Dyssynchronie a stimulace systémové PK

Indikace a technická úskalí

J. Janoušek

Dětské kardiocentrum 2. LF UK a FN v Motole

European Reference Network
for rare or low prevalence complex diseases

Network
Heart Diseases
(ERN GUARD-HEART)

Member
Motol University Hospital — Czechia

CIED Doporučené postupy

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

2012

American Heart Association

2012 ACCF/AHA/HRS Focused Update Incorporated Into the ACCF/AHA/HRS 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm Abnormalities : A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society

Andrew E. Epstein, John P. DiMarco, Kenneth A. Ellenbogen, N.A. Mark Estes III, Roger A.

2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

2013

The Task Force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA).

Authors/Task Force Members: Michele Brignole (Chairperson) (Italy)*, Angelo Auricchio (Switzerland), Gonzalo Baron-Esquivias (Spain), Pierre Bordachar

Pharmacological and non-pharmacological therapy for arrhythmias in the pediatric population: EHRA and AEPC-Arrhythmia Working Group joint consensus statement

2013

PACES/HRS Expert Consensus Statement on the Recognition and Management of Arrhythmias in Adult Congenital Heart Disease

2014

Developed in partnership between the Pediatric and Congenital Electrophysiology Society (PACES) and the Heart Rhythm Society (HRS). Endorsed by the governing bodies of PACES, HRS, the American College of Cardiology (ACC), the American Heart Association (AHA), the European Heart Rhythm Association (EHRA), the Canadian Heart Rhythm Society (CHRS), and the International Society for Adult Congenital Heart Disease (ISACHD).

2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

2015

ESC European Society of Cardiology

Europace (2018) 0, 1–35
doi:10.1093/europace/eux380

2018

EHRA POSITION PAPER

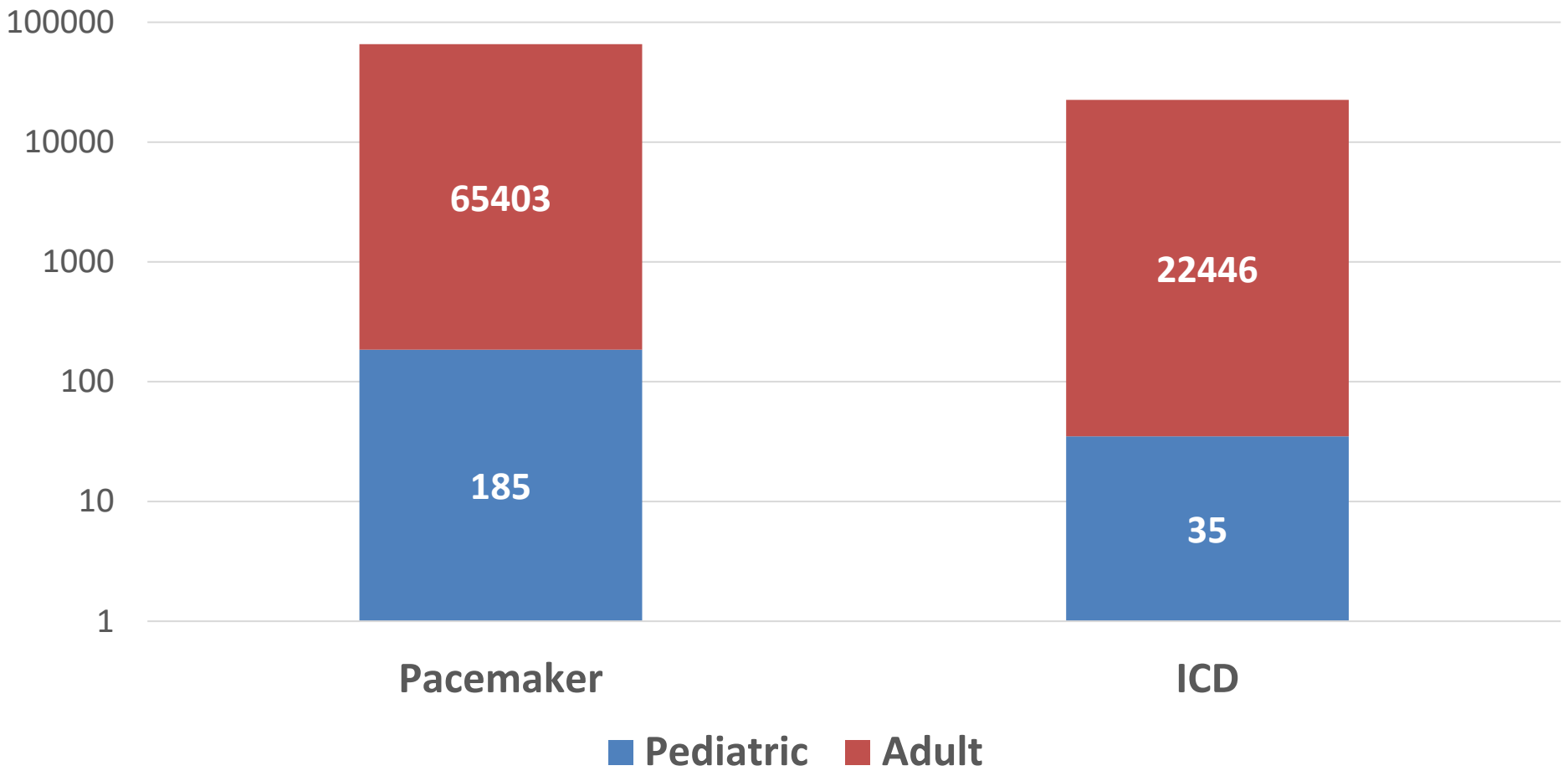
Arrhythmias in congenital heart disease: a position paper of the European Heart Rhythm Association (EHRA), Association for European Paediatric and Congenital Cardiology (AEPC), and the European Society of Cardiology (ESC) Working Group on Grown-up Congenital heart disease, endorsed by HRS, PACES, APHRS, and SOLAECE

2021 PACES Expert Consensus Statement on the Indications and Management of Cardiovascular Implantable Electronic Devices in Pediatric Patients

Developed in collaboration with and endorsed by the Heart Rhythm Society (HRS), the American College of Cardiology (ACC), the American Heart Association (AHA), and the Association for European Paediatric and Congenital Cardiology (AEPC). Endorsed by the Asia Pacific Heart Rhythm Society (APHRS), the Indian Heart Rhythm Society (IHRS), and the Latin American Heart Rhythm Society (LAHRS).

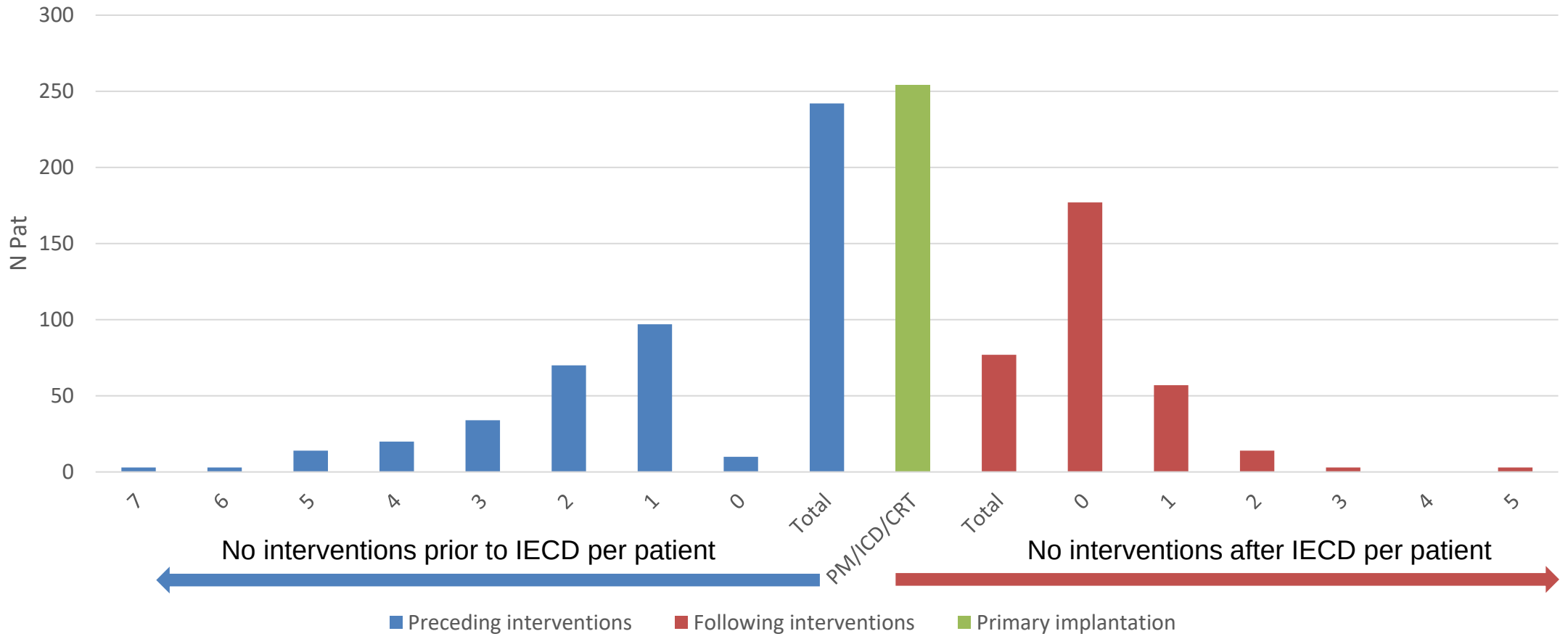
Počty implantovaných CIED

ČR, 2010-2016, 10.5 mil. obyvatel



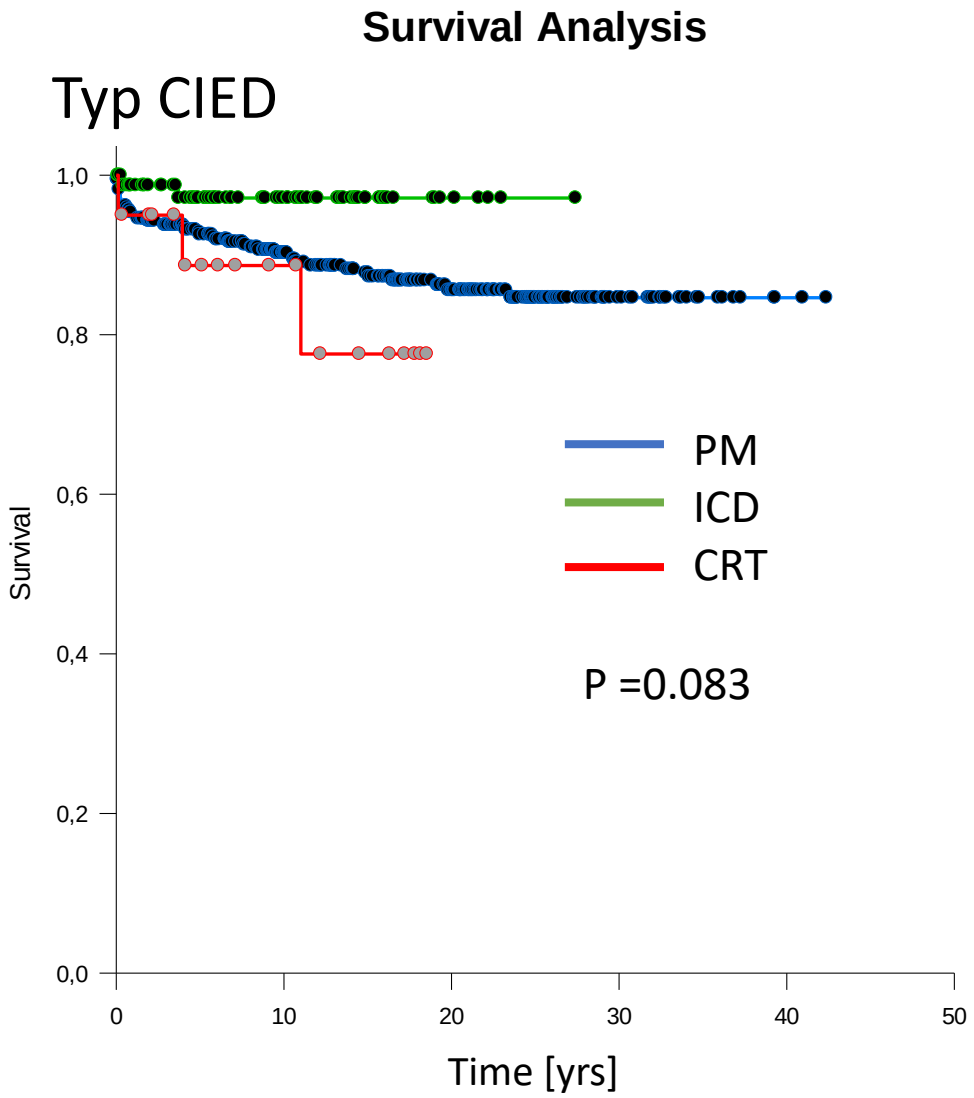
Strukturální srdeční intervence před a po implantaci CIED v dětském věku

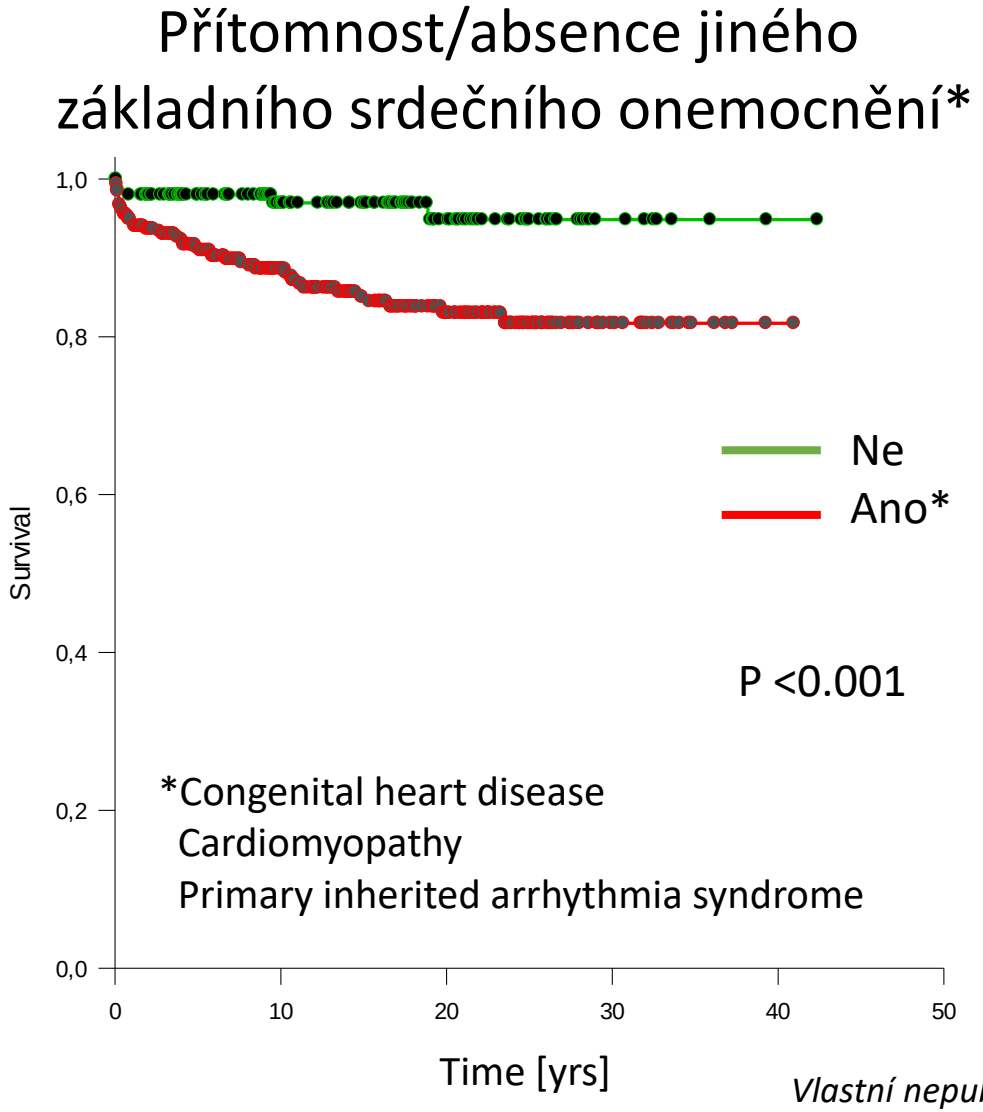
Pacienti se strukturálním srdečním onemocněním (N=253)



Own unpublished data

Dlouhodobé přežívání po implantaci CIED v dětství





Vlastní nepublikovaná data

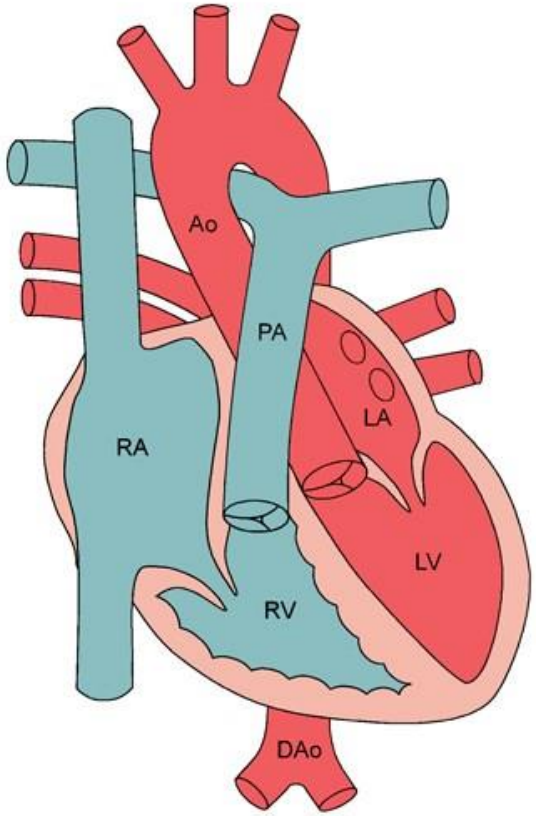
Patofyziologie systémové PK

- Myokardiální dysfunkce
  - Suboptimální uspořádání myokardiálních vlákem
  - Snížená koronární perfuzní rezerva
  - Kontraktilní disparita
- Regurgitace systémové AV chlopně

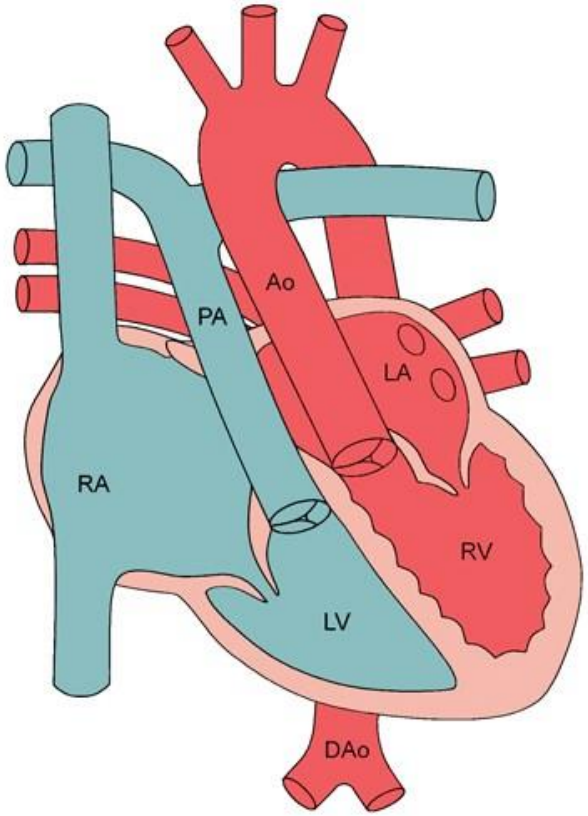
Predispozice ke kardiomyopatii asociované se stimulací

Anatomické situace u systémové PK

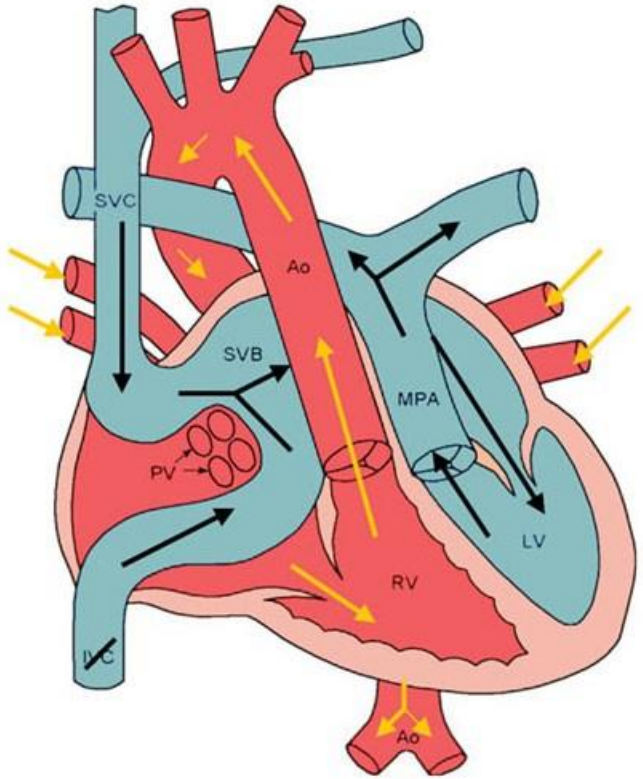
Normální srdce



Vrozeně korigovaná transpozice (CCTGA)

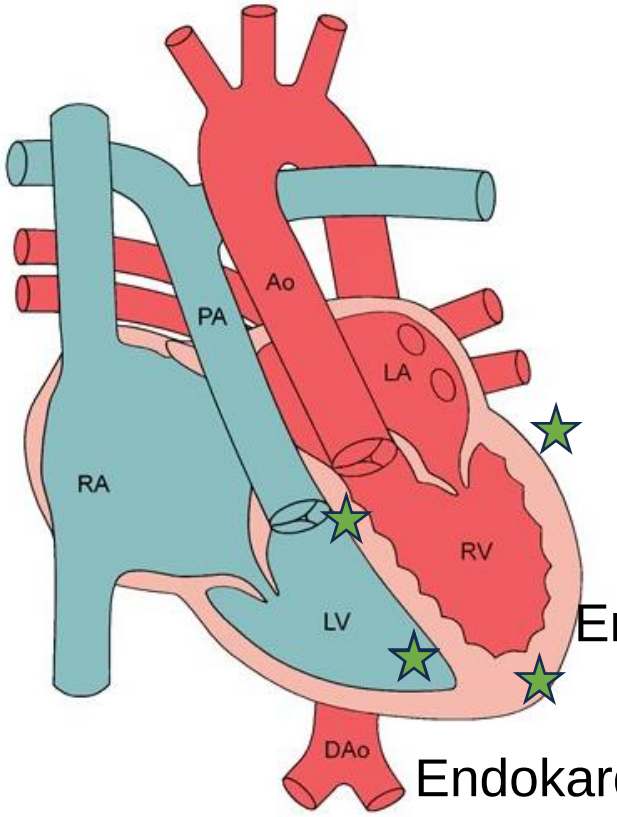


D-transpozice/Mustard, Senning



Stimulace u CCTGA

CCTGA +/- fyziologická korekce



Biventrikulární stimulace

Stimulace převodního systému

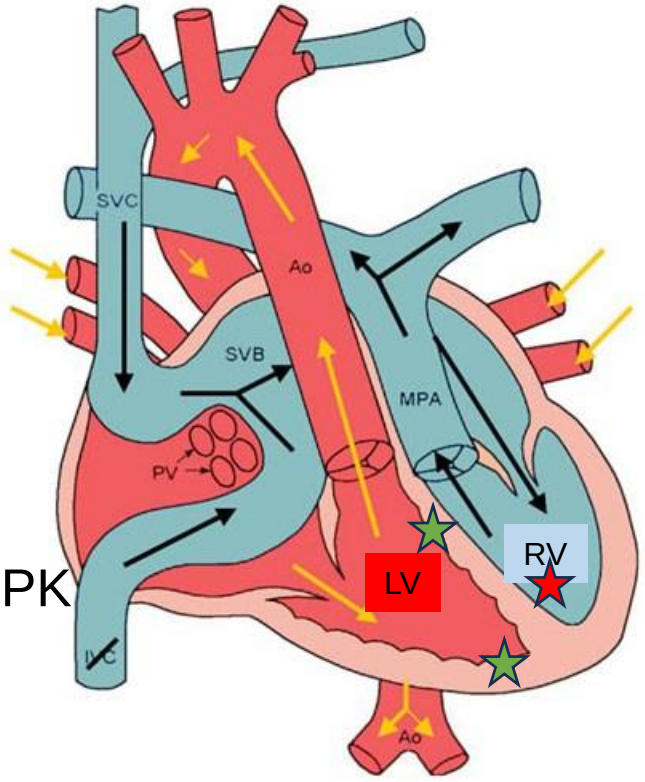
Stimulace převodního systému

Endokardiální stimulace hrotu subpulmonální PK

Epikardiální stimulace hrotu systémové PK

Endokardiální stimulace hrotu subpulmonální LK

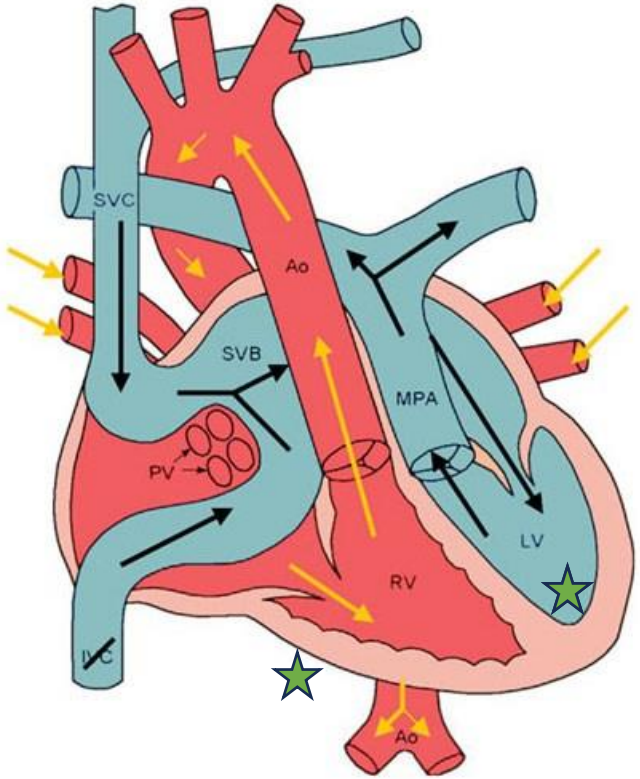
CCTGA + double switch

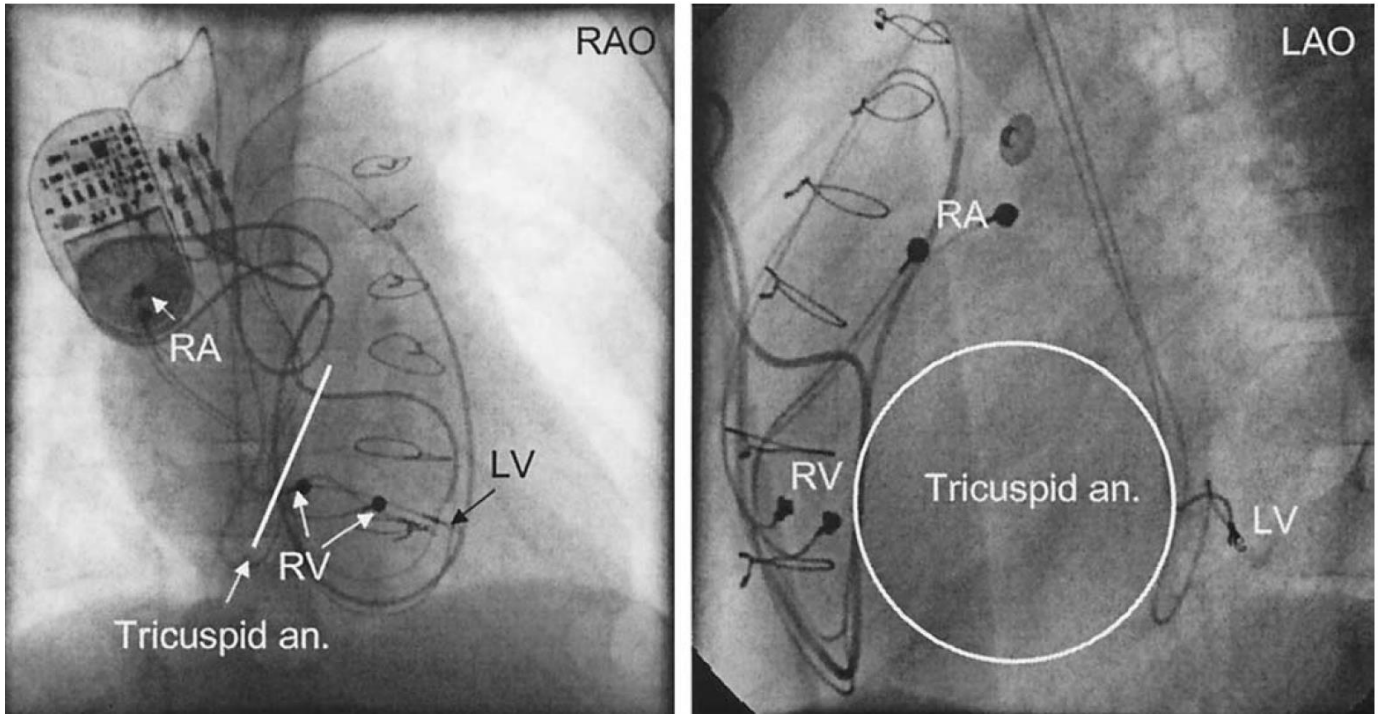


Epikardiální stimulace hrotu systémové LK

Stimulace u d-TGA/Mustard, Senning

D-TGA/Mustard, Senning





Biventrikulární stimulace kombinovaným endo-epikard.systémem

Endokardiální stimulace hrotu subpulmonální PK

Souhrn stimulačních strategií u systémové PK

- Konvenční stimulace ze subpulmonální komory

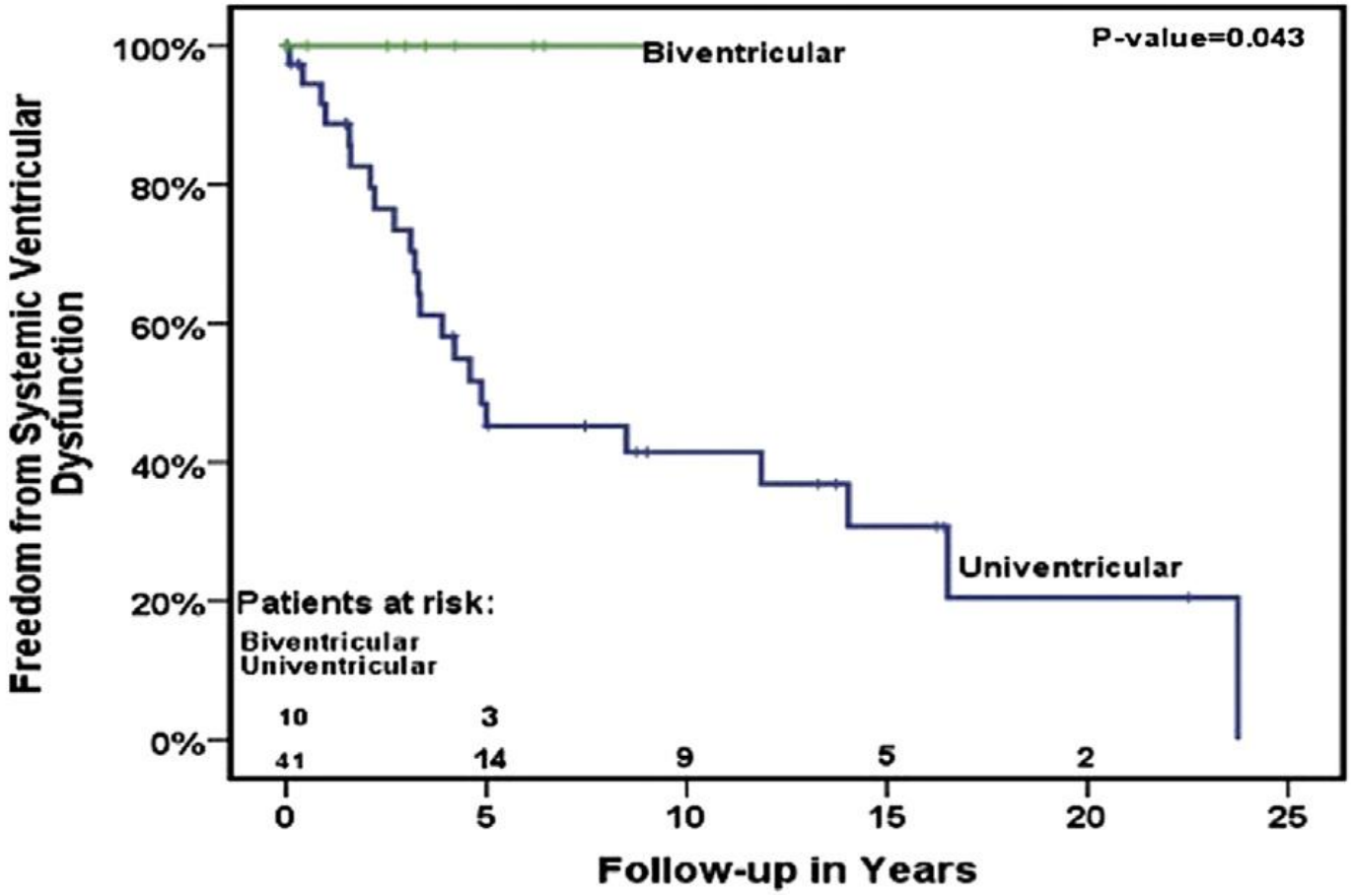
- Resynchronizace
  - Upgrade z konvenční stimulace na biventrikulární

- Prosynchronizace
  - Primárně biventrikulární stimulace
  - Stimulace ze specifických míst k prevenci dyssynchronie
  - Stimulace převodního systému

Impact of pacing on systemic ventricular function in L-transposition of the great arteries

The Journal of Thoracic and Cardiovascular Surgery • January 2016

Sophie C. Hofferberth, MBBS,[a] Mark E. Alexander, MD,[b] Douglas Y. Mah, MD,[b]
Victor Bautista-Hernandez, MD,[a] Pedro J. del Nido, MD,[a] and Francis Fynn-Thompson, MD[a]



Twenty-five (47%) univentricular pacing only

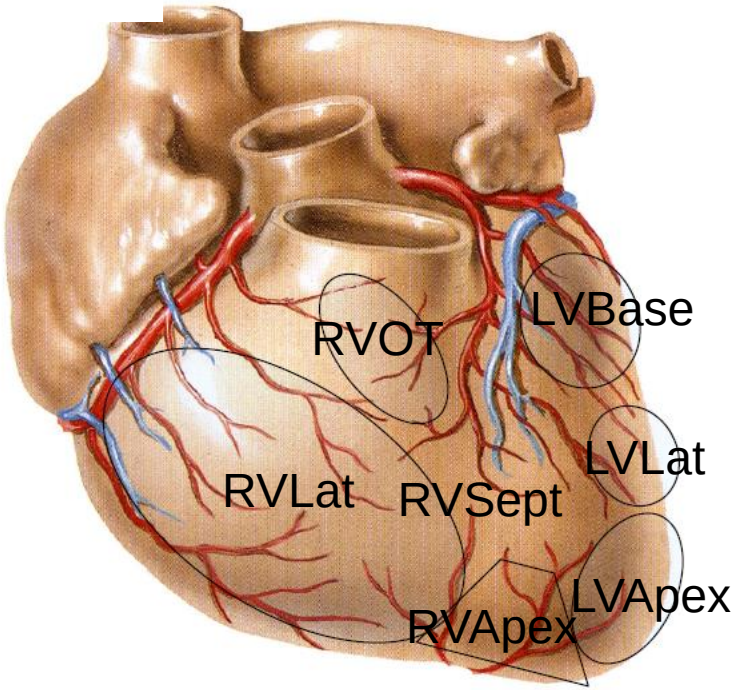
- 8 (32%) developed significant systemic ventricular dysfunction.

Twenty-eight (53%) received BiVP

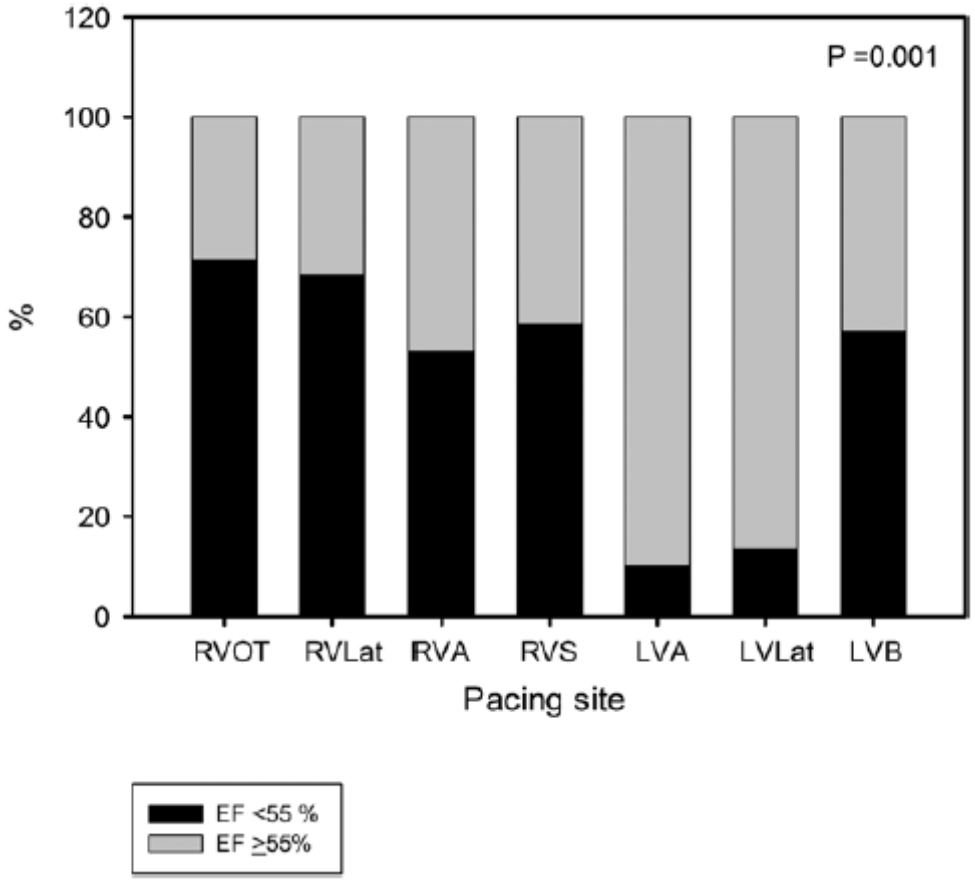
- 17 (26%) were upgraded from a dual-chamber system
- 11 (21%) received primary BiVP.

Zachování srdeční funkce při konvenční stimulaci u normálního srdce

Cross-sectional study (N=178, 21 centers)



Proportion of pts with LVEF<55 %



Preservation of LV function (LV EF ≥55 %):
LV apical/lateral pacing: OR 8.26, p=0.018

Janousek J et al. Circulation 2013;127:613-623

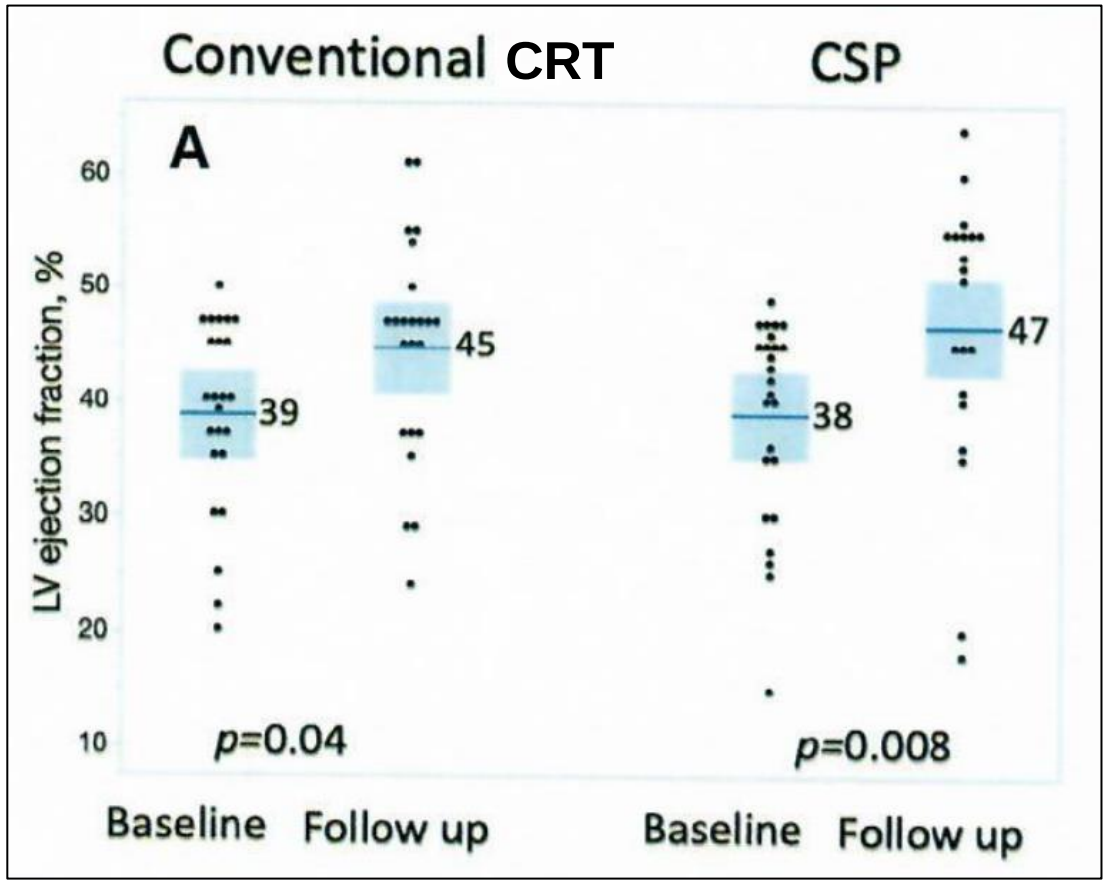
ORIGINAL RESEARCH

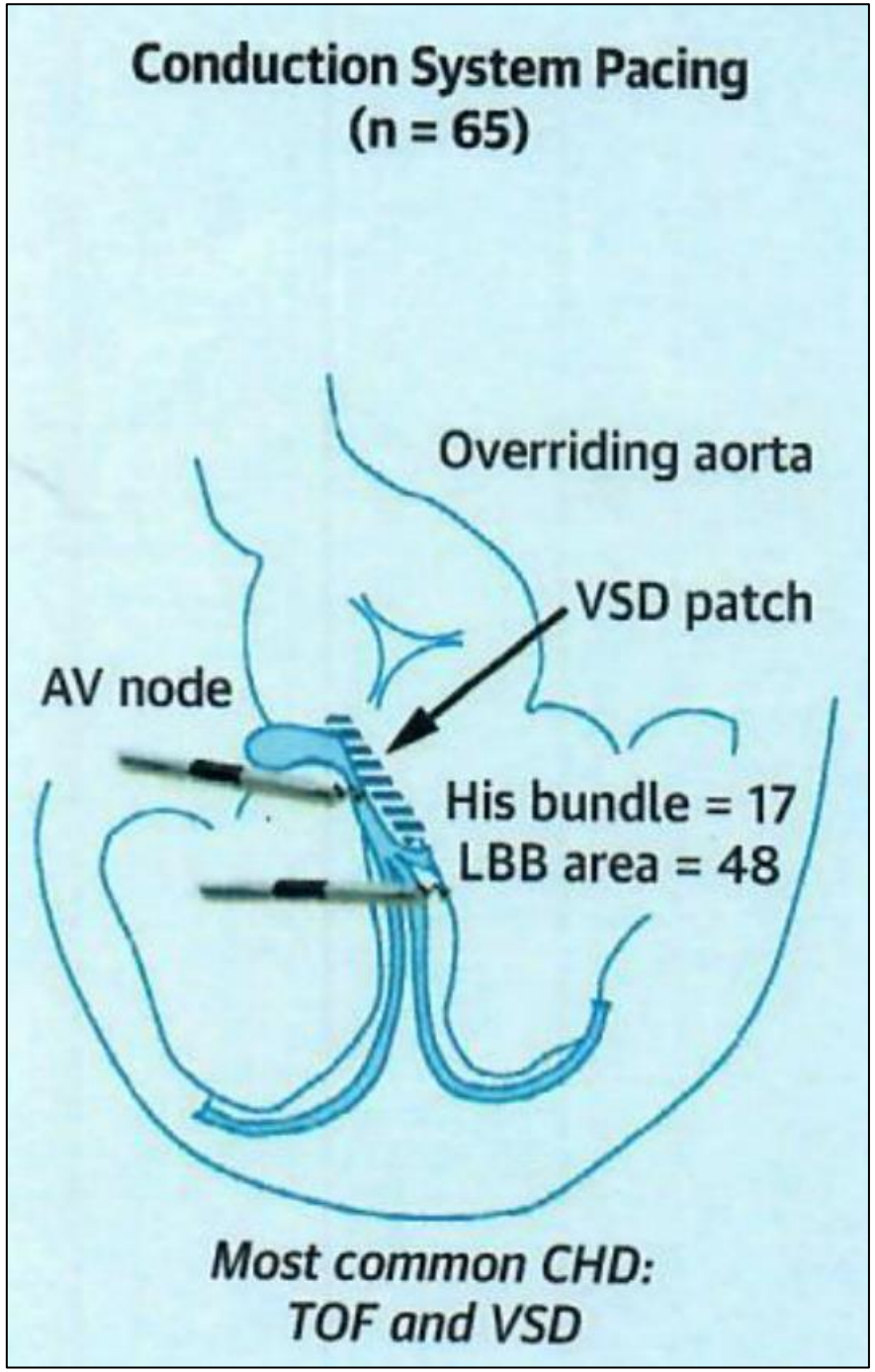
CIED - PHYSIOLOGICAL PACING

JACC: Clinical EP 2023

Conduction System Pacing Versus Conventional Cardiac Resynchronization Therapy in Congenital Heart Disease

Jeremy P. Moore, MD, MS,[a,b,c] Natasja M.S. de Groot, MD, PhD,[d] Matthew O'Connor, MD,[e] Daniel Cortez, MD, PhD,[f,g]





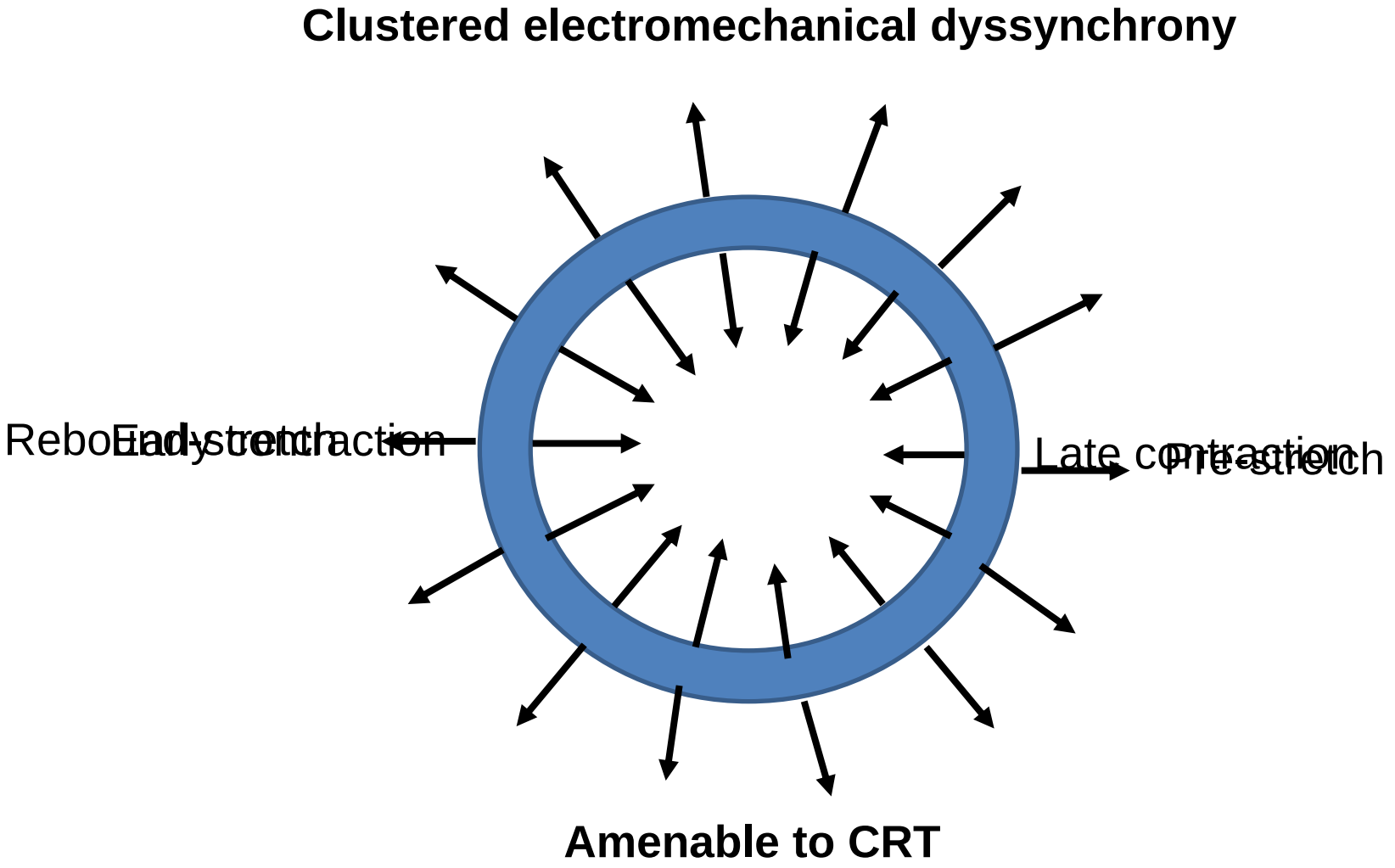
Kdy uvažovat o SRL?

Kdykoliv vidíte široké QRS u pacienta se srdečním selháním

- Srdeční frekvence
  - Kontraktilita
    - Předtížení
      - Dotížení

A

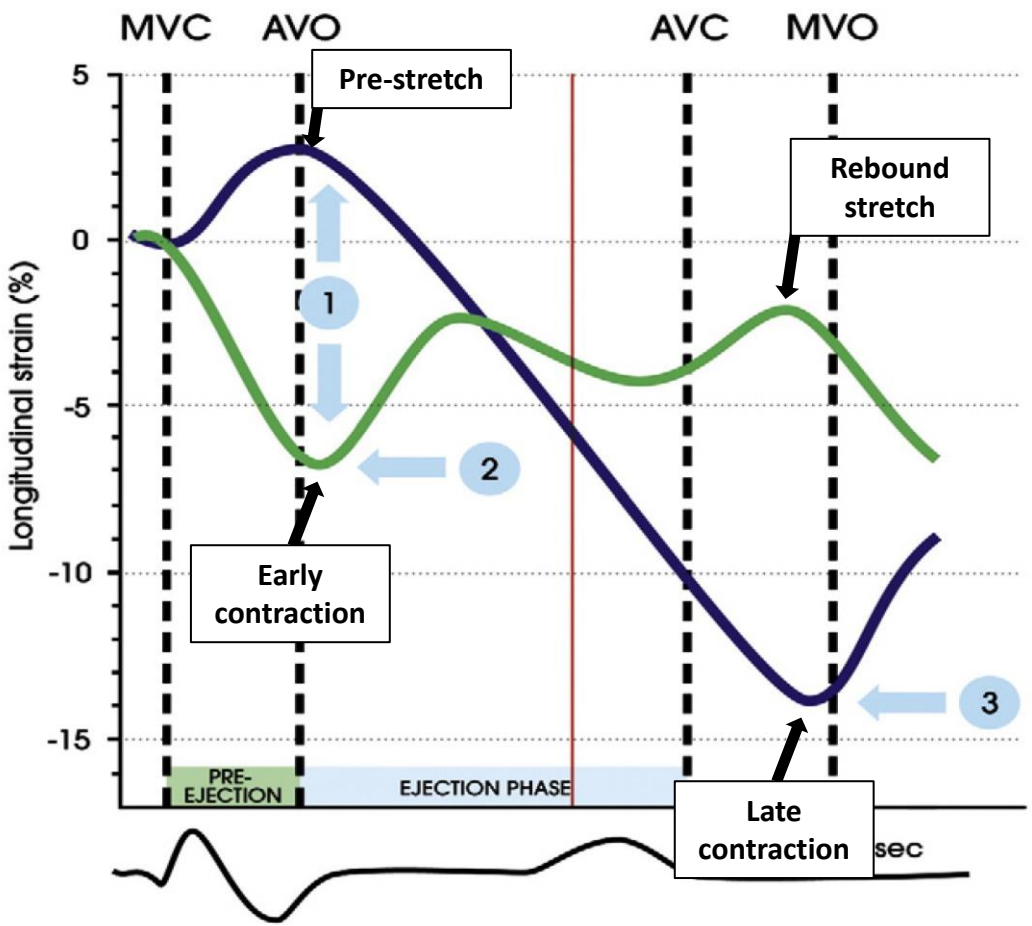
- **Synchronie!**



Helm RH et al.,Circulation 2005

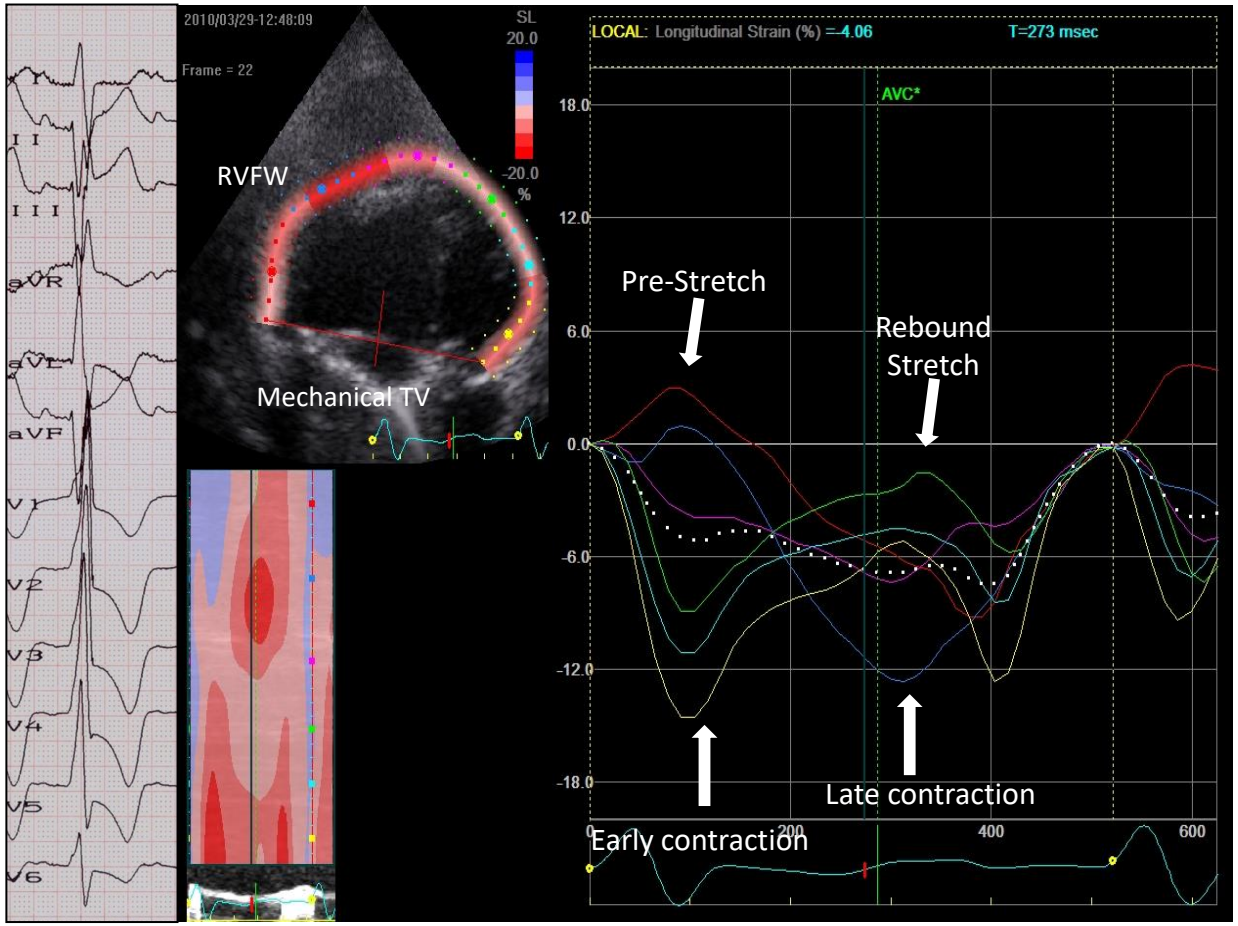
Jak vybrat správného kandidáta pro SRL?

Classic-pattern dyssynchrony



Risum N, Am Heart J 2012

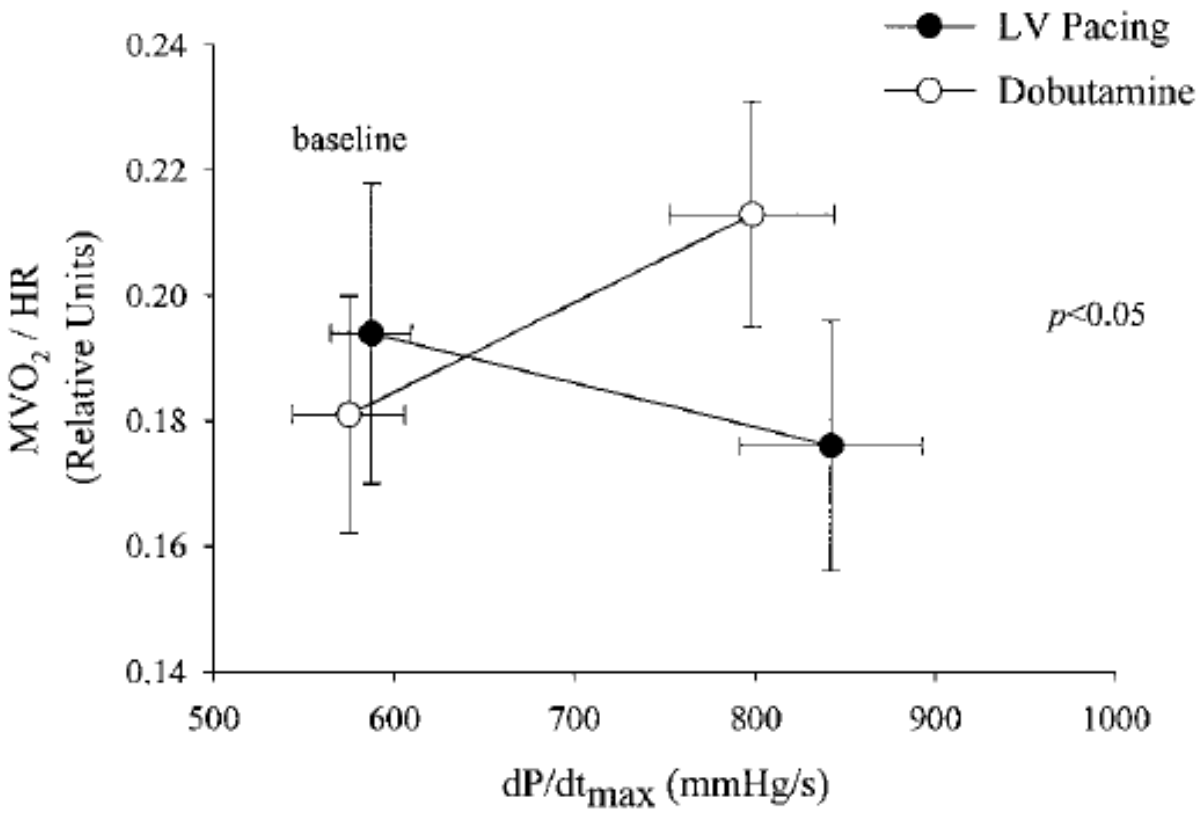
Speckle tracking: Single right ventricle, RBBB



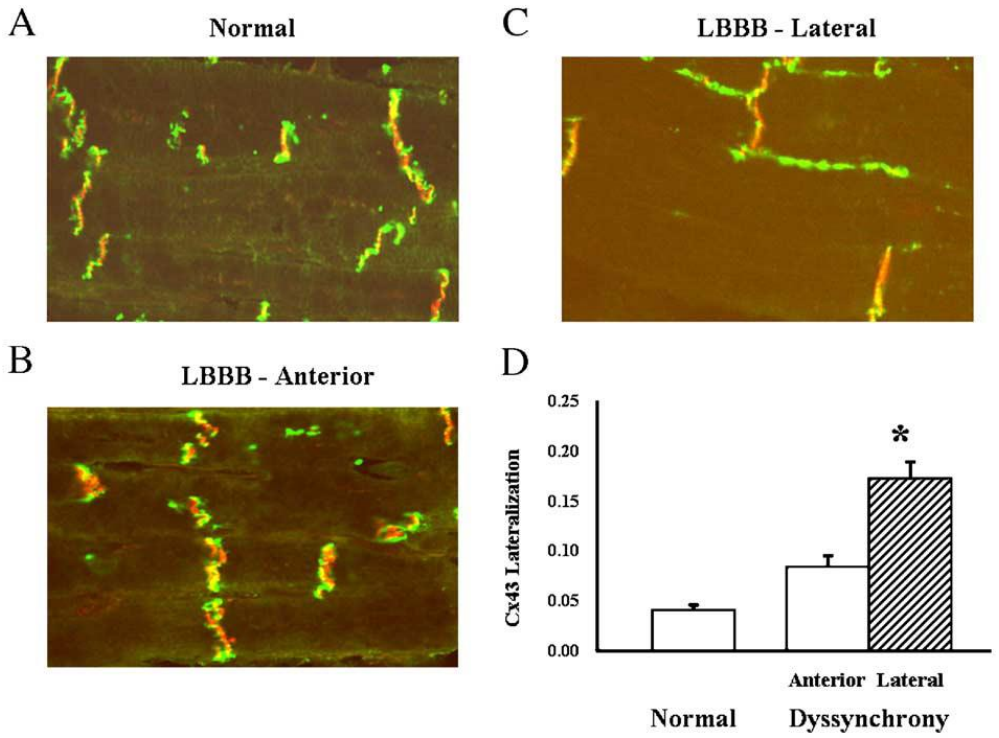
Materna O, HeartRhythm J 2014

Efekty SRL

Zlepšení srdeční funkce a snížení myokardiální spotřeby O_2



Reverzní buněčná remodelace



SRL obnovuje normální distribuci connexinu 43 a rychlost vedení v pozdě se kontrahujících segmentech

Nelson GS et al., Circulation 2000

Journal of the American College of Cardiology
© 2004 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 44, No. 9, 2004
ISSN 0735-1097/04/$30.00
doi:10.1016/j.jacc.2004.08.044

EXPRESS PUBLICATION

Cardiac Resynchronization Therapy: A Novel Adjunct to the Treatment and Prevention of Systemic Right Ventricular Failure

Jan Janoušek, MD,* Viktor Tomek, MD,* Václav Chaloupecký, MD, PHD,* Oleg Reich, MD, PHD,* Roman A. Gebauer, MD,* Josef Kautzner, MD, PHD,† Bohumil Hučín, MD, PHD*

N = 8 patients

D-TGA/Mustard or Senning

- N=4

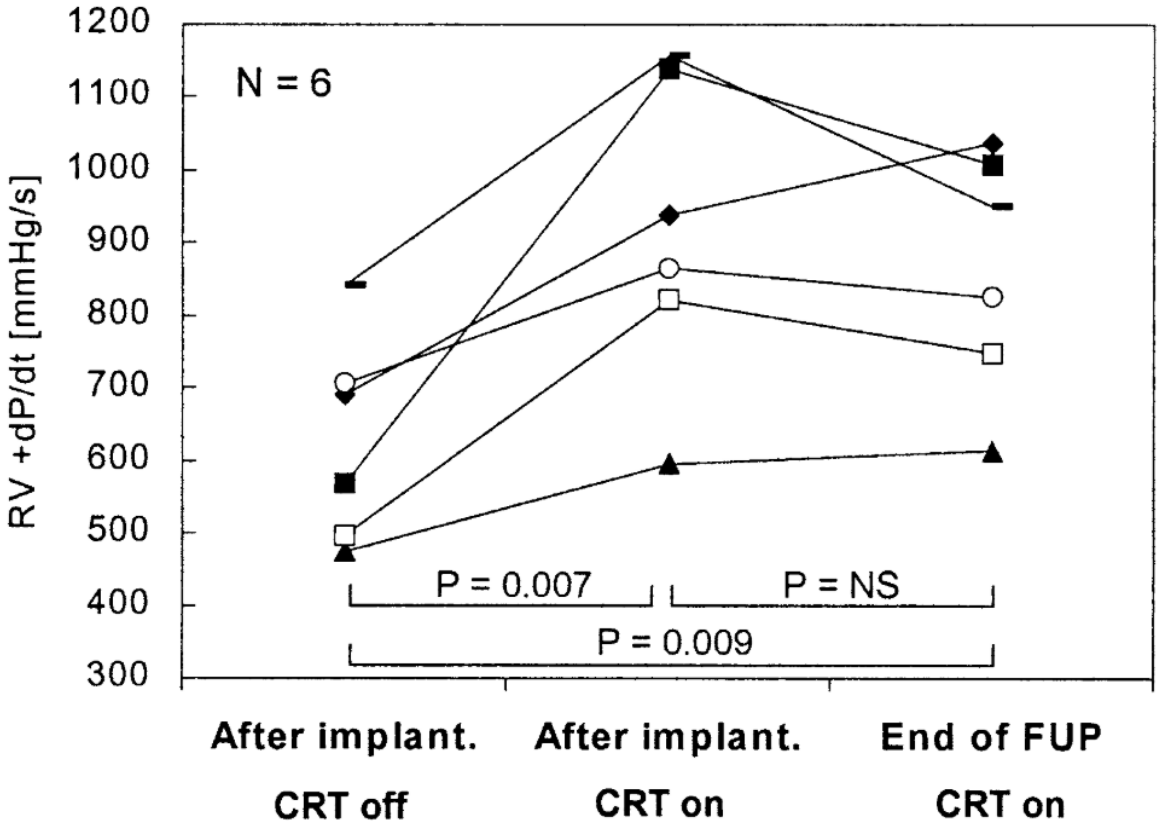
CCTGA

- N=3

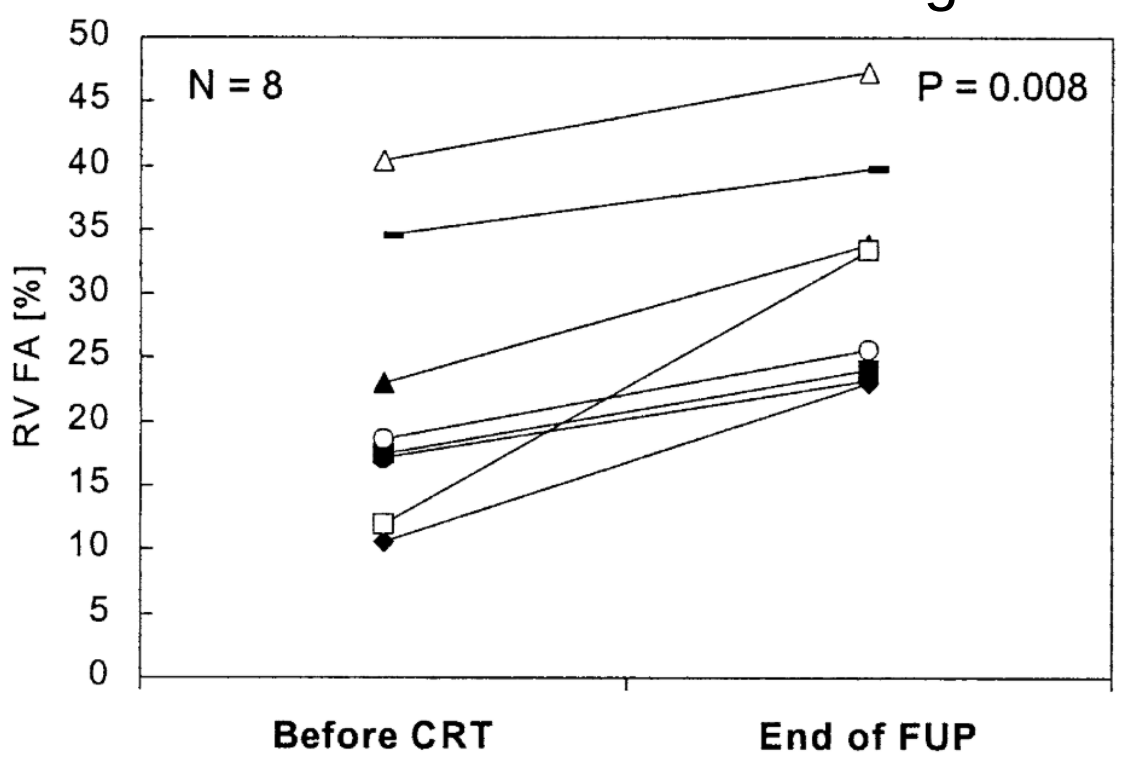
DORV, ventricular inversion

- N=1

RV +dP/dt



RV fractional area change



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 3. Studies That Reported Response to CRT in Patients With Systemic Right Ventricles

	Janousek et al,[37] 2004	Dubin et al,[44] 2005	Cecchin et al,[42] 2009	Janousek et al,[45] 2009	Jauvert et al,[41] 2009
Total patients with systemic RVs, n	8	17	9	27	7
Age (range), y	Median, 12.5 (6.9–29.2)	Median,12.7 (4.9-50)	Median,27 (0.5-43)	Median,28.8	Mean, 24.6 (15–50)
Follow-up duration (range), mo	Median, 17.4	Median, 4	Median, 8.4	Median, 7.3	Median, 19.4
CRT pacing method, n	7 BiV 1 multisite RV	BiV	BiV	26 BiV 1 single-site RV	BiV
Pre-CRT QRSd, ms	161±21	…	Median, 165	Median, 160	160±31
Pre-CRT sysV EF, %	…	…	Median, 28	28.8±10	…
Pre-CRT NYHA FC	Mean, 2	…	…	Median, 2	Mean, 3
Outcomes after CRT					
Change in QRSd, ms	↓ 45 (mean)	↓ 38.2±29.4 (mean±SD)	↓ 15 (median)	↓ 21 (median)	120±28 (mean±SD)
Change in sysV EF units	↑ 4 (mean)	↑ 13.3±11.3 (mean±SD)	↑ 14 (median)	↑ 7.2±9.9 (mean±SD)	…
NYHA improvement	Mean, ↓ 0.7 FC	…	…	Median, ↓ 1 FC	Mean, ↓ 1.4 FC
Clinical improvement, n (%)	8/8 (100)	13/17 (76.5)	2/8 (25)	19 (86.4)	7 (100)
Nonresponders (%N)	…	4/17 (23.5)	6/8 (75)	3/22 (13.6)	…

BiV indicates biventricular; CRT, cardiac resynchronization therapy; EF, ejection fraction; FC, functional class; NYHA, New York Heart Association; QRSd, QRS duration; RV, right ventricle; and sysV, systemic ventricle.

Zlepší SRL funkci komory pokud je provedeno současně s náhradou trikuspidální chlopně u TGA/Senning nebo CCTGA?

Patient data	All (n = 109)	CHD (CRT + concurrent cardiac surgery) (n = 16)
Age at CRT (years), median	16.9	13.9
Follow-up on CRT (months), median	7.5	4.0
Initial QRS (ms), median	160	160
Initial SVEDD (z score), median	3.3	2.6
Initial EF/FAC (%), median	27.0	24.5
Initial SAVV regurgitation (grade), median	1	0
Initial NYHA class (median)	2.5	2.0
Change in QRS (ms), median	−40§	−46§
Change in SVEDD (z score), median	−1.1§	−0.8
Change in EF/FAC (%), mean (SD)	+11.5 (14.3)§	+12.3 (17.1)¶
Change in SAVV regurgitation (grade), median	−1§	0
Change in NYHA class (median)	−1.0§	−1.0†
Non-responders	15/94	0/13

7/16 systemic AV valve replacement

All survived

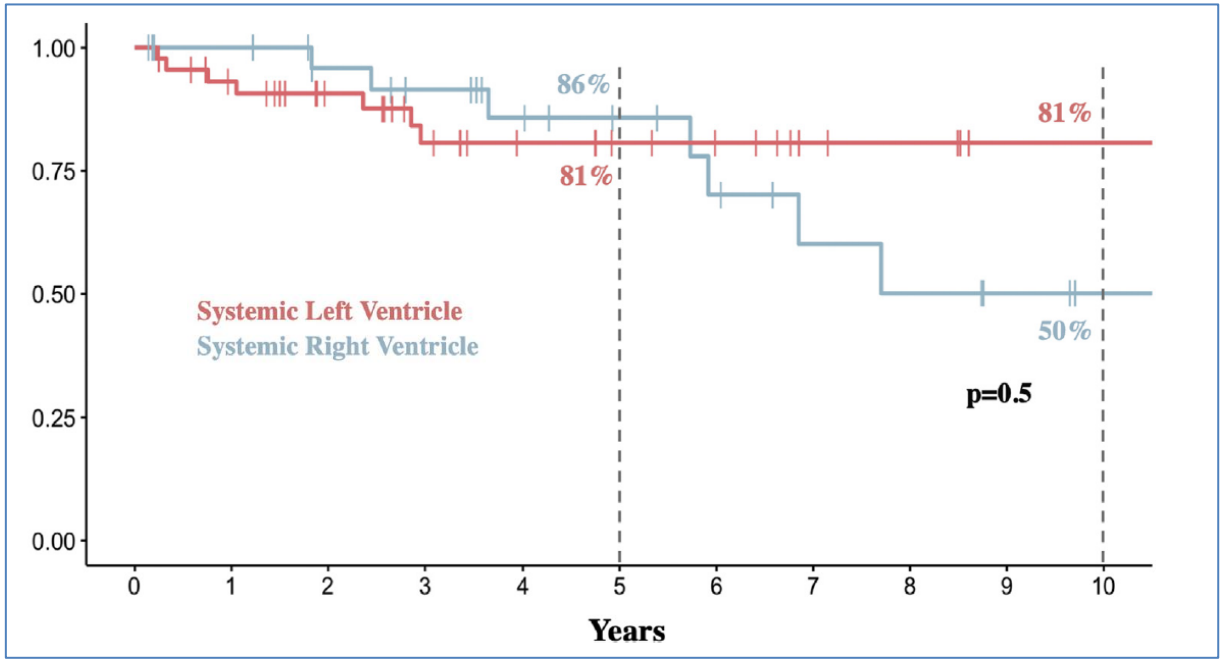
Janousek J et al. Heart 2009

Cardiac resynchronization therapy in patients with congenital heart disease and systemic right ventricle

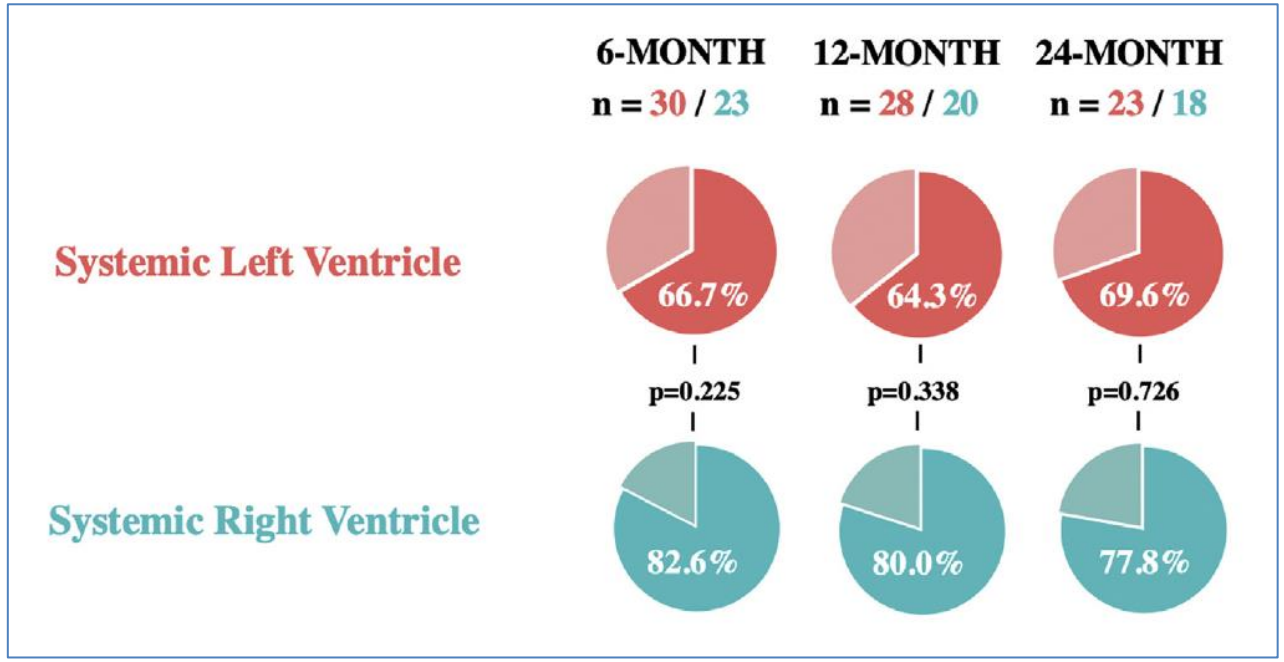
- N = 85 s VSV, většinou dospělí
- Systémová PK = 36,5 %

Response to CRT was defined as an increase in systemic ventricular ejection fraction of ≥10% and/or an improvement in New York Heart Association functional class by at least 1 grade.

Celková úmrtnost a transplantace srdce

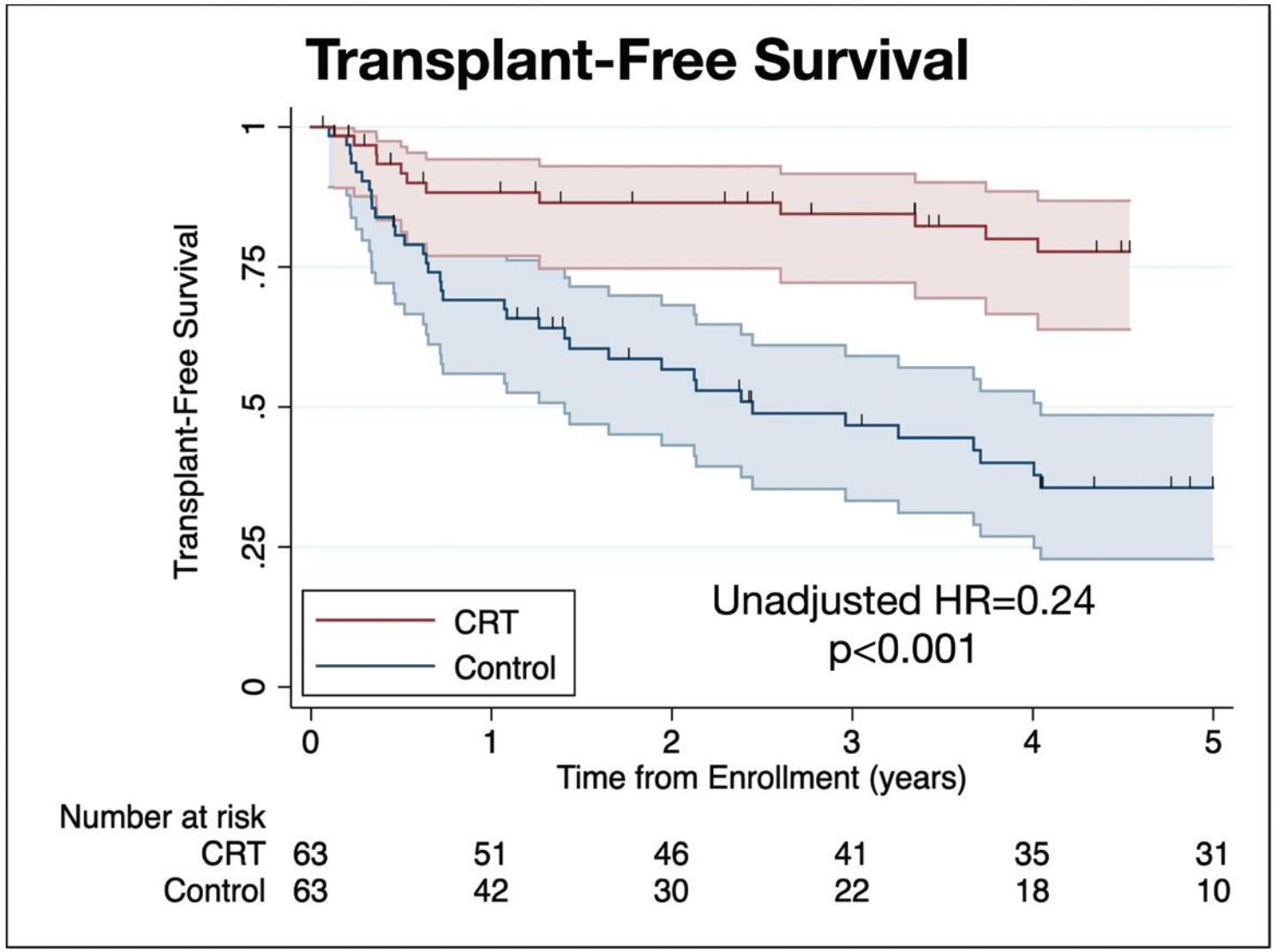


Podíl respondérů SRL



Jacquemart et al. Heart Rhythm 2022

Jaký je vliv SRL na přežití?

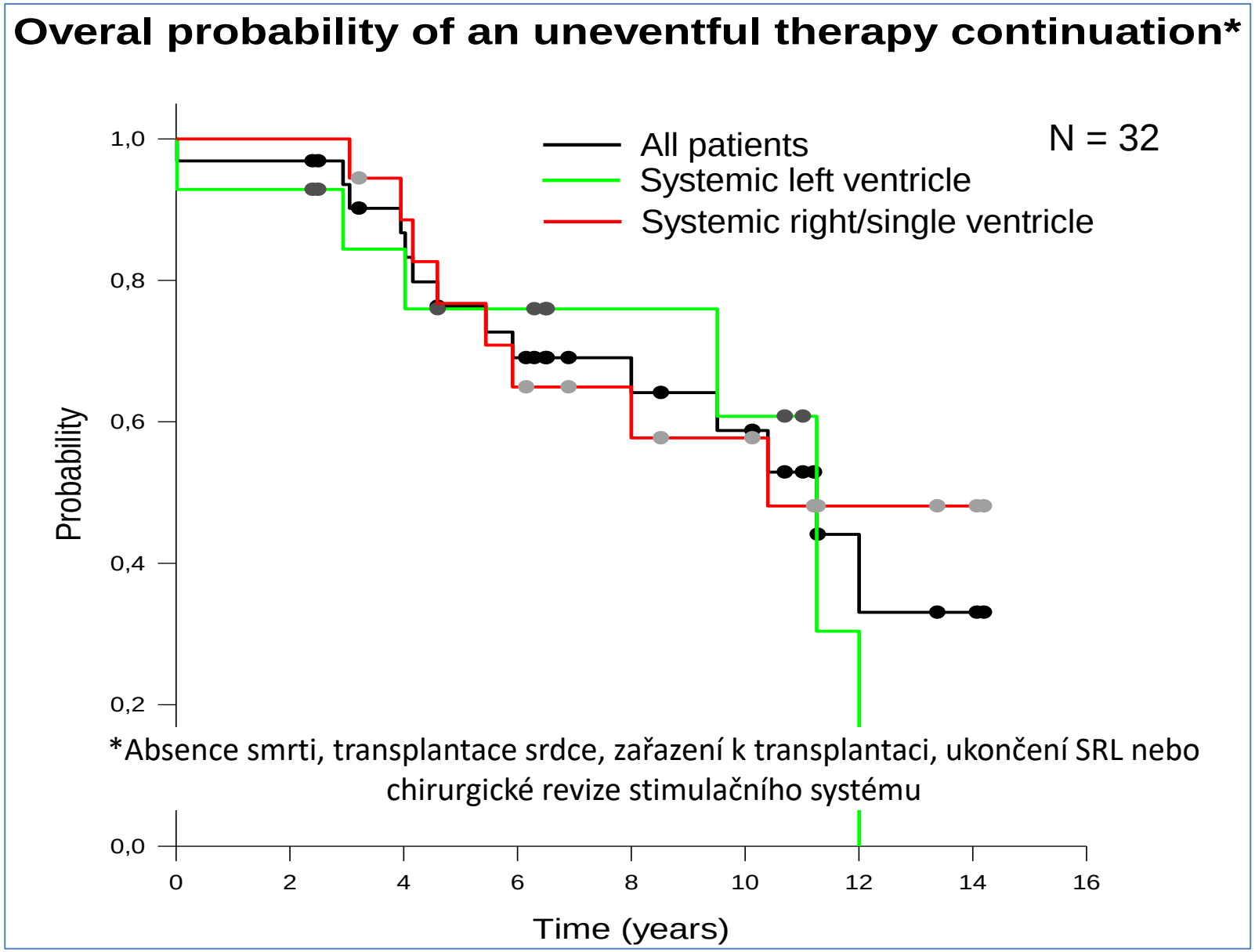


- 63 pacientů
  - věk 11 (3–25) let
- 63 propensity score matched kontrol
  - věk 13 (3–25) let

Impact of Cardiac Resynchronization Therapy on Heart Transplant–Free Survival in Pediatric and Congenital Heart Disease Patients

Chubb H et al. Circulation AE 2020

Pravděpodobnost absence komplikací SRL u VSV

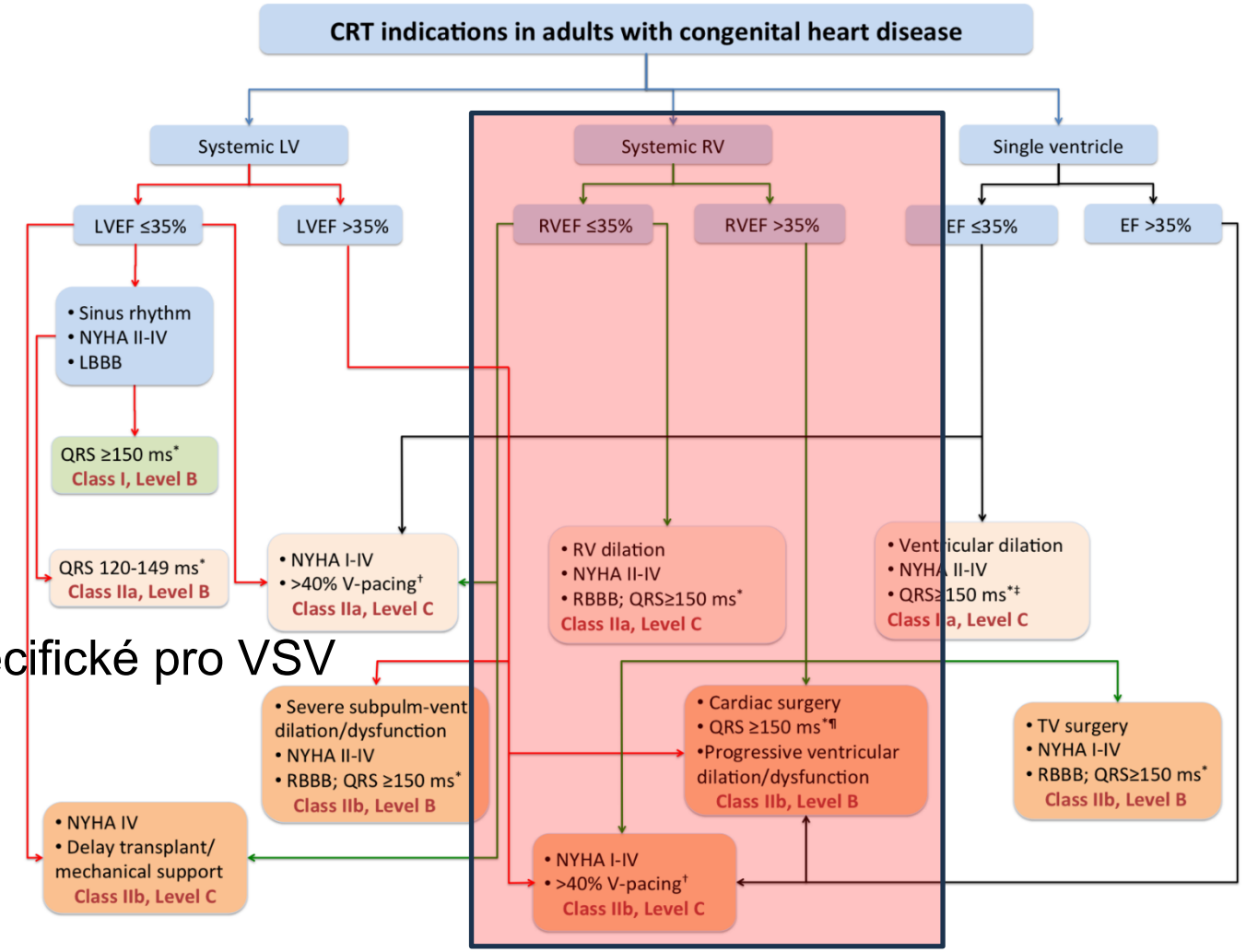


(P. Kubuš et al., JAHA 2021)

Jaké jsou indikace SRL u VSV?

- Selhání systémové LK
  - LBBB
  - Stimulace PK
- Selhání systémové PK
  - RBBB
  - Stimulace LK
- Selhání společné komory
  - Raménkové blokáda
  - Konvenční stimulace
- Selhání subpulm.komory?
  - RBBB

Specifické pro VSV



Khairy P et al. PACES/HRS Expert Consensus Statement on the Recognition and Management of Arrhythmias in Adult Congenital Heart Disease. HeartRhythm Journal 2014

Souhrn

- Prosynchronizace při nutnosti stimulace systémové PK!
- Resynchronizace v případě dyssynchronní složky selhání systémové PK!
  - Echocardiografie je schopna identifikovat typ dyssynchronie korigovatelný SRL
  - SRL zlepšuje fukci systémové PK a kontrakční efektivitu
  - [redacted]
- St[redacted]přístupy
  - [redacted]
  - Využití oken příležitosti (jiná srdeční chirurgie)
  - Max. využití existujících stimulačních elektrod
  - Rizika stimulace
    - Infekce, žilní trombóza, stenóza žilních kanálů u Senninga/Mustarda atd.
- Stimulace převodního systému – budoucí alternativa k prosynchronizaci/resynchronizaci systémové PK

Každý kardiostimulační výkon musí být indikován v multidisciplinárním týmu

Děkuji za pozornost

Zůstaňte synchronizováni☺