Cardiac Resynchronization Therapy (CRT)

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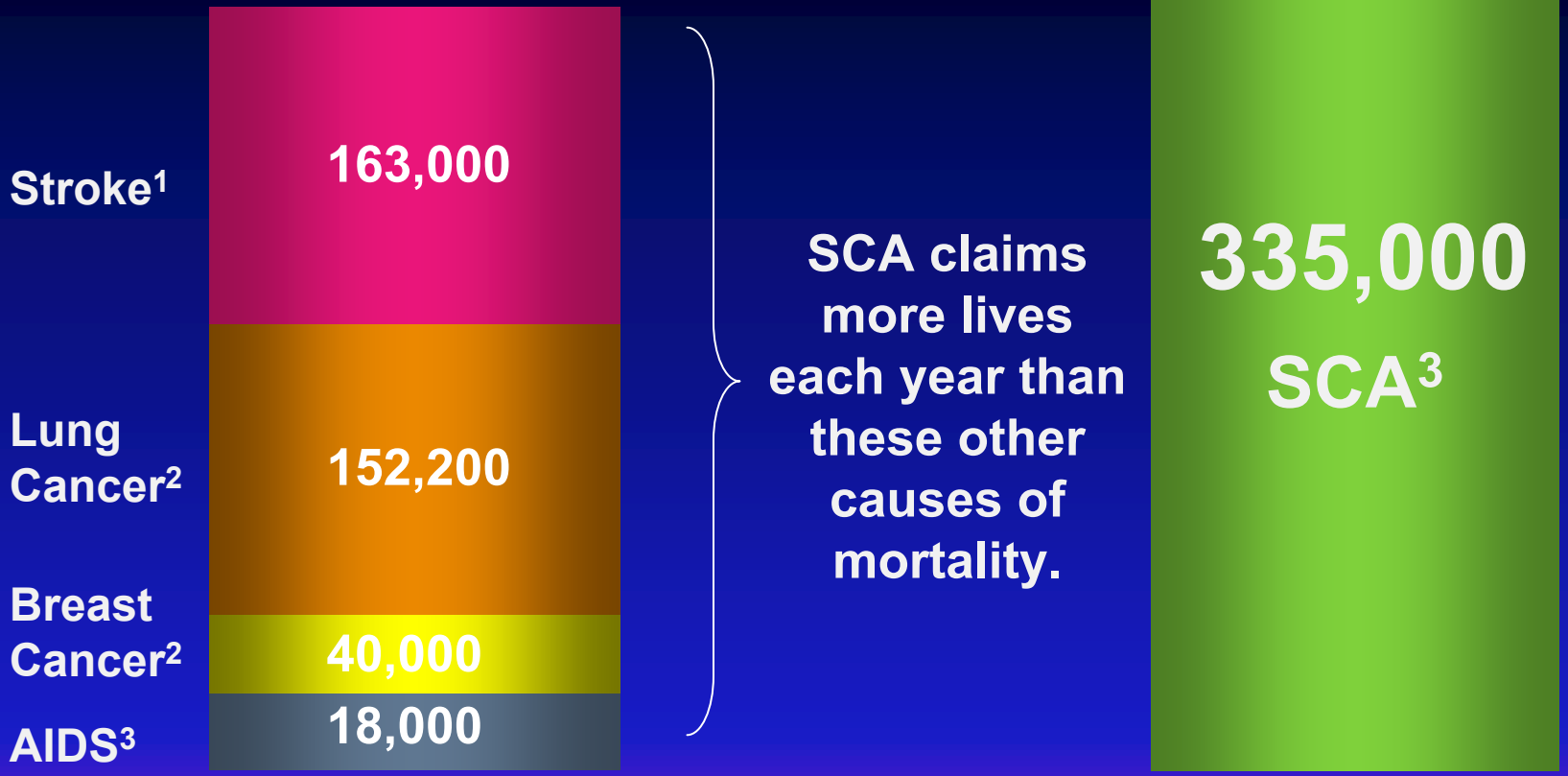
Congestive Heart Failure (CHF) in the US

- ≈ 5 million have CHF (prevalence)[1]
- ≈ 550,000 new cases annually (incidence)[1]
- HF: most common cardiovascular discharge in elderly patients[2]
- 25% probability of dying over 2.5 years[3]
  - 50% of these deaths occur **SUDDENLY (VT/VF)**
  - Despite improvements in medical therapy

[1] American Heart Association. *Heart Disease and Stroke Statistics – 2005 Update.*
[2] NHLBI, CHF Data Fact Sheet, September 1996.
[3] Sweeney MO. *PACE.* 2001;24:871-888.

Magnitude of Sudden Cardiac Arrest (SCA) in the US



[1] American Heart Association. *Heart Disease and Stroke Statistics –2005 Update.*
[2] Jemel A. *CA Cancer J Clin*. 2003;53:5-26.
[3] U.S. *HIV & AIDS Statistic Summary*. Avert.org.

In people diagnosed with heart failure, sudden cardiac death occurs at 6-9 times the rate of the general population

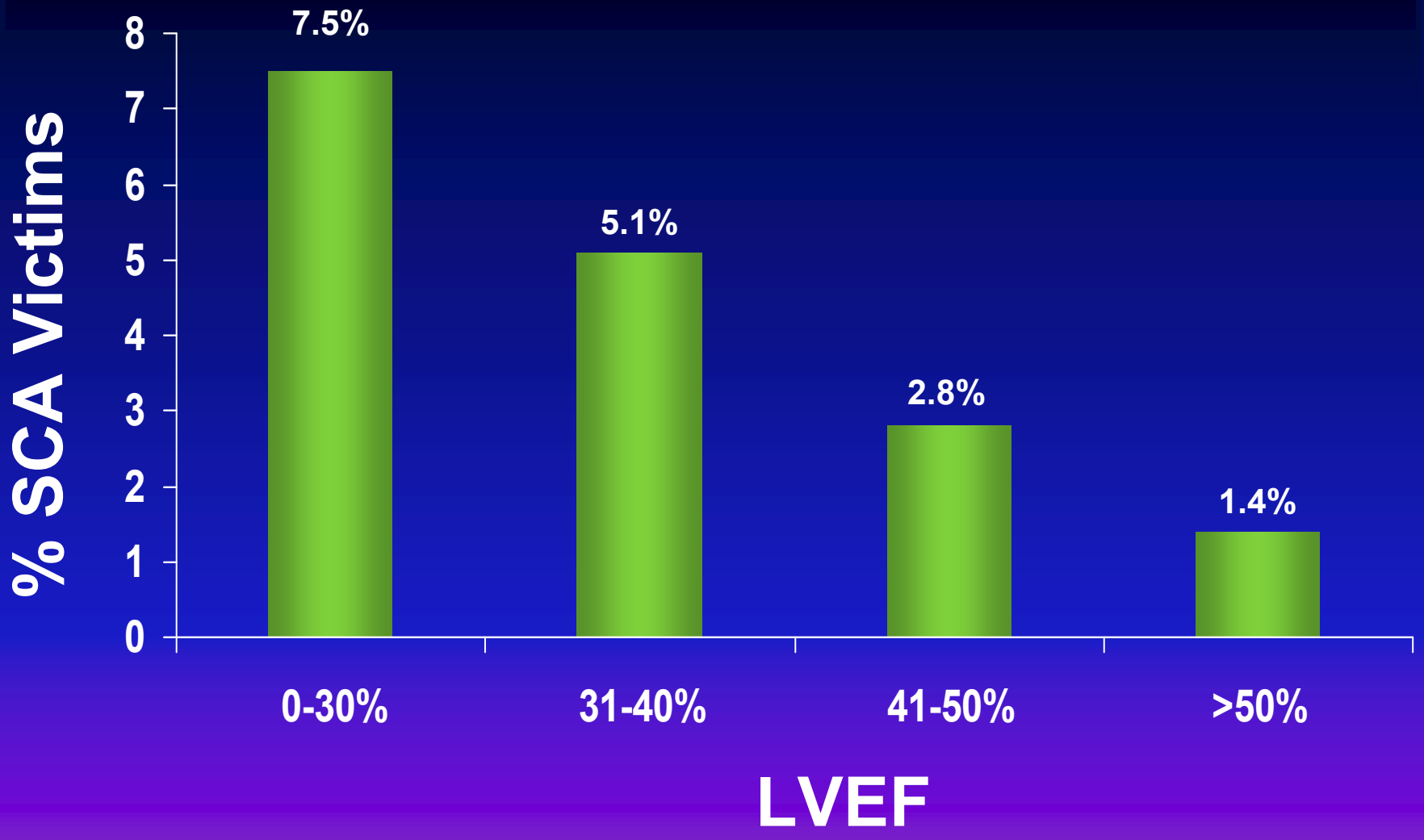
American Heart Association. *Heart Disease and Stroke Statistics – 2005 Update*.

Relationship of SCD and LV Dysfunction

- Reduced left ventricular ejection fraction (LVEF) remains the single most important risk factor for overall mortality and sudden cardiac death[1]
- An ejection fraction ≤ 30% is the single most powerful independent predictor for SCD[2]

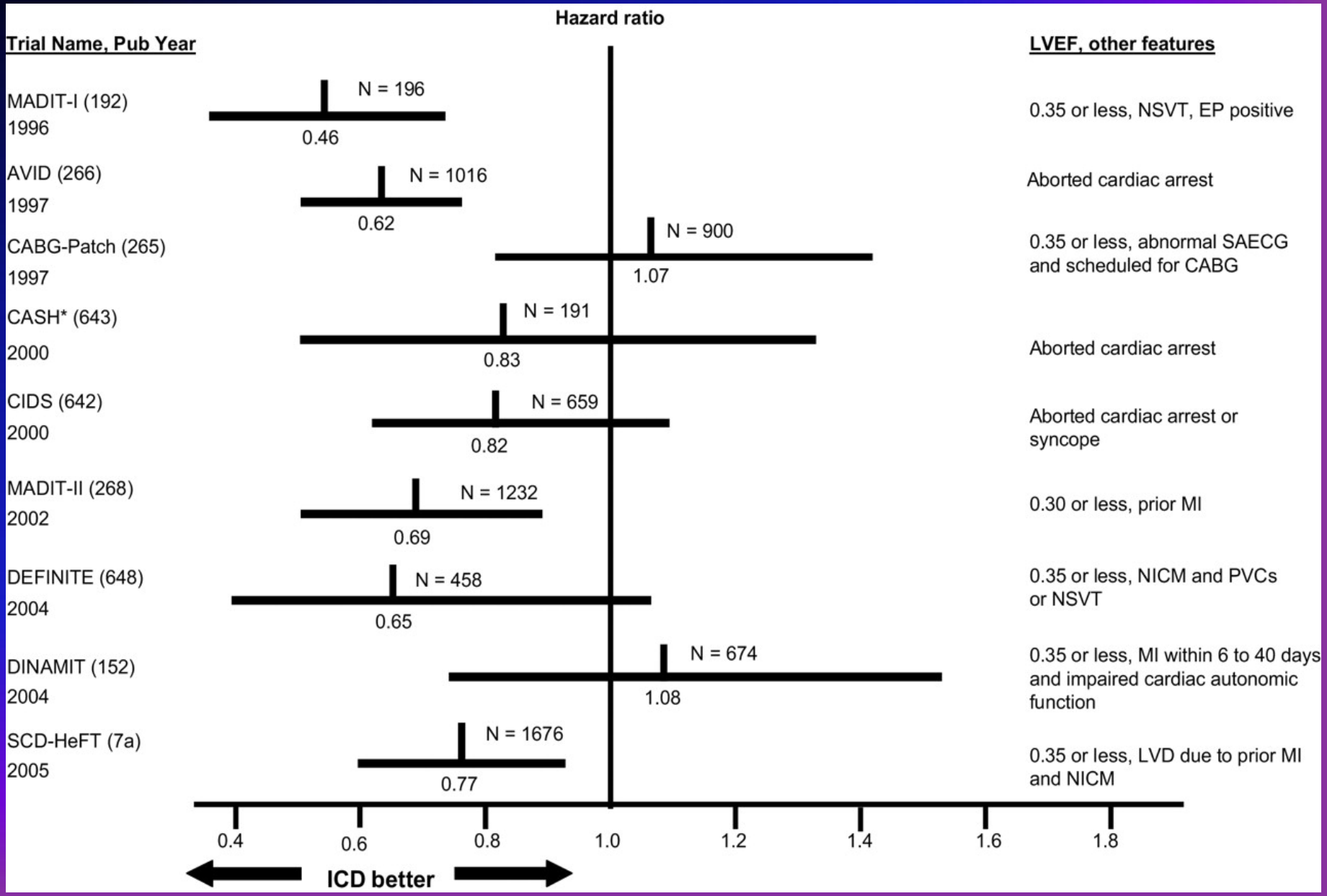
[1] Task Force on Sudden Cardiac Death of the European Society of Cardiology. *Eur Heart J*, 2001;22:1374-1450.
[2] Myerburg RJ, In Braunwald E, Zipes DP, Libby P, *Heart Disease, A textbook of Cardiovascular Medicine.* 6th ed. Philadelphia: W.B. Saunders, Co. 2001: 895.

LVEF and SCA Incidence



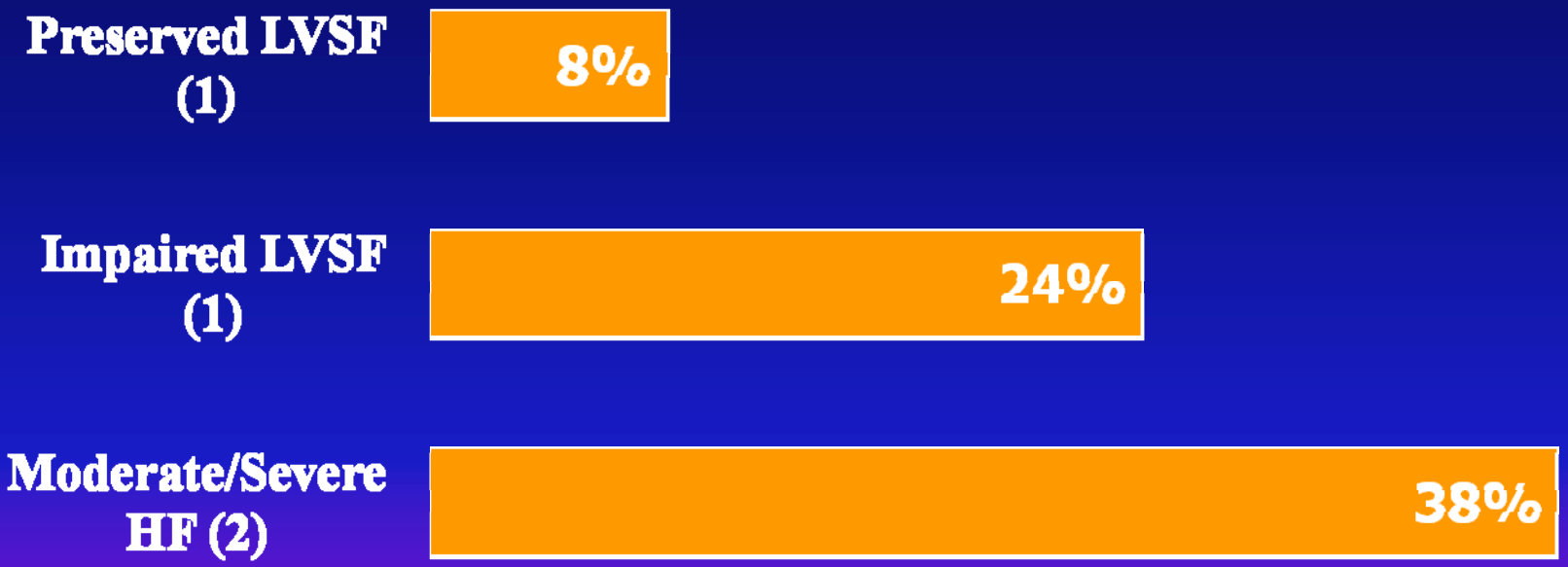
Gorgels PMA. *European Heart Journal*. 2003;24:1204-1209.

Implantable Cardiac Defibrillator (ICD) reduces SCD

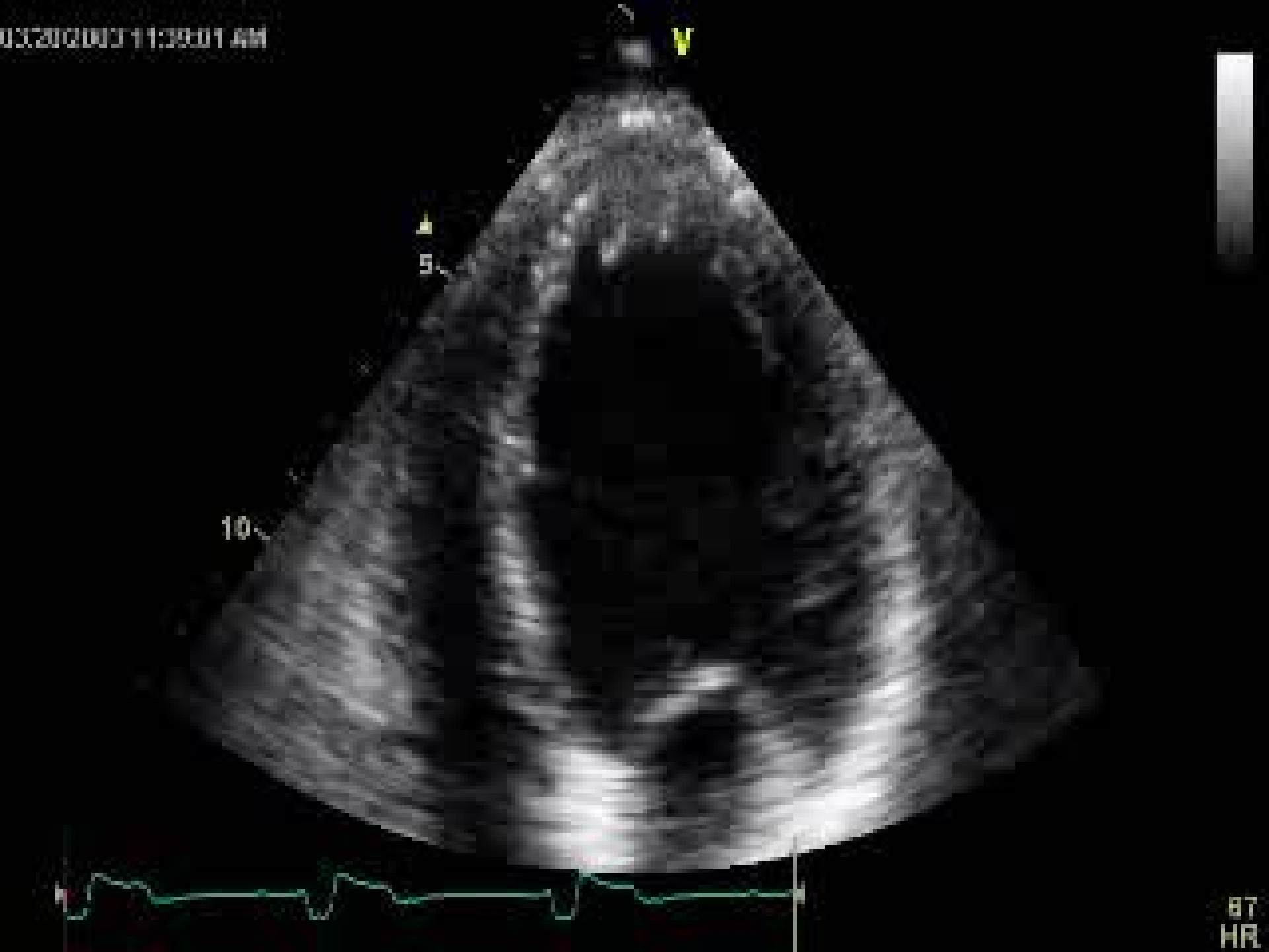


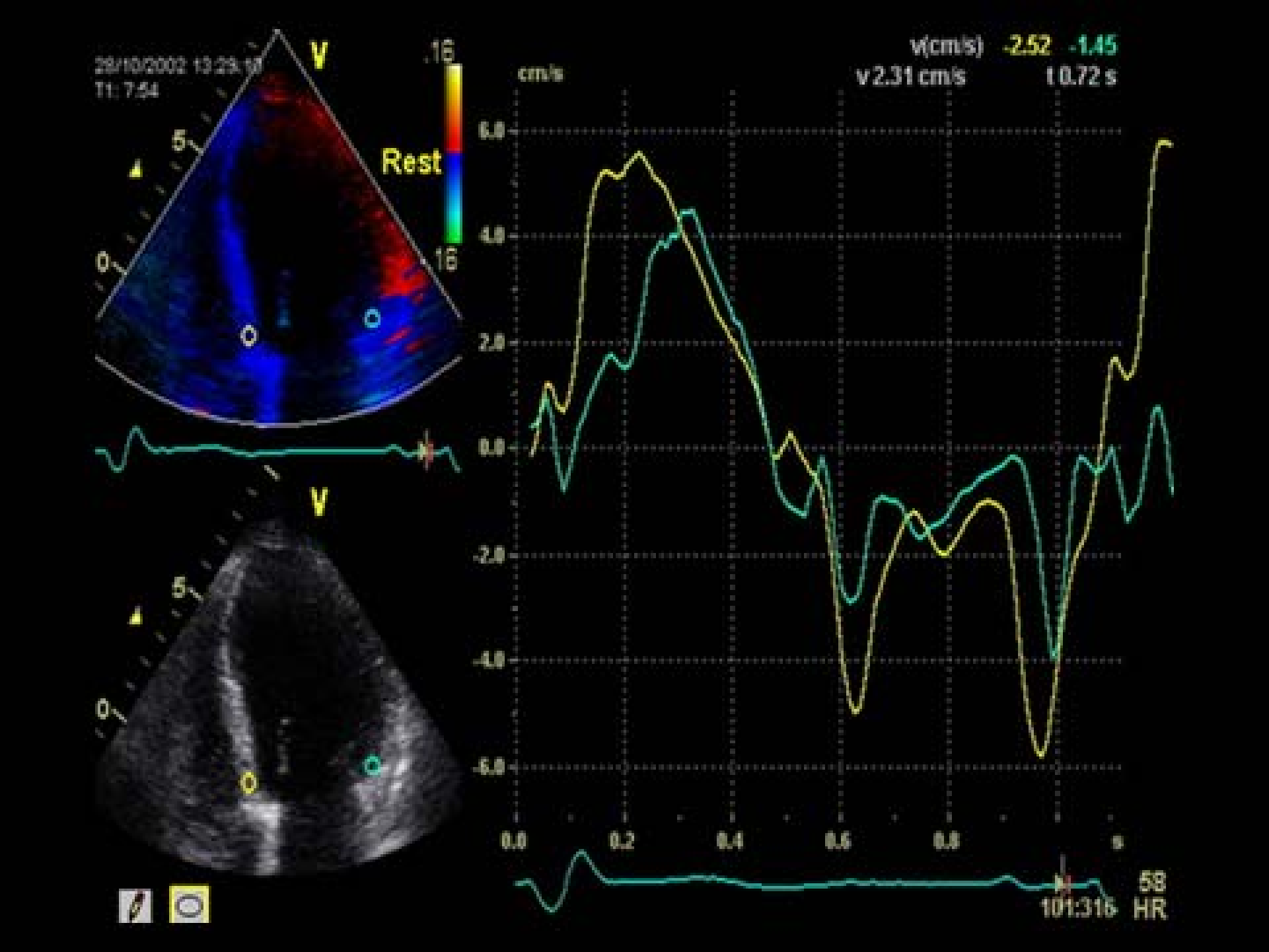
Ventricular Dyssynchrony in Heart Failure

Left Bundle Branch Block More Prevalent with Impaired LV Systolic Function



1. Masoudi, et al. JACC 2003;41:217-23
2. Aaronson, et al. Circ 1997;95:2660-7


5
10
87
HR


28/10/2002 13:29:10
T1: 7:54
V
.16
Rest
16
5
0
V
5
0
v(cm/s) -2.52 -1.45
v 2.31 cm/s
t 0.72 s
cm/s
6.8
4.8
2.8
0.8
-2.8
-4.8
-6.8
0.0
0.2
0.4
0.6
0.8
s
58
101:316 HR

Deleterious Effects of Ventricular Dyssynchrony

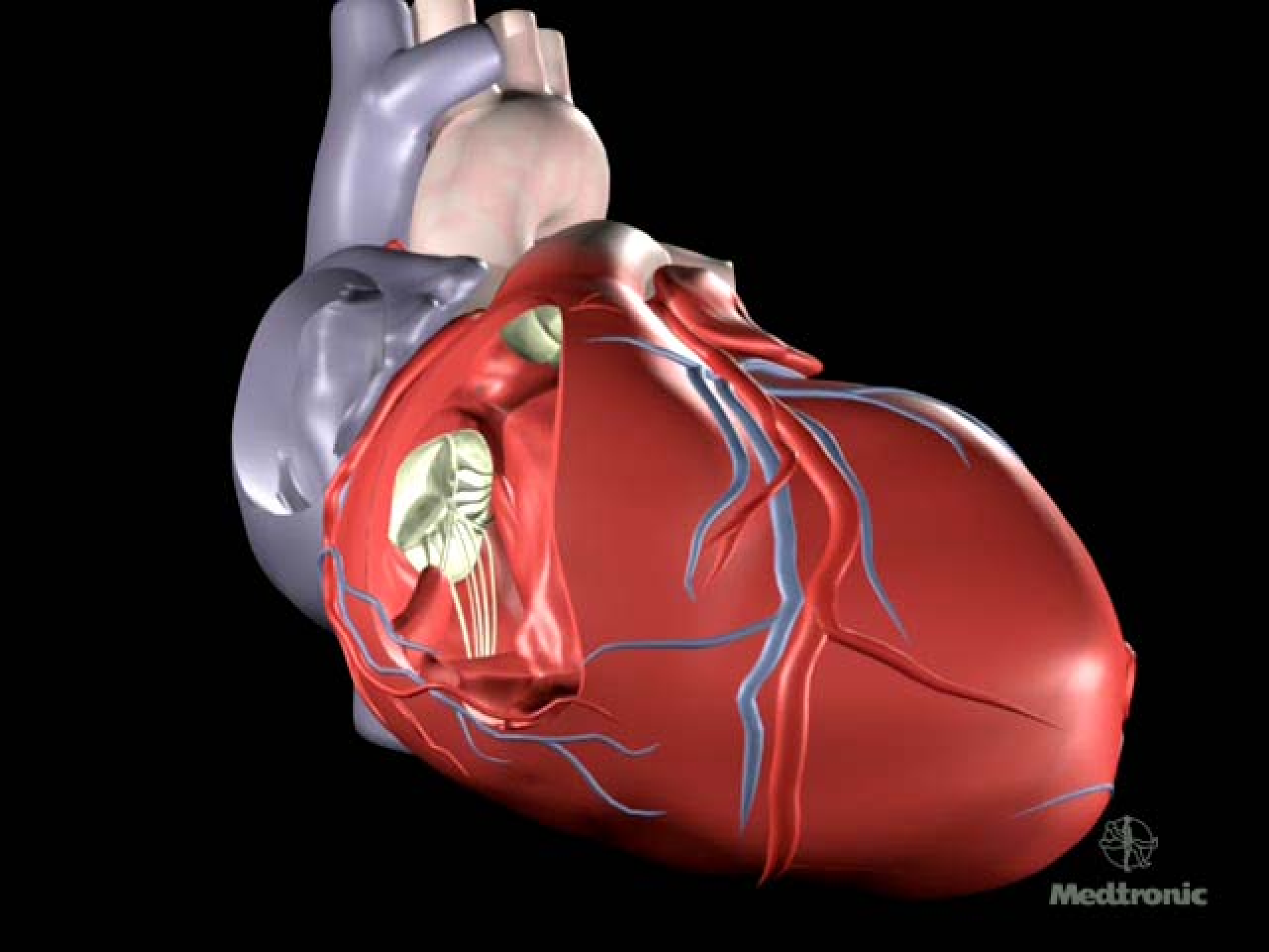
+ Reduced diastolic filling time
+ Weakened contractility
+ Protracted mitral regurgitation
+ Diminished stroke volume

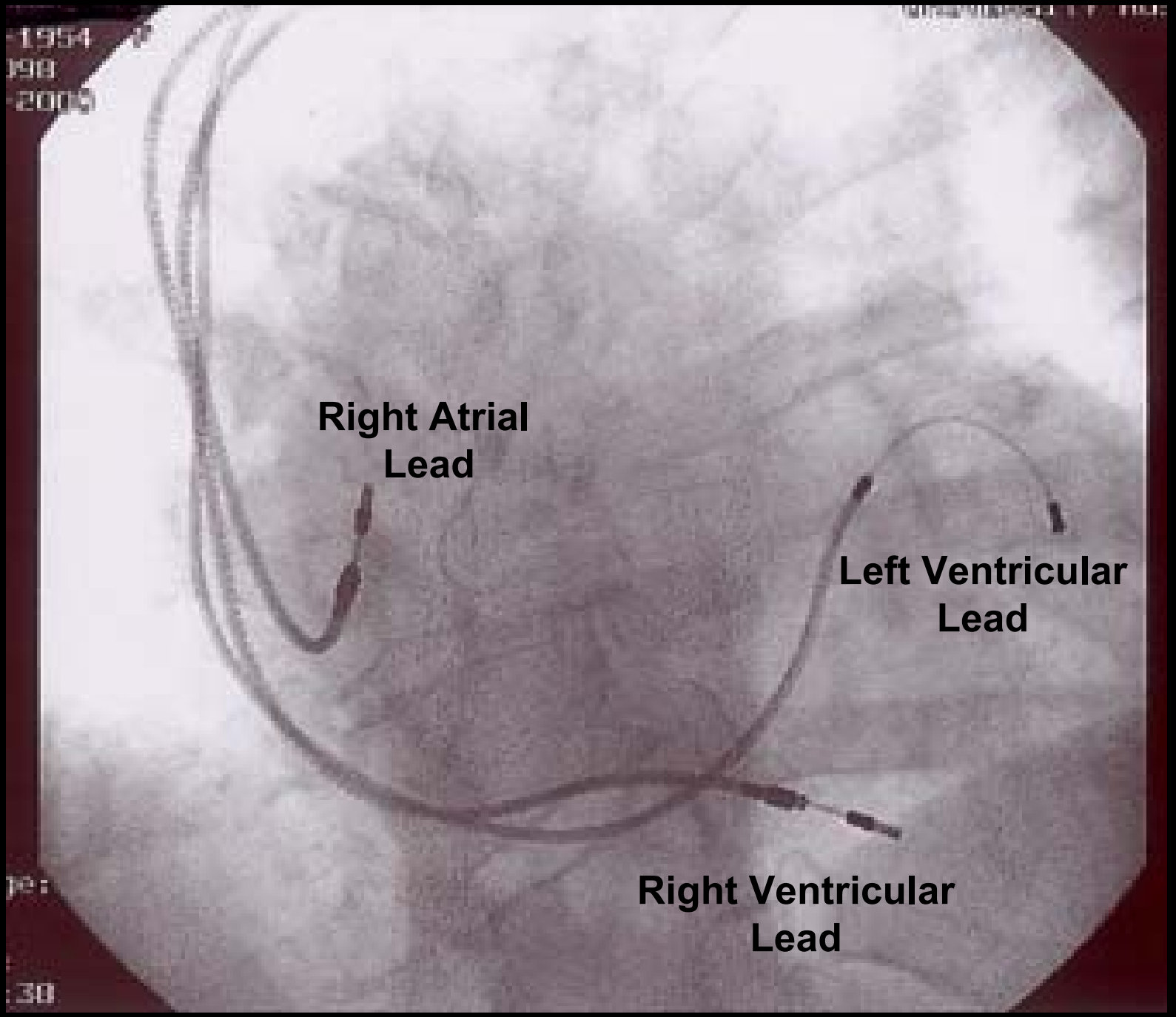
1. Grines CL, et al *Circulation* 1989;79: 845-853
2. Xiao HB, et al *Br Heart J* 1991;66: 443-447
3. Søgaard P, et al. *J Am Coll Cardiol* 2002;40:723–730

Achieving Cardiac Resynchronization

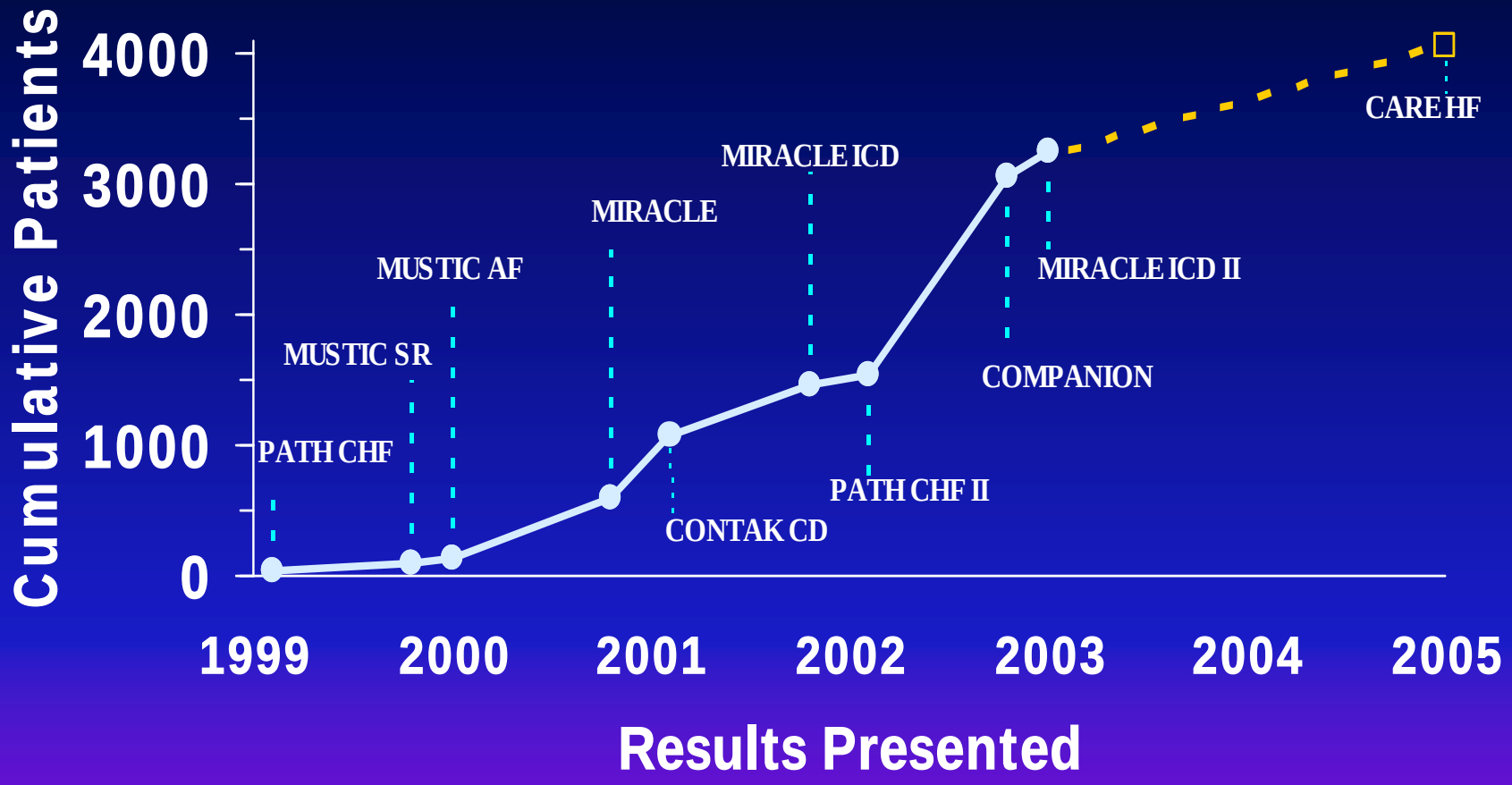
Synchronous biventricular pacing by transvenous approach for LV lead via coronary sinus


Medtronic


Medtronic

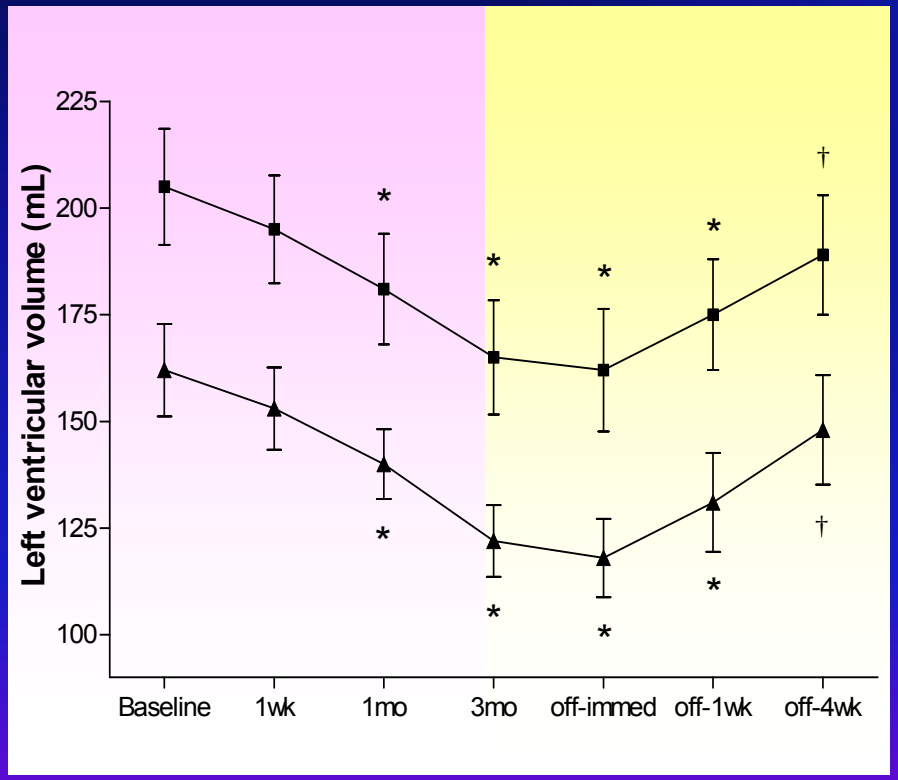

Right Atrial Lead
Left Ventricular Lead
Right Ventricular Lead

Cardiac Resynchronization Theapy
Randomized Trials

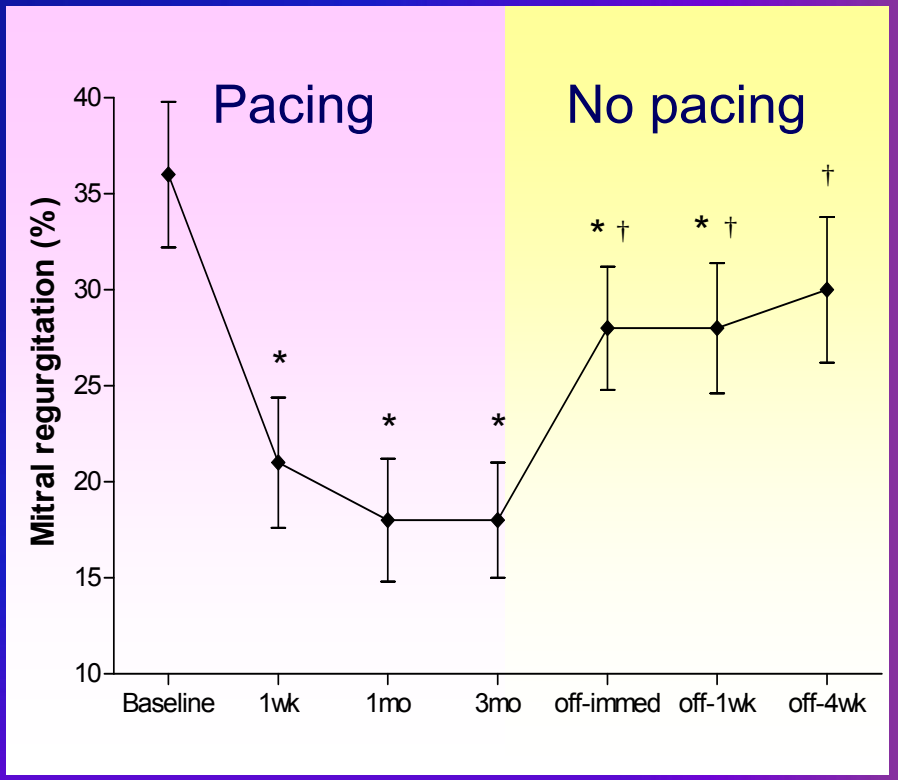


LV Reverse Remodeling after CRT

LV End Systolic and End Diastolic Volumes



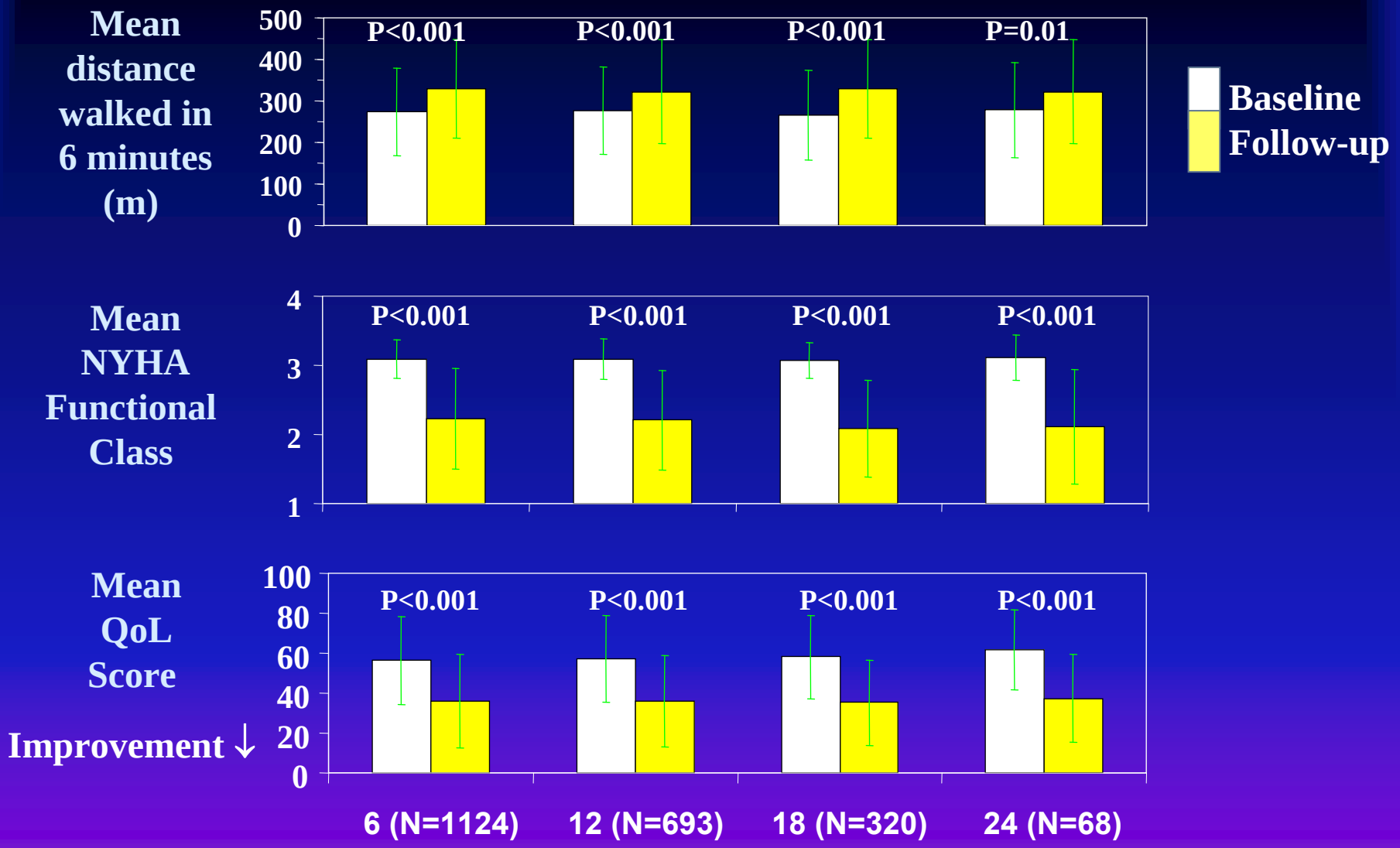
Mitral Regurgitation Area



N = 25

Yu CM, et al, Circulation 2002;105:438-445

MIRACLE Study Program



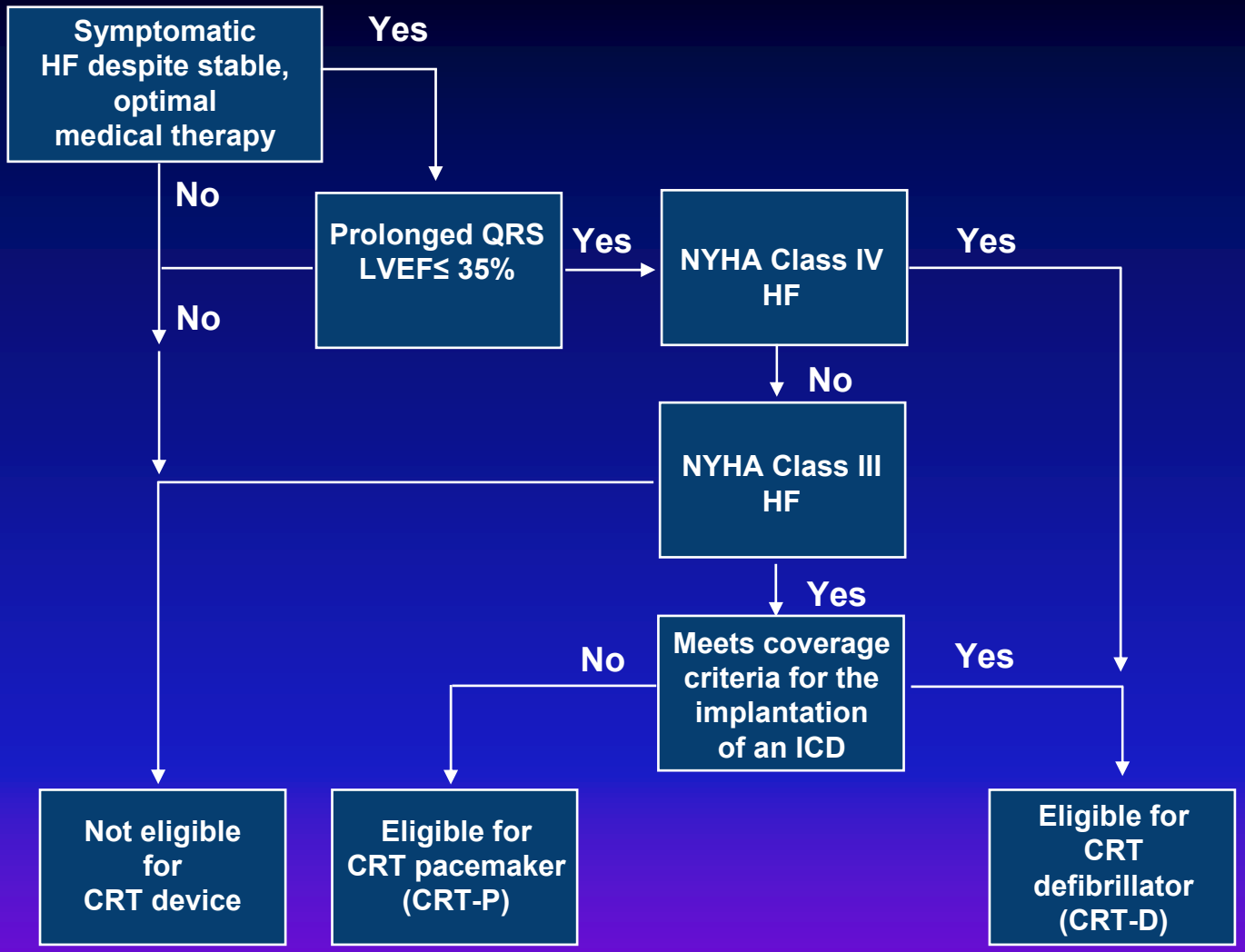
Source: Abraham, WT et al. AHA 2003

Who Responds to CRT?

Responder Parameter(s)	Finding	Limitation(s)
NYHA III/IV, QRS≥ 130 ms, EF≤ 35%, LVEDD≥ 55 mm	Confirmed in RCTs of over 2,500 patients	• ~ 70% respond favorably
QRS ≥ 150/155 and/or dP/dt ≤ 700 mm Hg/s	Correlated with improved dP/dt [1,2]	• Small studies, < 30 pts; • No clinical endpoint • Not confirmed by MIRACLE
Difference in time to peak systolic contraction	Correlated with ↓ volumes [3,4,5]	• Small studies, ≤ 30 pts; • Varying techniques • No clinical endpoint
No MI, significant mitral regurgitation	Correlated with improved NYHA[6]	• Observational study; • Not confirmed by MIRACLE

1. *Circulation*. 2000;101:2703-2709
2. *Circulation* 1999;99:2993-3001
3. *Am J Cardiol* 2002;91:684–688
4. *J Am Coll Cardiol* 2002;40:1615-1622
5. *J Am Coll Cardiol* 2002;40:723–730
6. *Am J Cardiol* 2002;89:346-350

CMS CRT/CRT-D Coverage Reference Guide



Reference CMS Local Coverage Decision and Bulletins for any specific coverage requirements specific to your region or state. Some local policies require a QRS duration ≥ 130 ms.