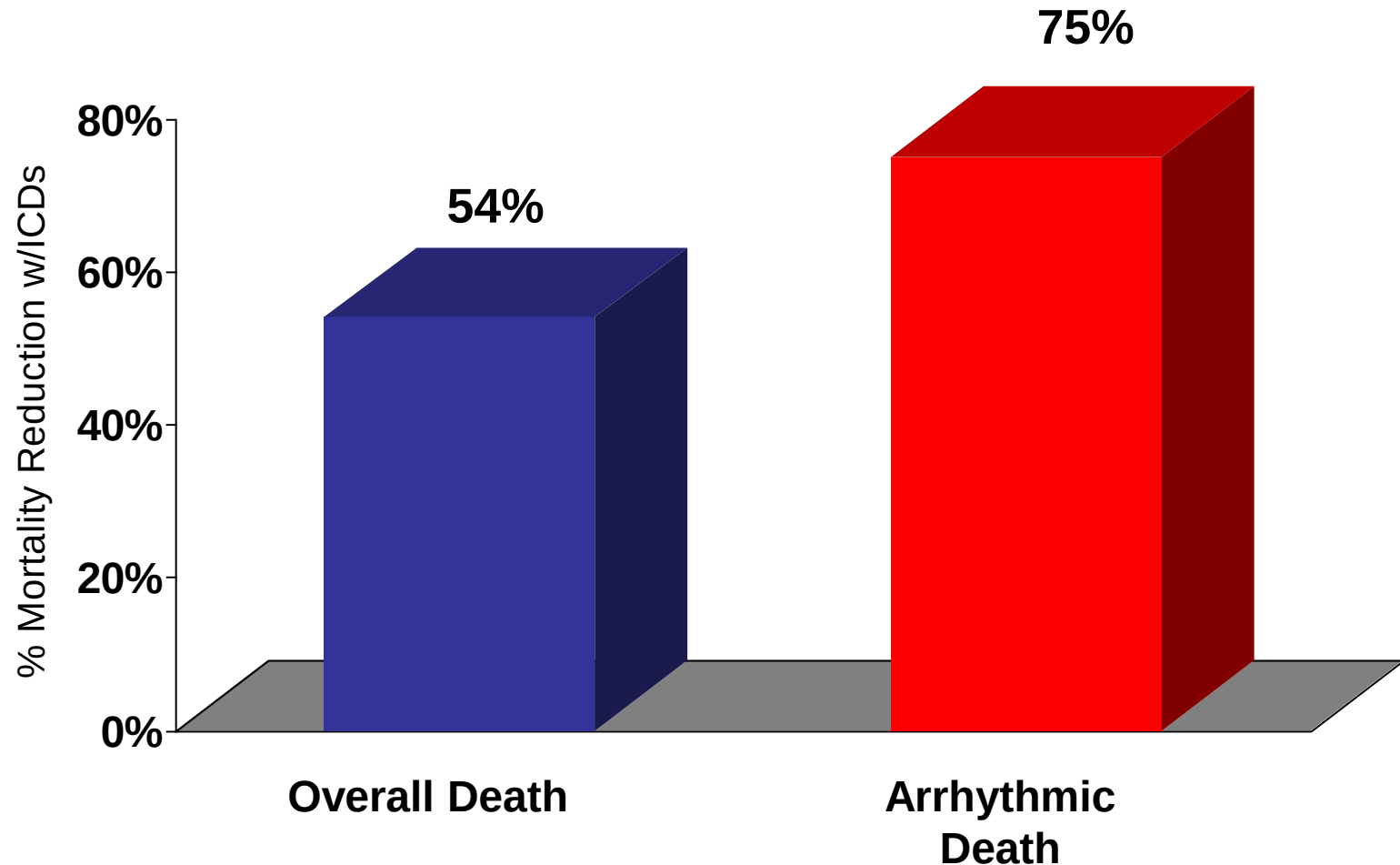


MUSTT Randomized Patient Results: Total Mortality





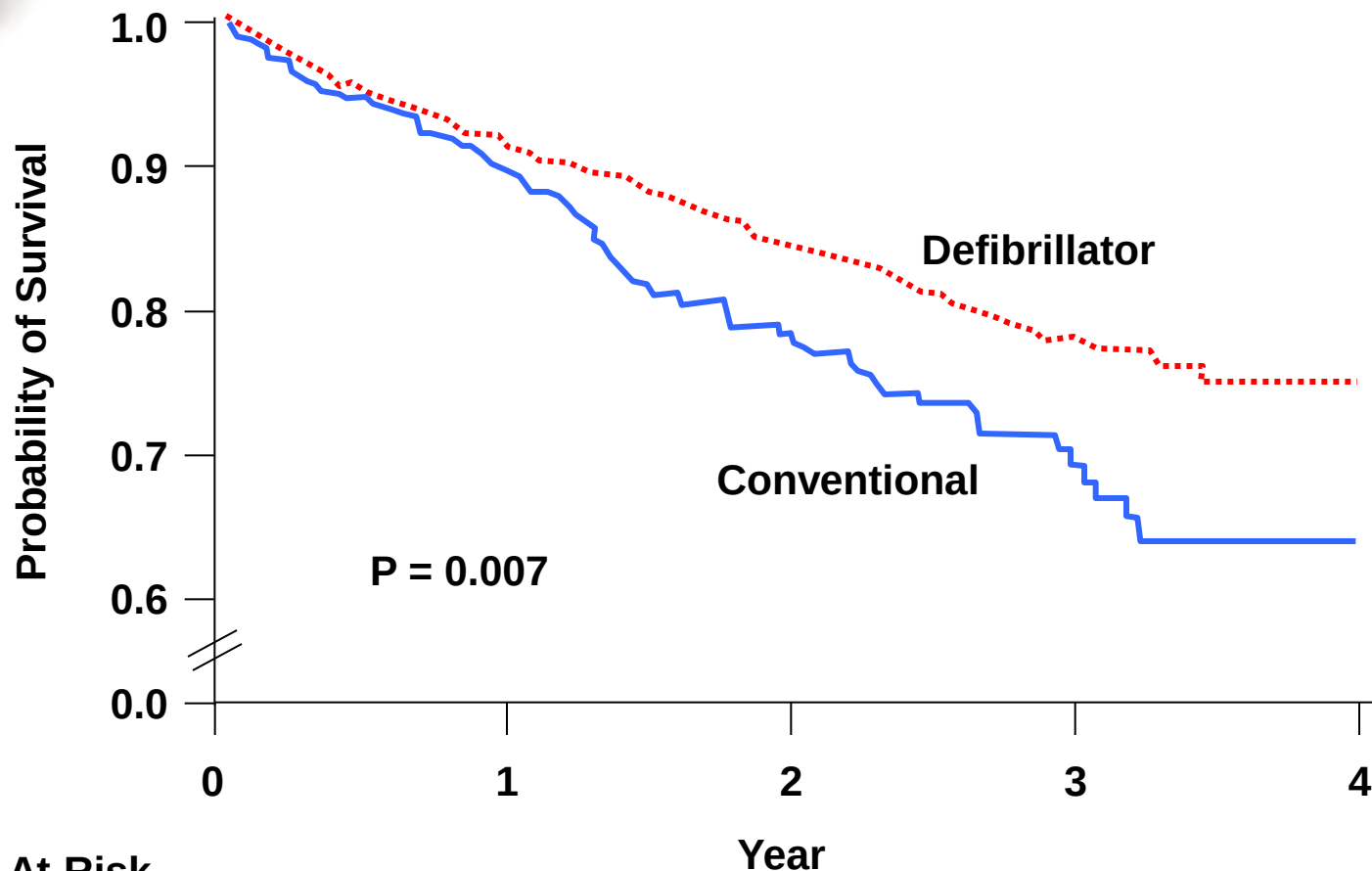
MADIT: ICDs Significantly Reduced Mortality¹



1. Moss AJ. *N Engl J Med.* 1996;335:1933-1940.



MADIT-II Survival Results



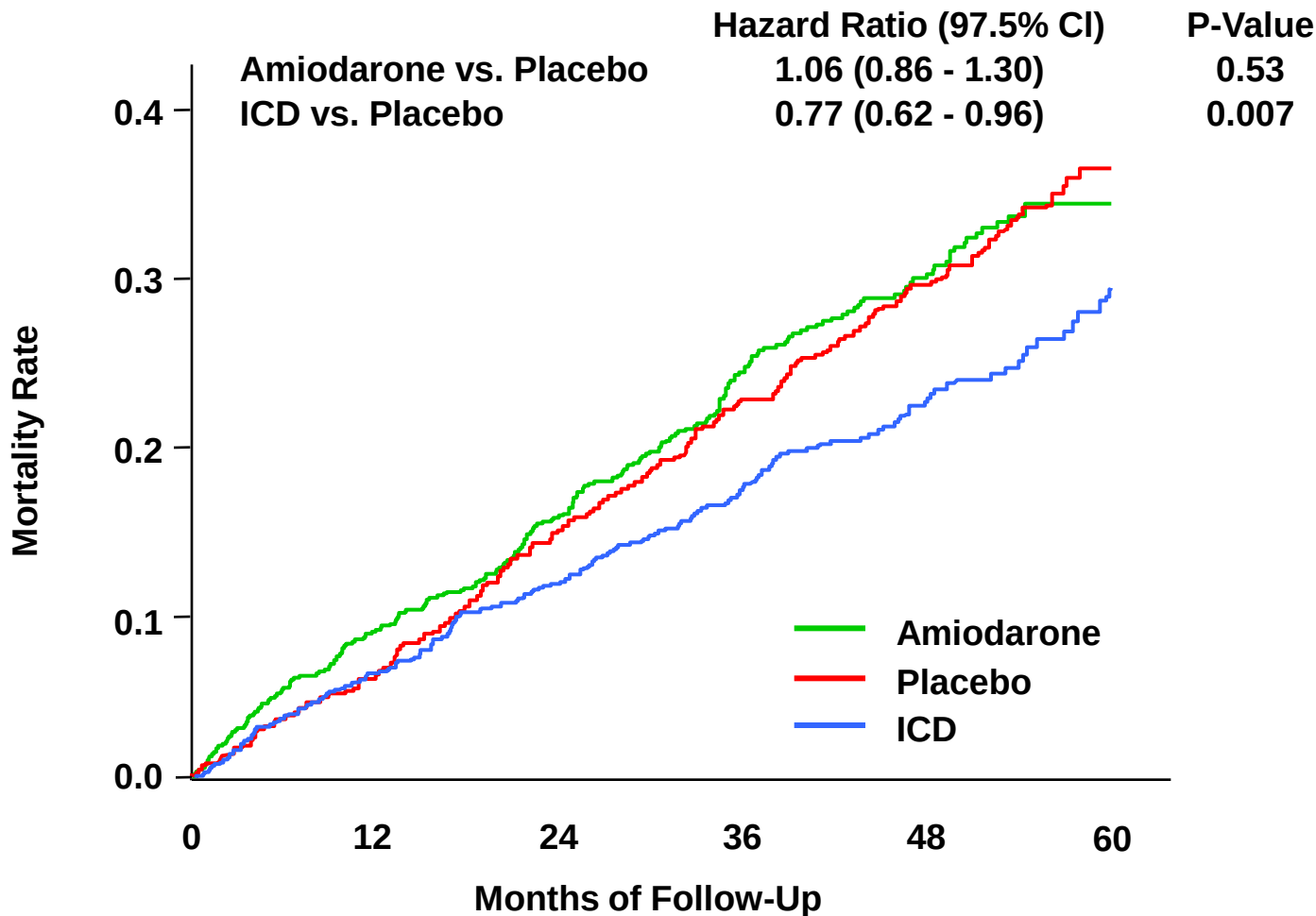
No. At Risk

Defibrillator	742	502 (0.91)	274 (0.94)	110 (0.78)	9
Conventional	490	329 (0.90)	170 (0.78)	65 (0.69)	3



SCD-HeFT Mortality Rate Overall

Results



No. at Risk

Amiodarone	845	772	715	484	280	97
Placebo	847	797	724	505	304	89
ICD	829	778	733	501	304	103



CD-HeFT Overall Mortality Results

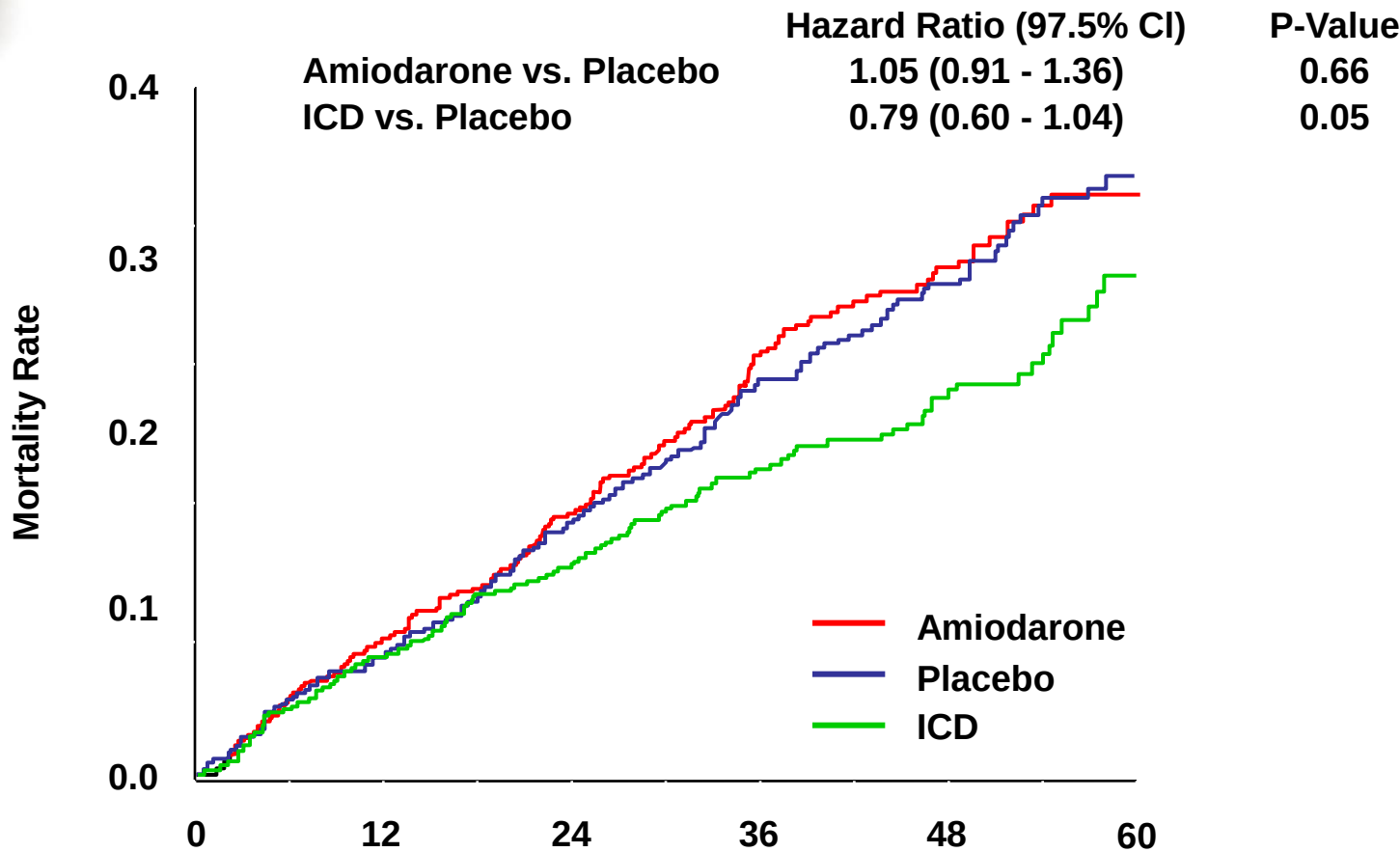
	Hazard Ratio (97.5% CI)	P-Value
Amiodarone vs. Placebo	1.06 (0.86 - 1.30)	0.53
ICD vs. Placebo	0.77 (0.62 - 0.96)	0.007

**ICDs reduce
mortality
by 23%**



SCD-HeFT Mortality Rate

Ischemic CHF Patients



No. at Risk

	0	12	24	36	48	60
Amiodarone	426	384	346	227	130	
Placebo	453	415	370	244	152	48
ICD	431	395	365	244	144	48



SCD-HeFT Mortality Rate

NYHA Class II Patients

