

Long-term outcome of patients with congenital heart disease undergoing cardiac resynchronization therapy

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CRT indications in children/congenital heart disease (CHD)

- Systemic LV
 - LBBB
 - RV pacing
- Systemic RV
 - RBBB
 - LV pacing
- Single ventricle
 - Any bundle branch block
 - „Single site“ pacing
- Subpulmonary RV?
 - RBBB

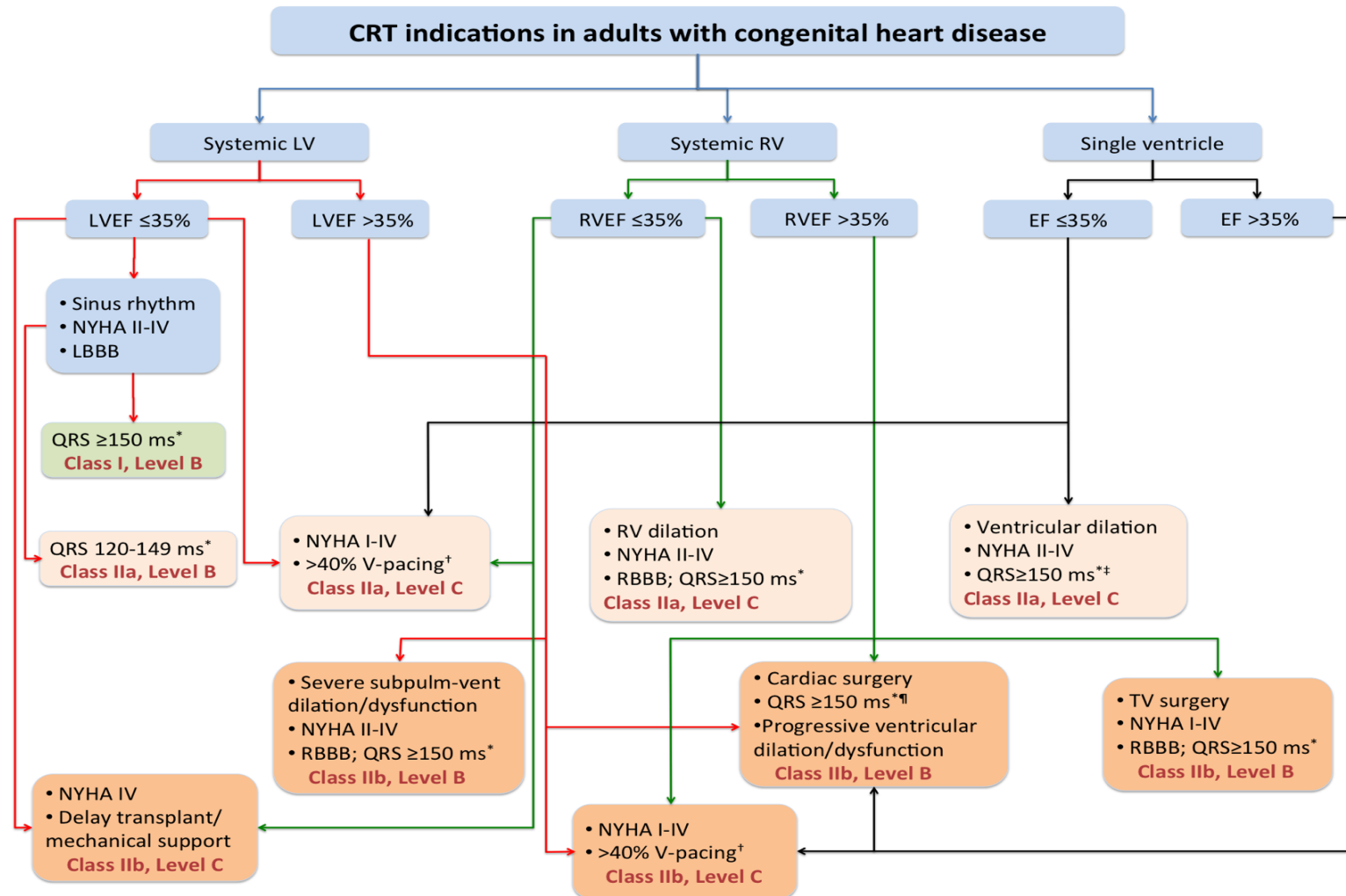


„classic“ CRT

**Electrical activation delay
within failing ventricle
required for CRT indication!**

Specific for CHD

CRT indication in adults with CHD



Cardiac Resynchronization Therapy for Pediatric Patients With Heart Failure and Congenital Heart Disease

A Reappraisal of Results

Kara S. Motonaga, MD; Anne M. Dubin, MD

(*Circulation*. 2014;129:1879-1891.)

Table 1. Single-Center Retrospective Studies of Permanent CRT in Pediatric and CHD-Related HF

	Janousek et al, ³⁷ 2004	Strieper et al, ³⁸ 2004	Moak et al, ³⁹ 2006	Khairy et al, ⁴⁰ 2006	Jauvert et al, ⁴¹ 2009	Cecchin et al, ⁴² 2009	Perera et al, ⁴³ 2013
Total patients, n	8	7	6	13	7	60	67
Age (range), y	Median, 12.5 (6.9–29.2)	Mean, 11 (2.3–28)	Mean, 11.3 (0.5–23.7)	Mean, 7.8 (0.8–15.5)	Mean, 24.6 (15–50)	Median, 15 (0.4–47)	Unknown
Follow-up duration	Median, 17.4 mo	Median, 19 mo	Median, 10 mo	Mean, 16.5 mo	Mean, 19.4 mo	Median, 0.7 y	Mean, 2.75 y
CHD population, n (%)	8 (100)	7 (100)	3 (50)	10 (76.9)	7 (100)	46 (76.7)	50 (74.6)
Systemic RV	8 (100)	1 (14.3)	...	4 (30.8)	7 (100)	7 (11.7)	...
Systemic LV	...	6 (85.7)	3 (50)	6 (46.2)	...	26 (43.3)	...
Single ventricle	13 (21.7)	...

Aim

- To evaluate long-term impact of CRT in pts with CHD and systemic ventricular dysfunction

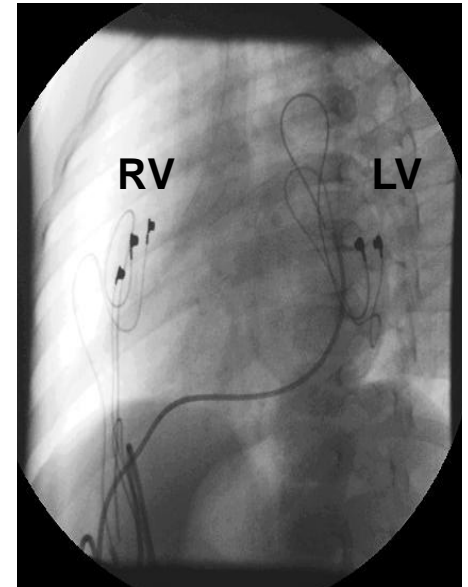
Patients

Single centre, CRT implantation 2002 – 2014

- N = 30, 15 ♀, 15 ♂
- Underlying substrate
 - Structural CHD (N = 28/30)
 - Systemic ventricle
 - Left = 12
 - Right = 14
 - Single = 4
- Age at CRT implantation: median 12.9 (IQR 6.5 - 18.2) years
- Follow up: median 9.0 (IQR 4.5 - 11.4) years on CRT

Procedures

- Type
 - Primary CRT implantation = 11
 - Upgrade from conventional pacing = 19
- CRT-P in all
 - Later upgrade to CRT-D in 1/30
- Implantation
 - Transvenous = 3
 - Thoracotomy = 19
 - Mixed = 8
- Associated with other cardiac surgery = 13/30

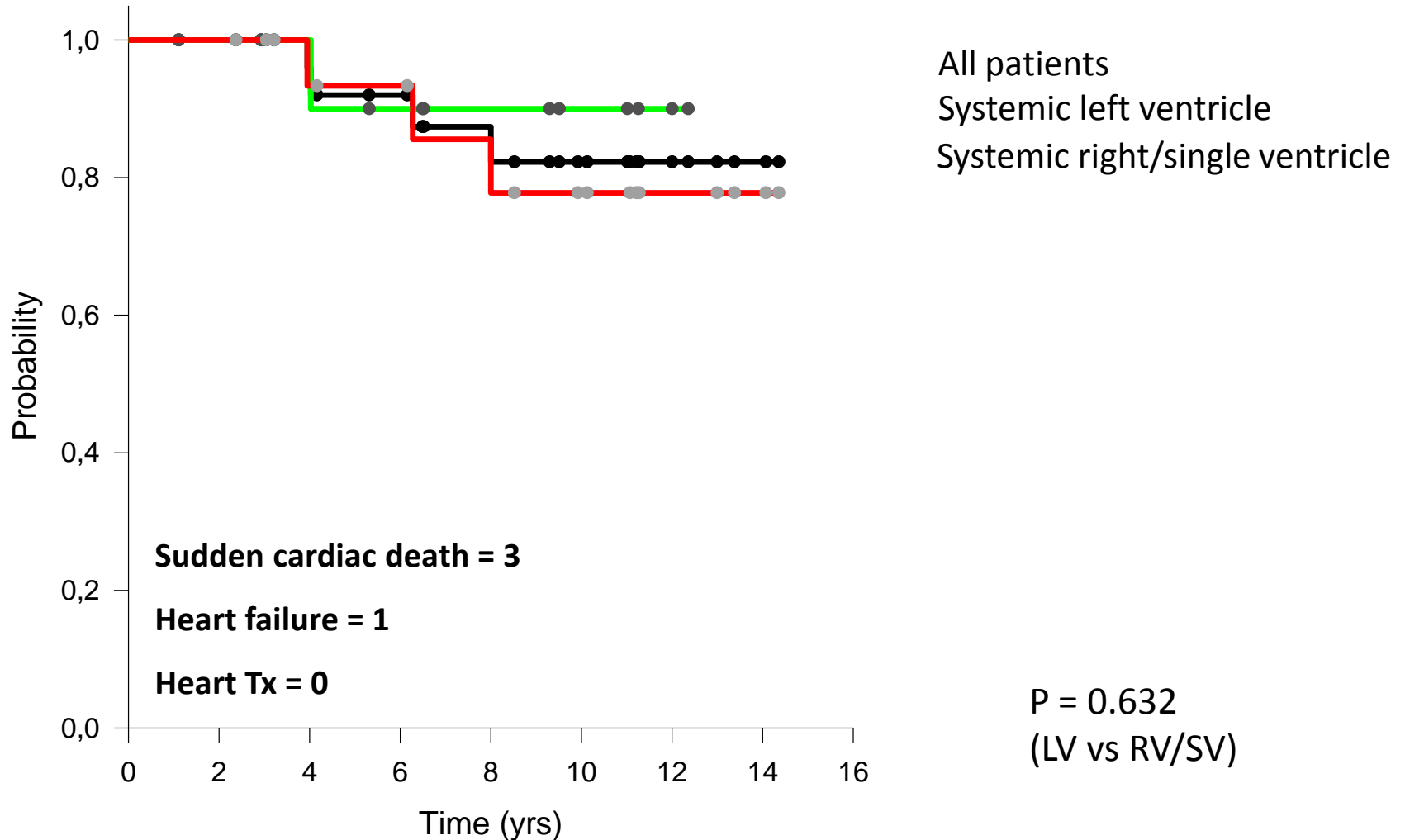


Follow-up

- Echocardiographic follow-up of systemic ventricular function
- CRT response definition
 - increase in systemic ventricular
 - EF (Simpson biplane, systemic LV) or
 - fractional area of change (FAC, systemic RV/SV) by >10 units **and**
 - \leq NYHA class at the end of FUP
- Actuarial survival probability

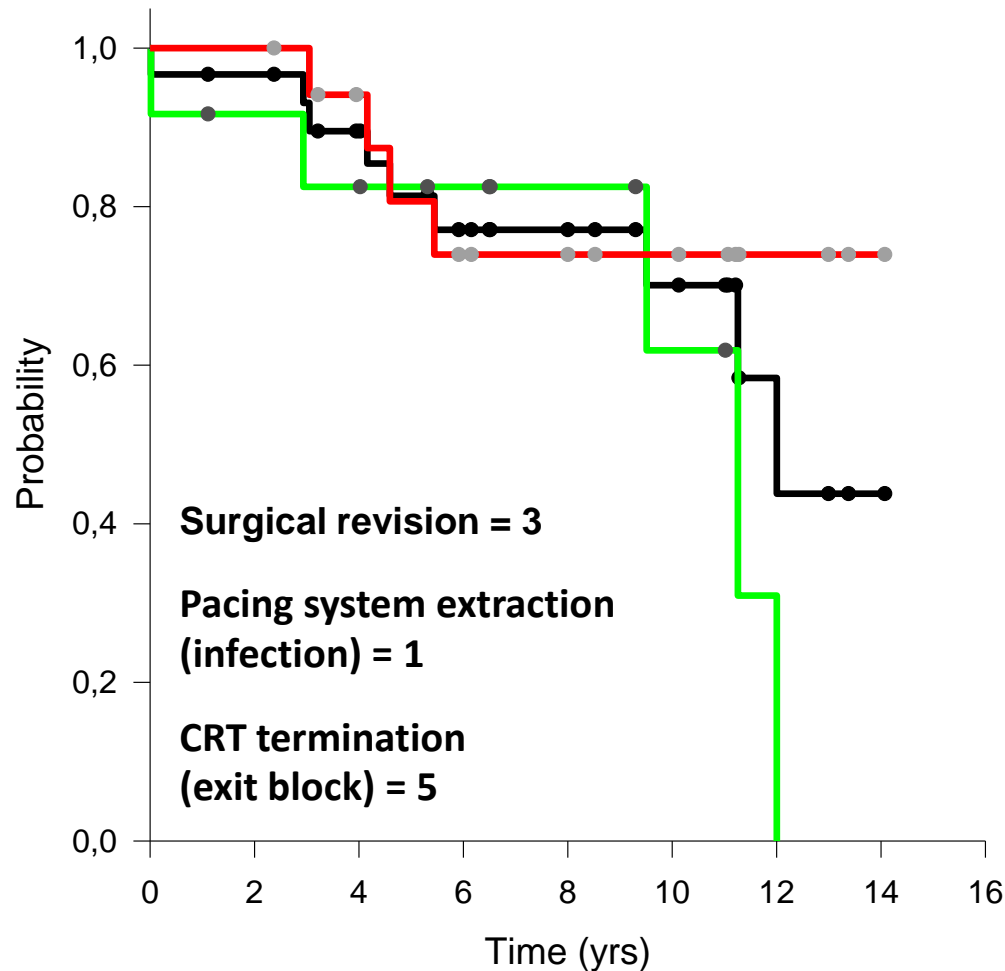
Cardiovascular death/heart failure hospitalization

Freedom from cardiovascular death or heart failure hospitalization



CRT system complications

Freedom from CRT complications leading to surgical system revision (elective generator replacement excluded) or therapy termination

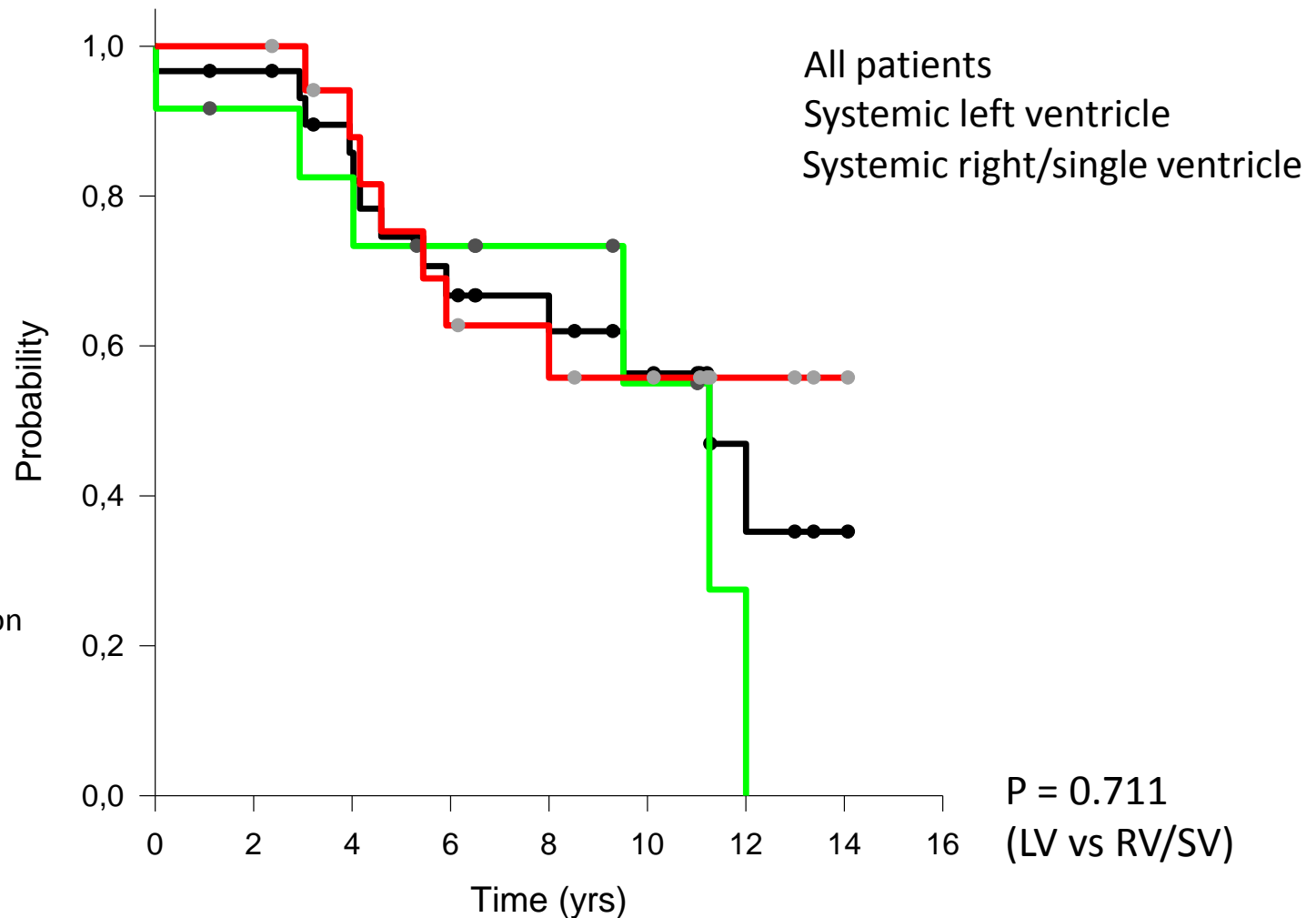


All patients
Systemic left ventricle
Systemic right/single ventricle

P = 0.418
(LV vs RV/SV)

Uneventful therapy continuation

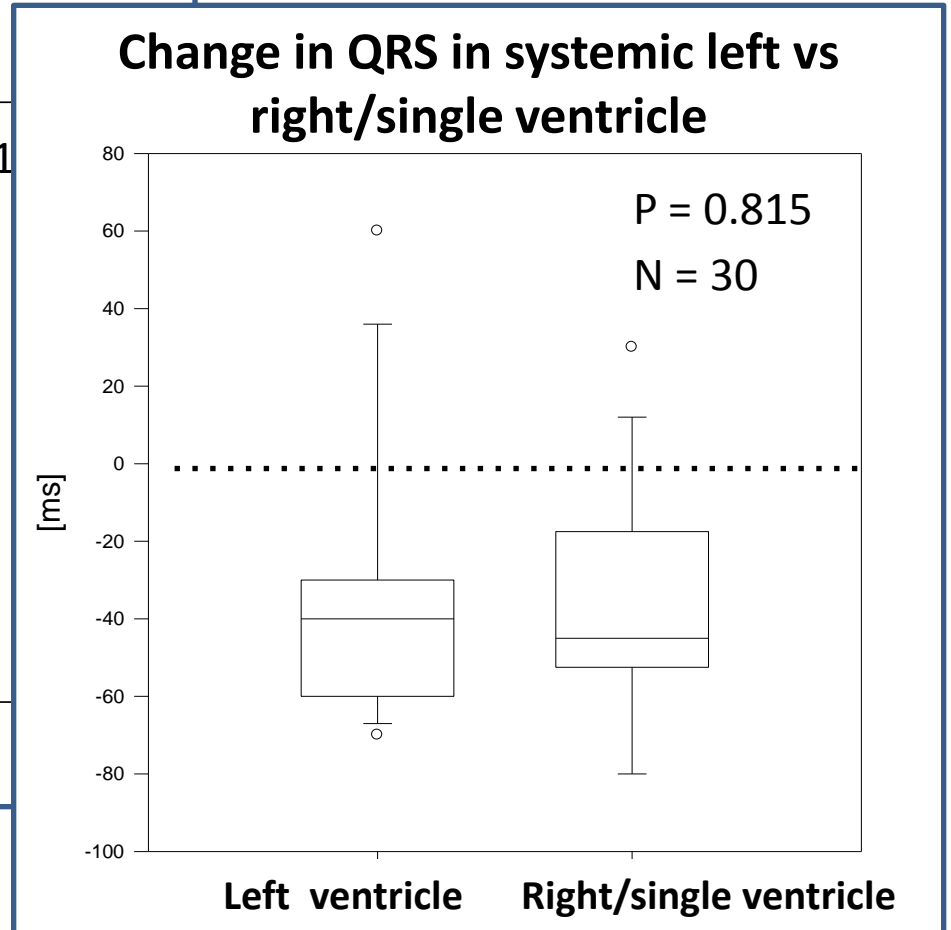
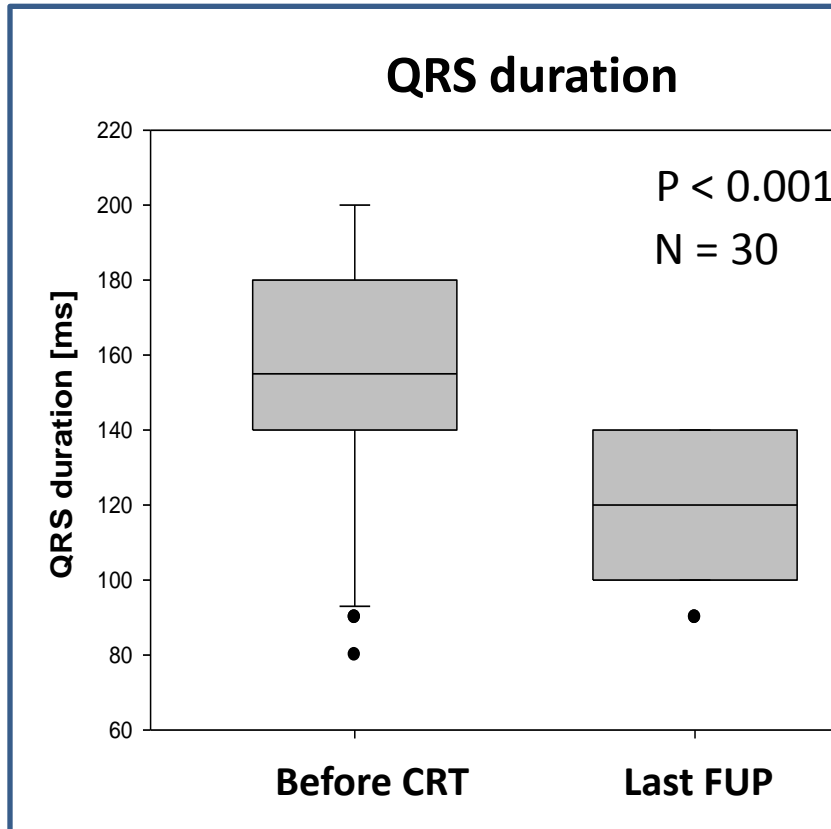
Overall probability of uneventful therapy continuation*



* freedom from:

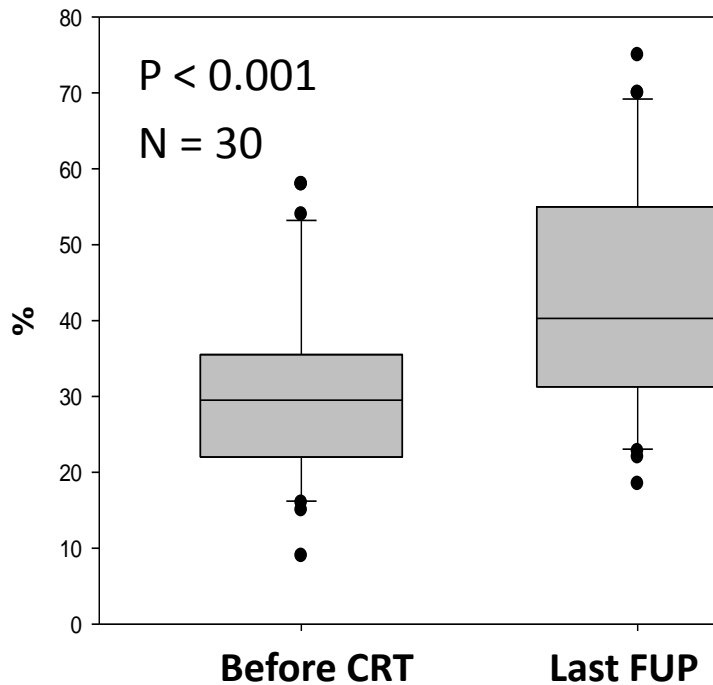
- death
- heart failure hospitalization
- therapy termination
- surgical revision
(other than elective
battery replacement)

QRS duration

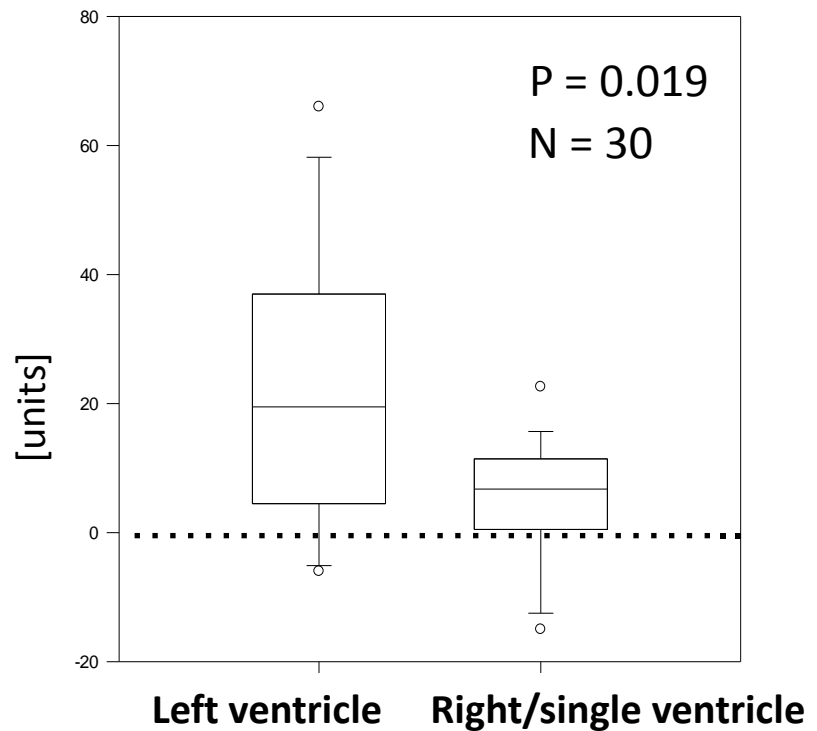


Systolic function of the systemic ventricle

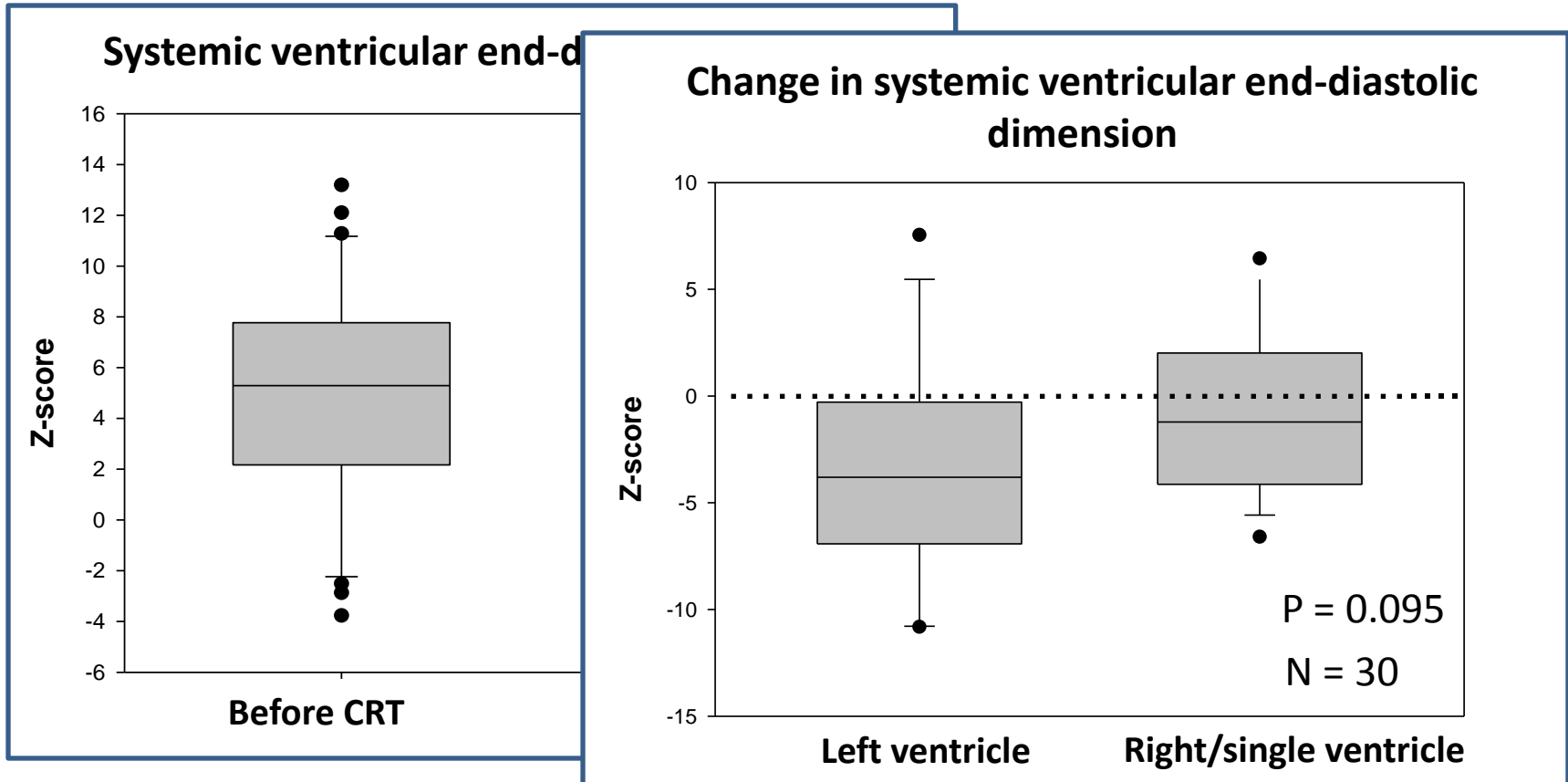
Ejection fraction/fractional area



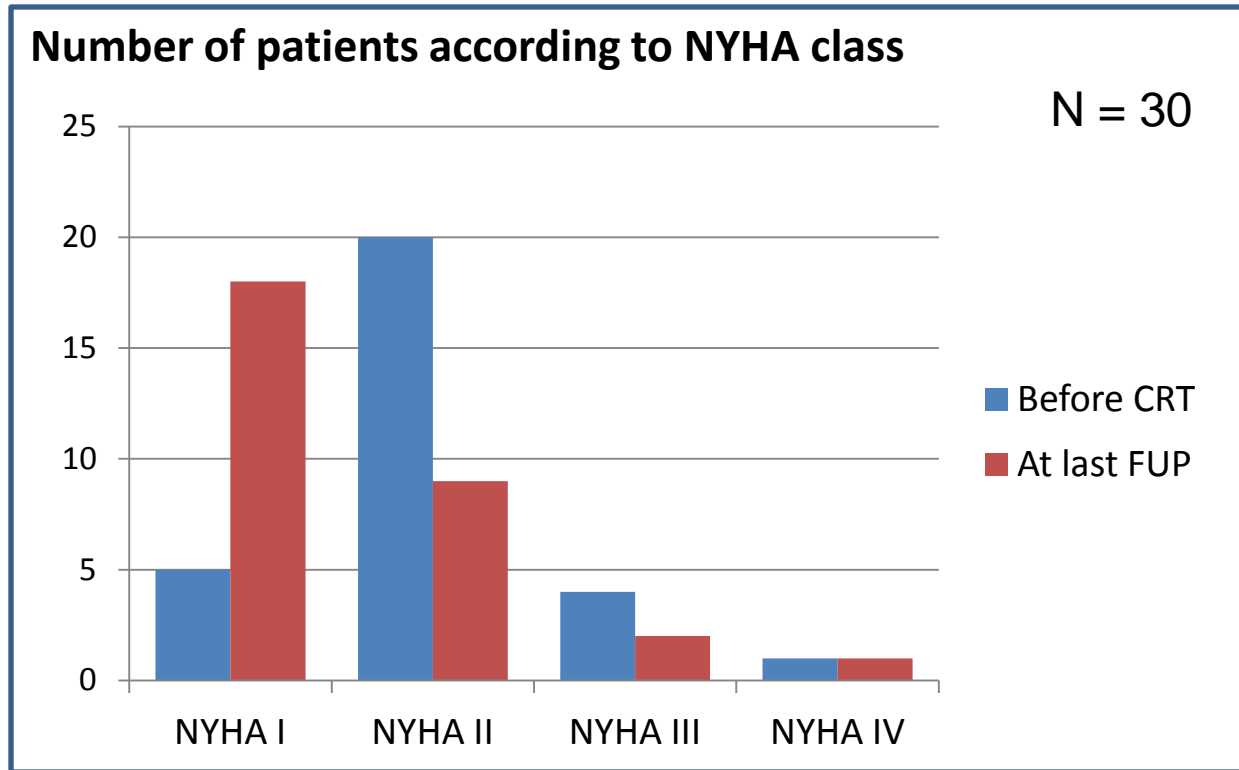
Change in ejection fraction/fractional area of change



Systemic ventricular end-diastolic dimension



NYHA classification

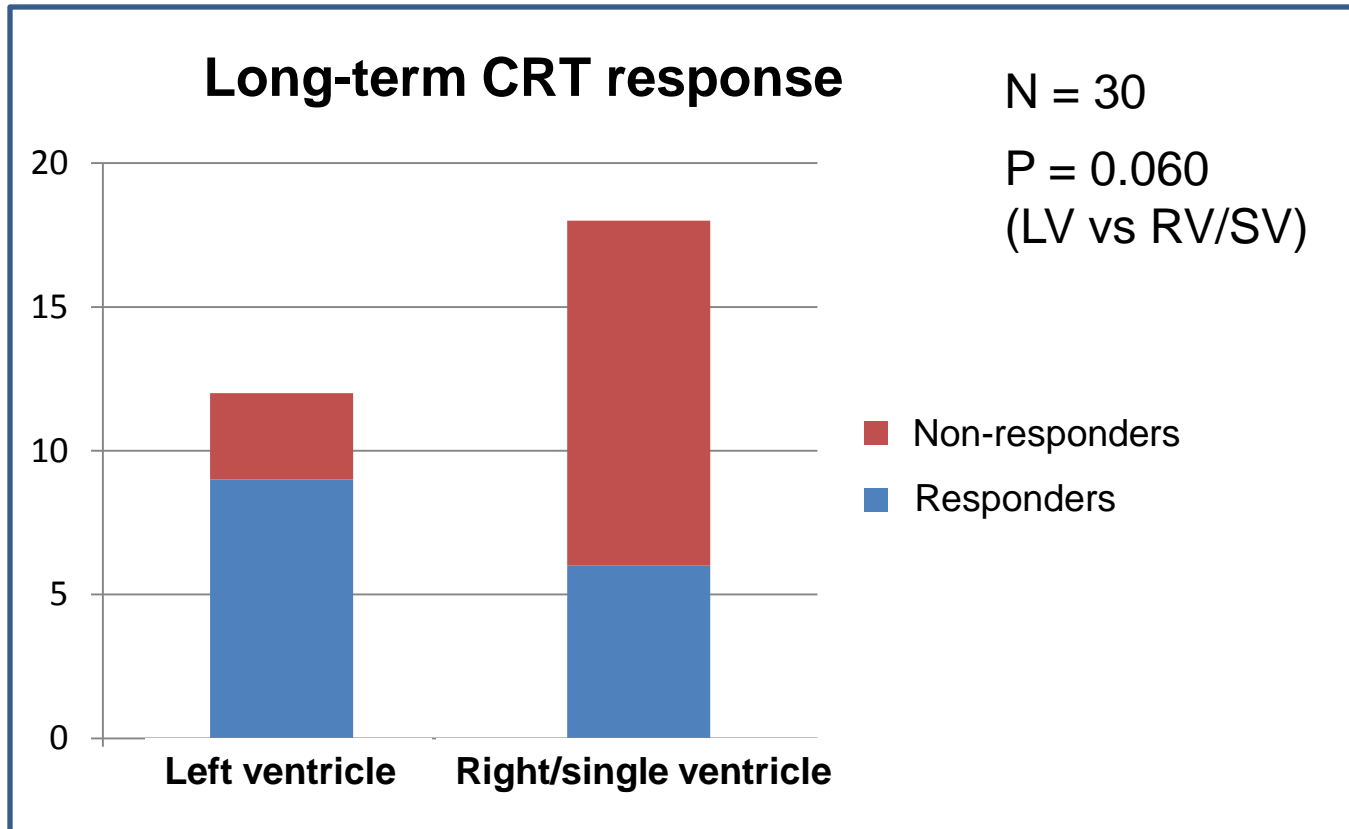


Improved:

Systemic LV: 6/12 pts.

Systemic RV/SV: 6/18 pts.

Long-term CRT response*



*Increase in EF (systemic LV) or FAC (systemic RV/SV) by >10 points and \leq NYHA class at the end of FUP

Conclusions

- Long-term CRT in patients with CHD was associated with significant improvement of systemic ventricular function
- CRT was more effective in patients with systemic left ventricle.
- Probability of device complications necessitating surgical revision or therapy termination was high.
- Rate of sudden death was significant (10%)
 - CRT-D should be individually considered in every patient.

Thank you