Stimulací indukovaná kardiomyopatie

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Dětské kardiocentrum 2. LF UK v Praze a
FN v Motole, Praha

Komponenty srdečního výdeje

- Srdeční frekvence
- Kontraktilita
- Preload
- Afterload

A

- Synchronie!

Patofyziologie dyssynchronie

Dyssynchronie

⇩

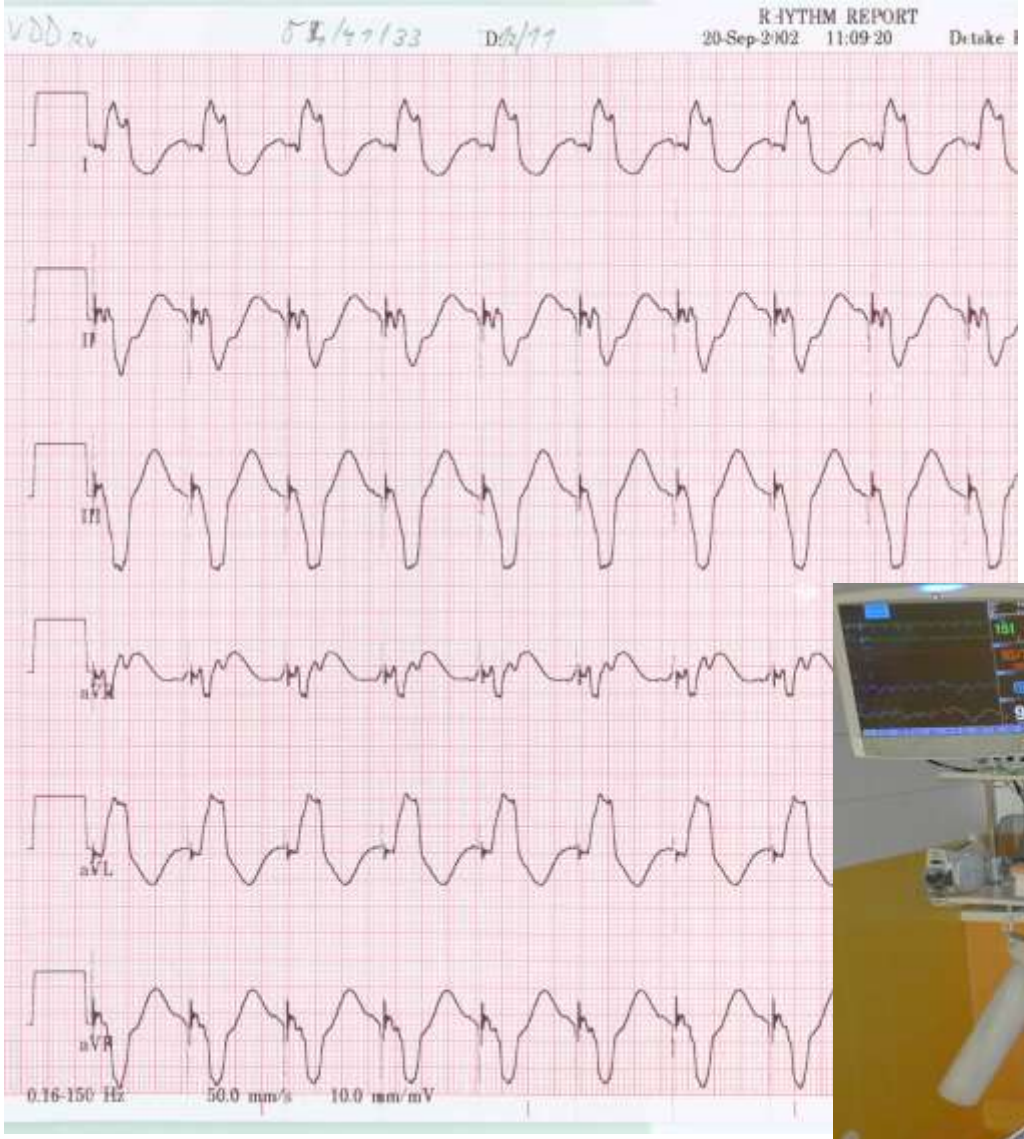
Regionální heterogenita funkce a plnění

⇩

Strukturální a buněčná remodelace

⇩

Dyssynchronnní kardiomyopatie


RHYTHM REPORT
20-Sep-2002 11:09:20
I
II
III
aVR
aVL
aVF
0.16-150 Hz
50.0 mm/s
10.0 mm/mV

Heart Fail Rev (2011)| 16:305–314
DOI 10.1007/s10741-010-9207-1

Chronic ventricular pacing in children: toward prevention of pacing-induced heart disease

Irene E. van Geldorp · Ward Y. Vanagt · Frits W. Prinzen · Tammo Delhaas

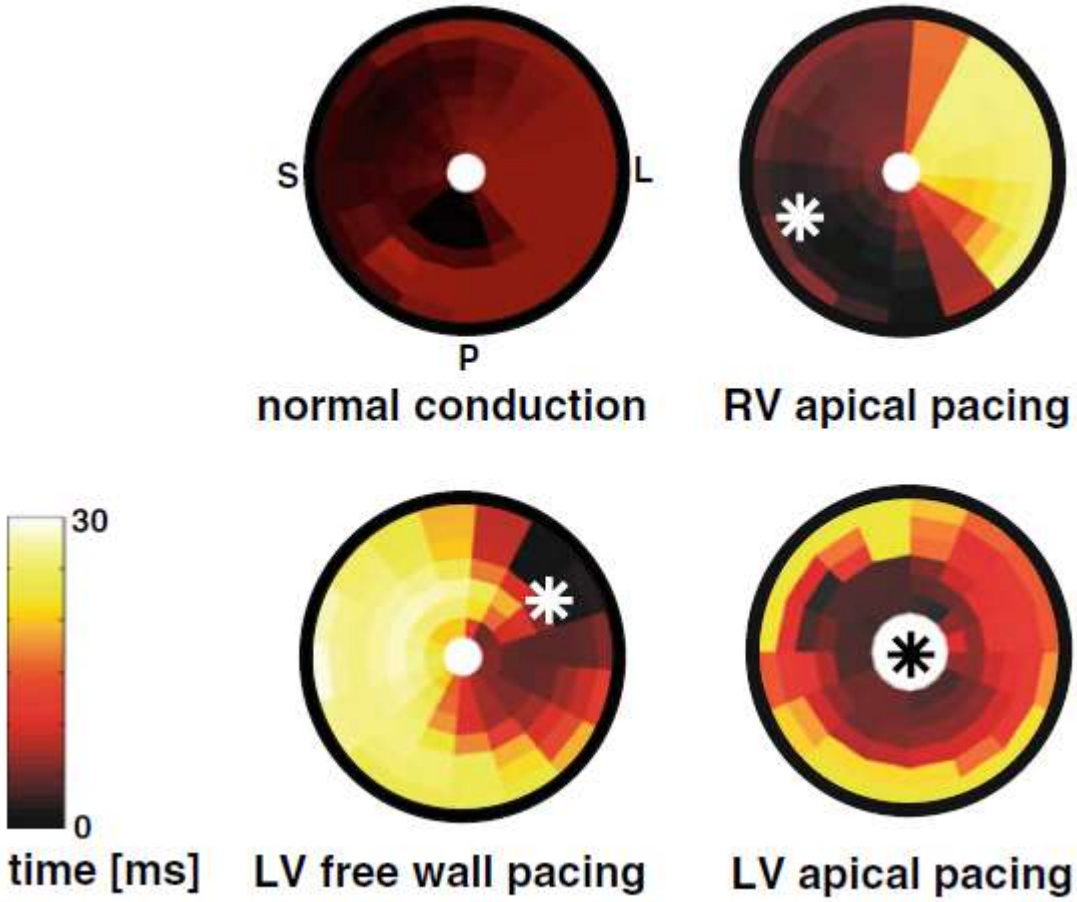
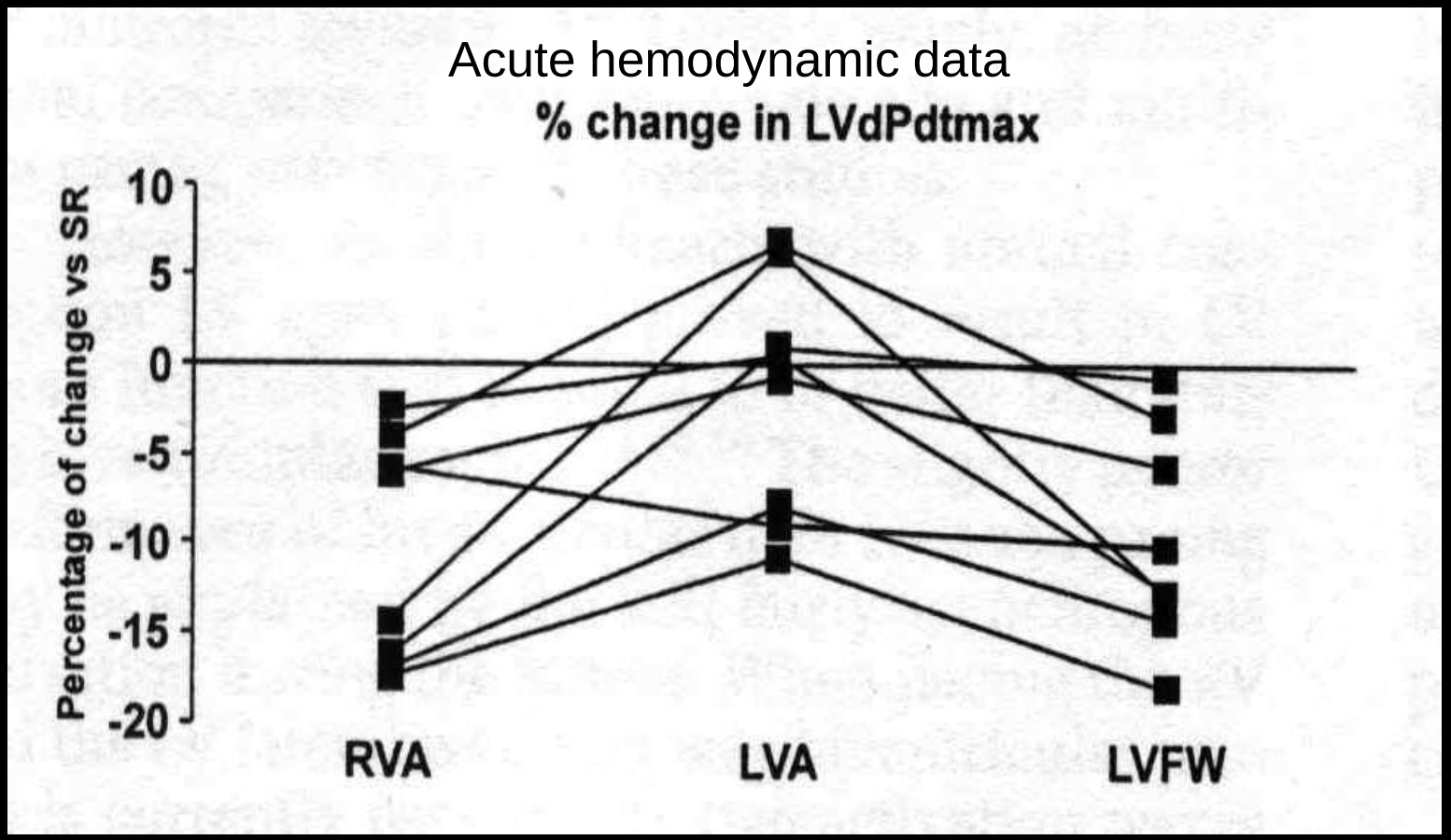


Fig. 1 Left ventricular endocardial activation in canine hearts.

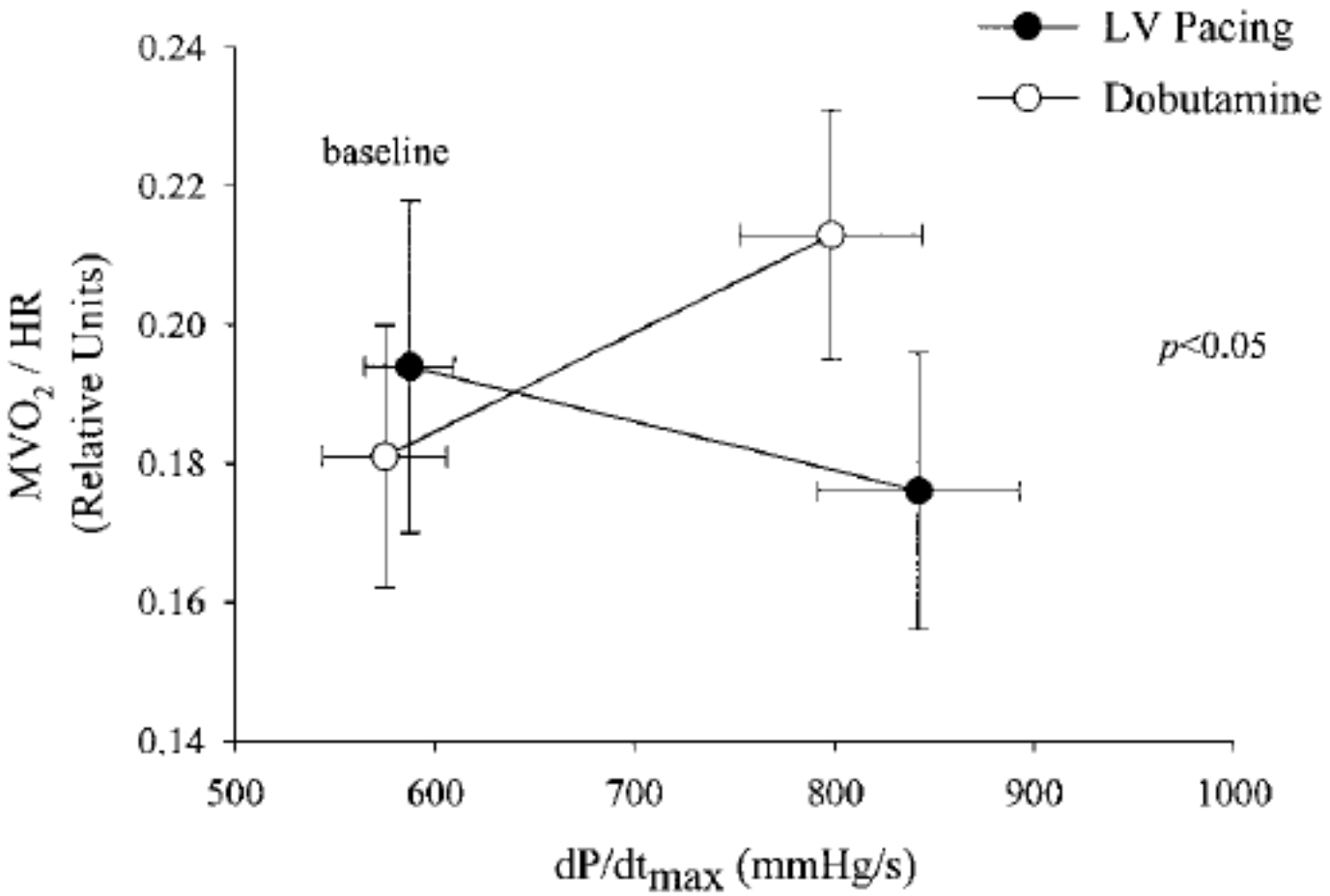
První studie na stimulaci levé komory u dětí



Vanagt WY et al. PACE 2004 and Ann Thorac Surg 2005

Konvenční stimulace pravé komory

CRT – lepší výkon při menší spotřebě



Nelson GS et al., Circulation 2000

Dilated Cardiomyopathy Associated with Dual-Chamber Pacing in Infants: Improvement Through Either Left Ventricular Cardiac Resynchronization or Programming the Pacemaker Off Allowing Intrinsic Normal Conduction

JAN JANOUŠEK, M.D., VIKTOR TOMEK, M.D., VÁCLAV CHALOUPECKÝ, M.D., PH.D., and ROMAN ANTONÍN GEBAUER, M.D.

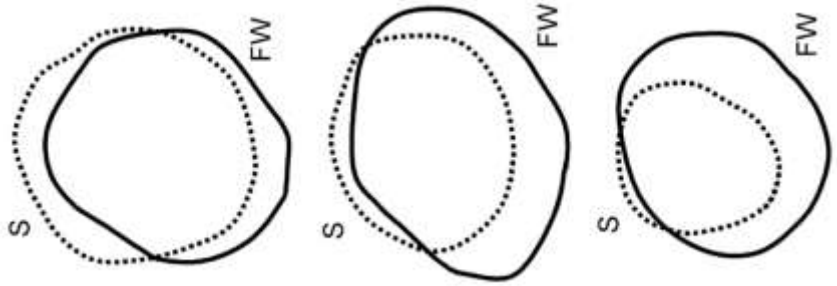
From Kardiocentrum, University Hospital Motol, Prague, Czech Republic

(J Cardiovasc Electrophysiol, Vol. 15, pp. 470-474, April 2004)

Left Ventricular Function and Reverse Remodeling

	LVEDD		LVESD					
	mm	% Normal	mm	% Normal	LVEDV (mL)	LVESV (mL)	SF %	EF %
Case 1								
At admission	57.1	182	52.5	260	110†	105	8	22
After 2 weeks of conventional heart failure therapy	58.2	186	52.1	258	98†	96	10	28
After 4 weeks of cardiac resynchronization therapy*	52.6	168	42.2	209	77†	57	20	48
Case 2								
At admission	49.0	184	43.2	253	53‡	47	12	32
After 4 weeks of pacemaker off*	34.8	131	21.6	126	37‡	20	38	76

End-diastolic and end-systolic LV contours



CRT off CRT on 1 month of CRT

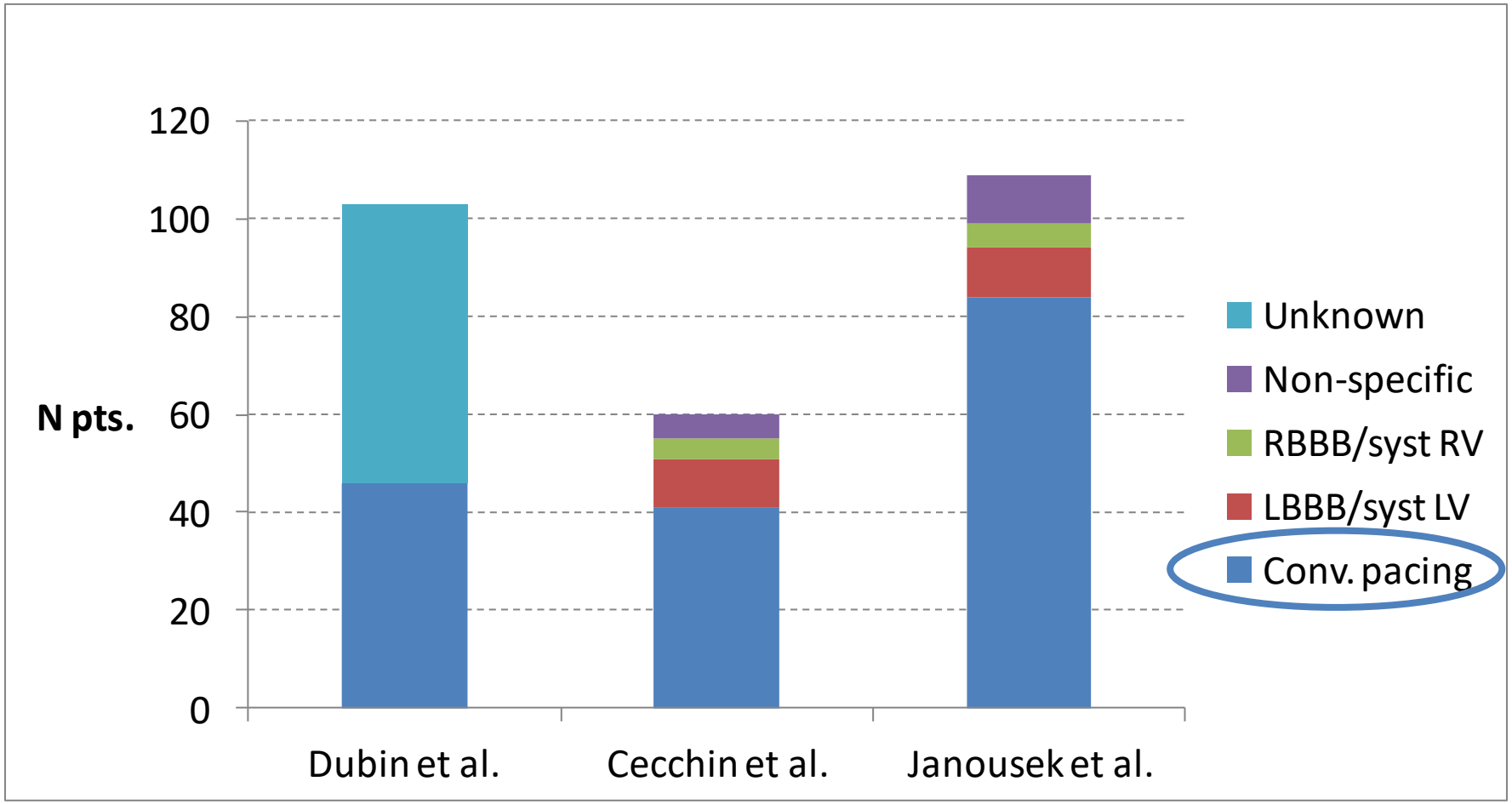
Je nutné zvažovat specifické stimulační místo?

- Incidence dysfunkce levé komory asociované se stimulací PK u dětí
  - » 6 - 13.4 %[1-3]
- Patologická remodelace LK [4]

	Long-Term RV Pacing	Controls
Cardiac output, L/min	3.8±0.6*	4.9±0.8
Mean LV EDD, mm	55±7*	46±6
Pathological LV EDD, %	52†	0
Septal/posterior wall delay, ms	84±26†	18±9
Exercise, W	123±24†	185±39

[1]*Kim JJ et al. J Cardiovasc Electrophysiol 2007;18:373-7*
[2]*Moak JP et al. Cardiovasc Electrophysiol 2006;17:1068-71*
[3]*Gebauer RA et al. Eur Heart J 2009; 30:1097-104*
[4]*Thambo JB et al. Circulation 2004; 110:3766-72*

Typy elektrické dyssynchronie u dětí a pac. s VSV



Dubin AM et al. J Am Coll Cardiol 2005;46:2277-83

Cecchin F et al. JCE 2009;20:58-65

Janousek J et al. Heart 2009, 95:1165-71

CRT u selhávající systémové LK

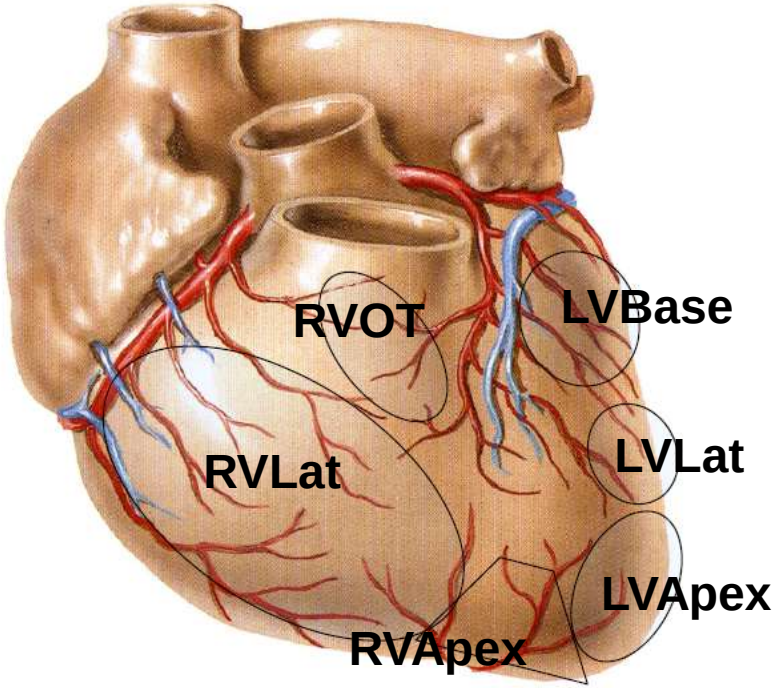
Change after CRT	EF/FAC units mean (SD)	SVEDD z-score median	NYHA median
Upgrade from RV pacing, systemic LV (N=44)	+14.0 (16.5)	-2.1	Grade 3 → 1
All other pts (N=54)	+7.7 (10.9)	-0.8	Grade 2 → 2
P	=0.101	=0.036	=0.030

Janousek J et al. Heart 2009;95:1165-71

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION
American Heart Association
Janoušek J. e al. 2013;127:613-623

Permanent Cardiac Pacing in Children - Choosing the Optimal Pacing Site: A Multi-Center Study

- Cross-sectional study (N=178, 21 centers)
  - CAVB, structurally normal heart
  - initially normal LV function
  - Pacing sites
    - RVOT = 8, RVLat = 44, RVApex = 61, RVSeptum = 29
    - LVApex = 12, LVLat = 17, LVBase = 7



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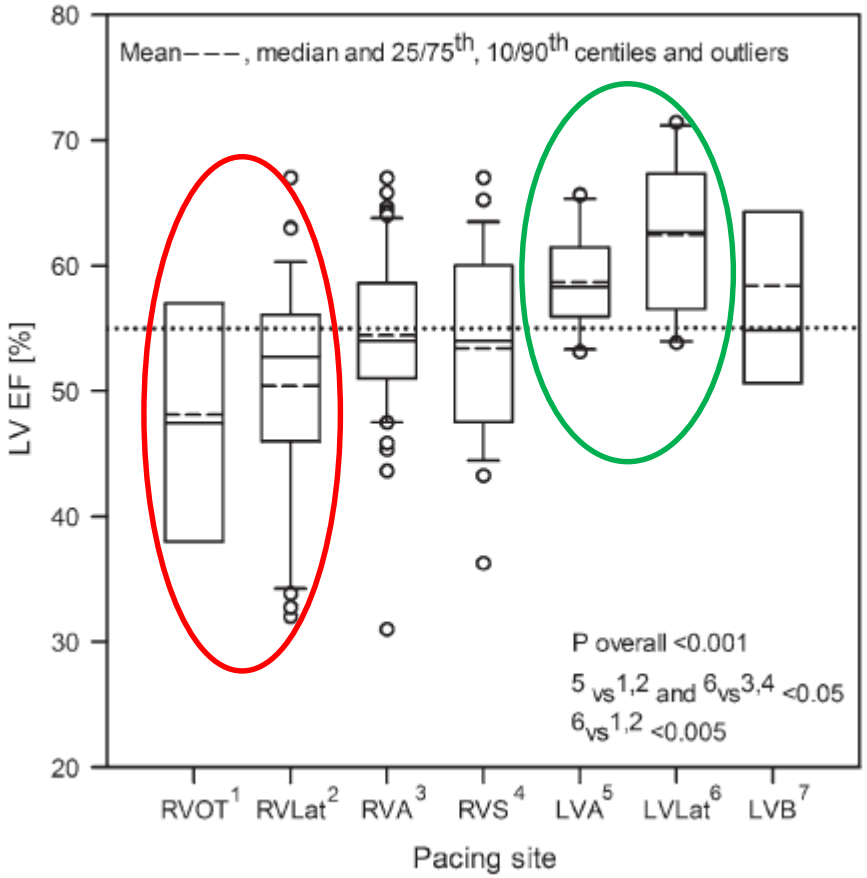
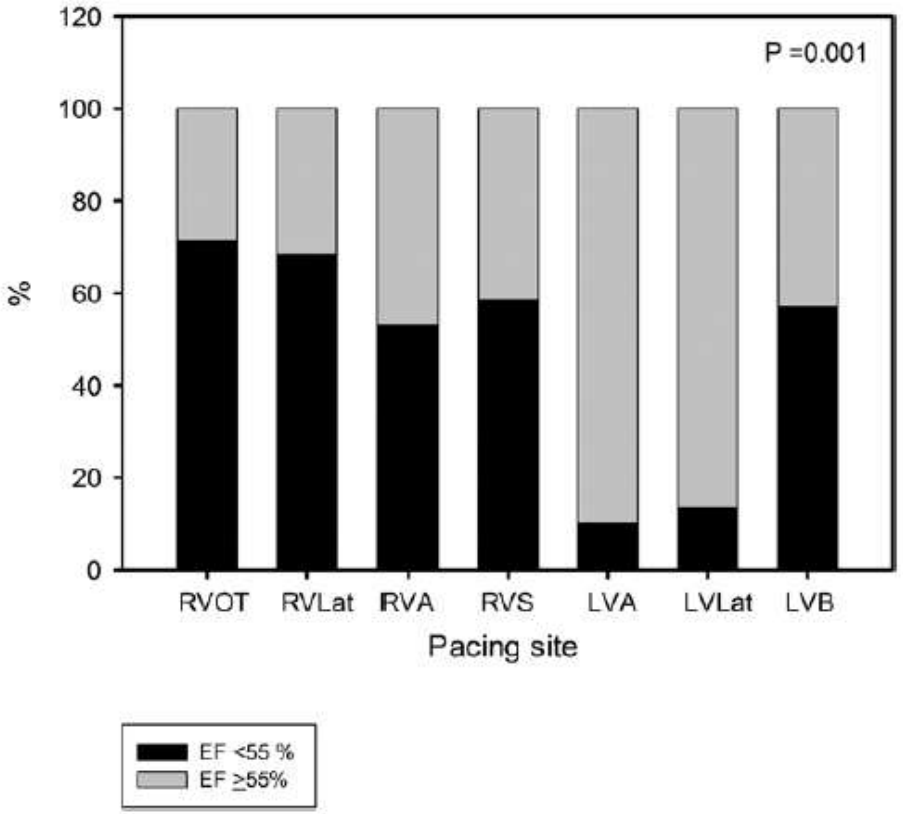
LV ejection fraction at follow-up



Proportion of pts with LVEF<55 %



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Janoušek J. e al. 2013;127:613-623

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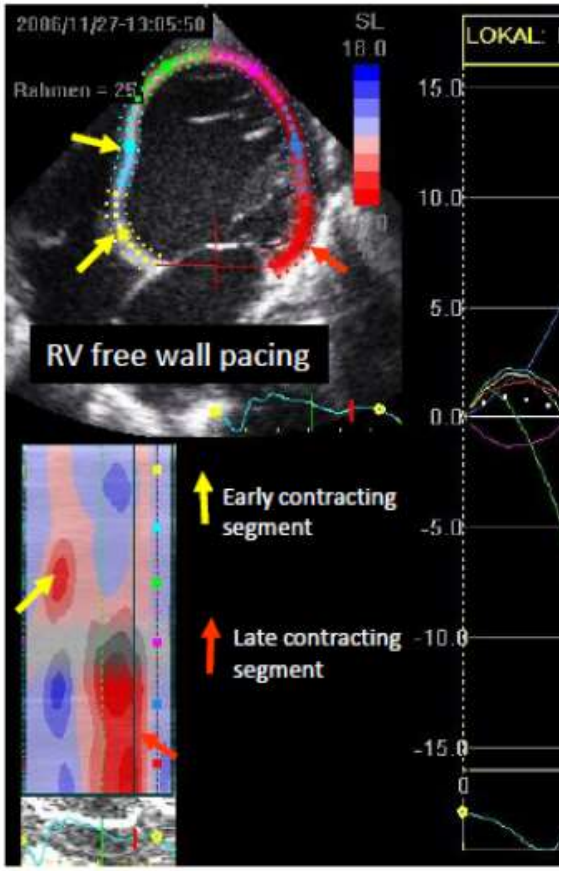
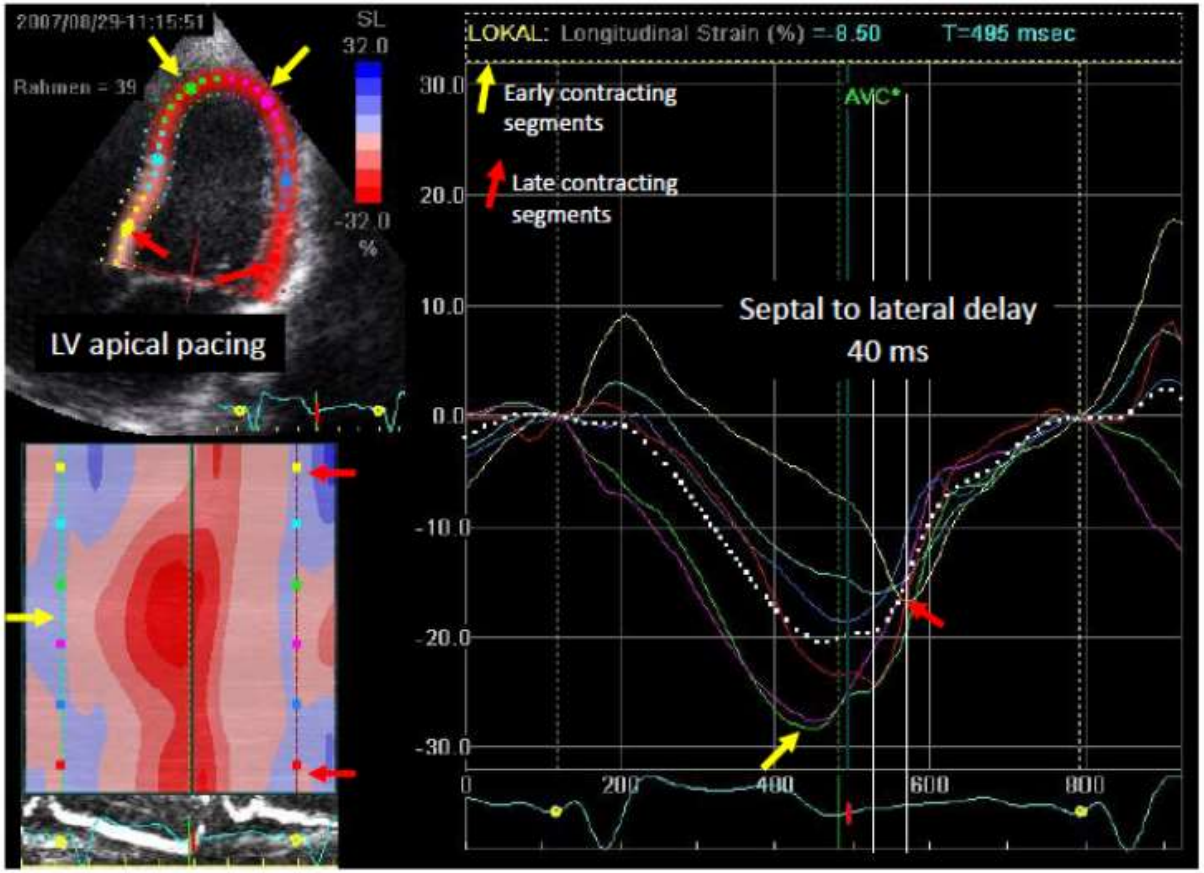
RV free wall pacing

LV apical pacing





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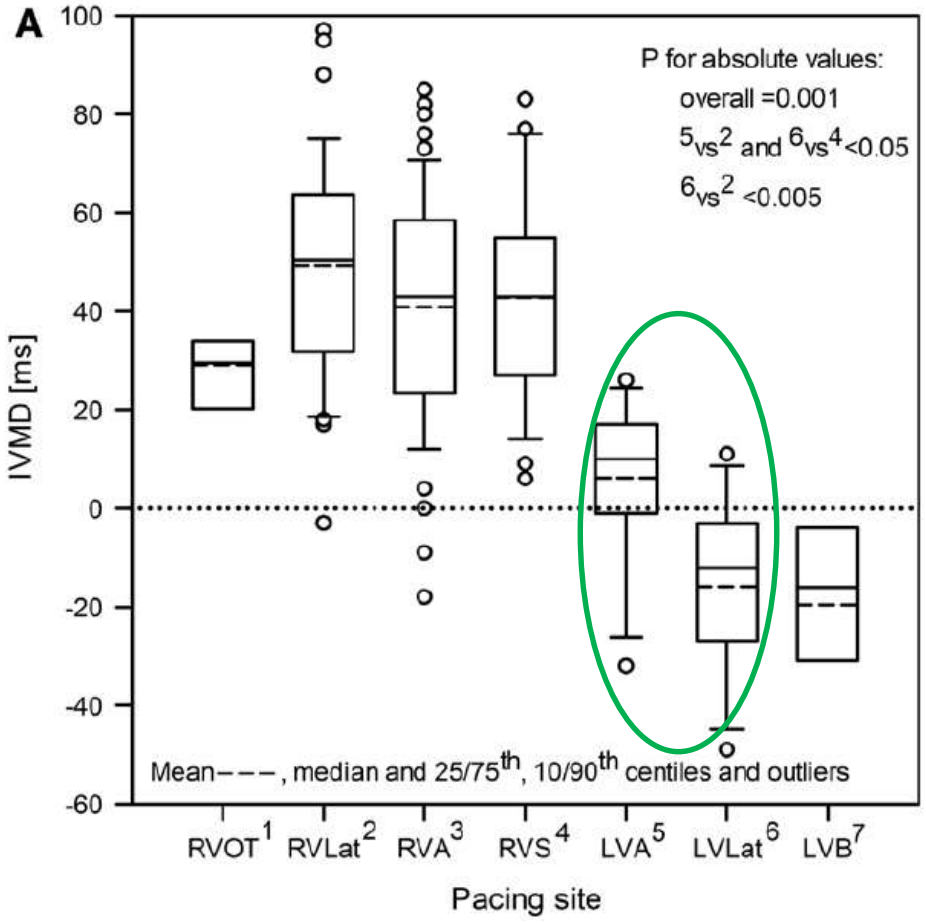
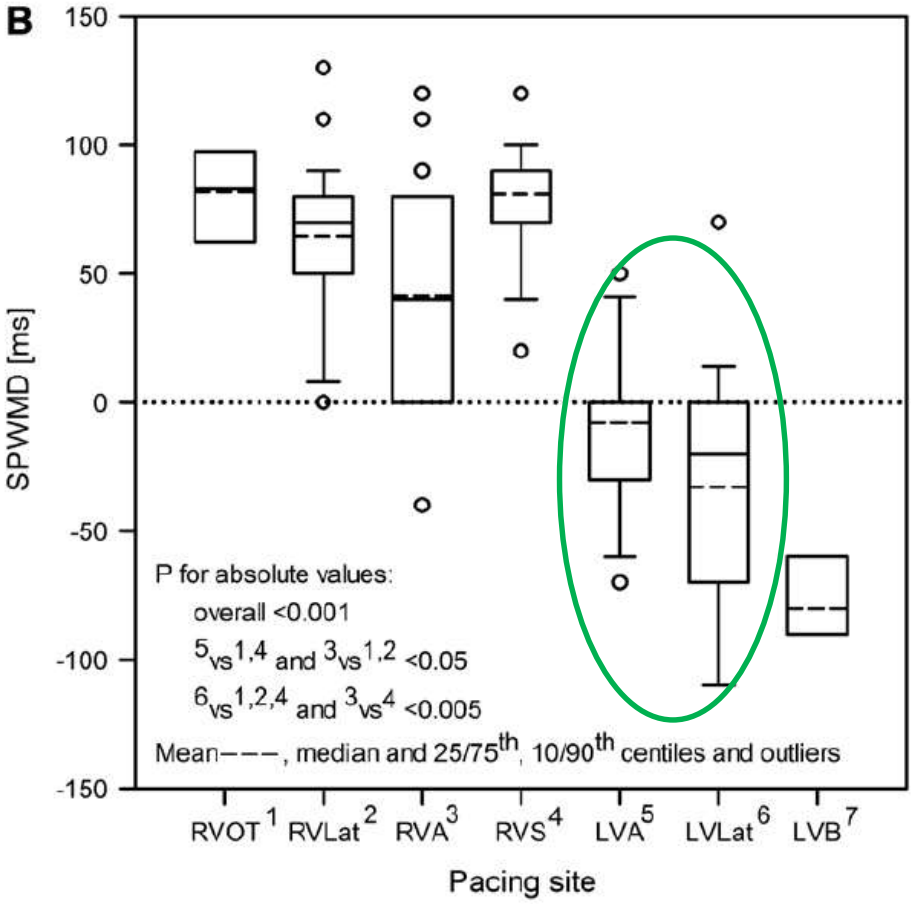
Inter-ventricular mechanical delay



Septal-posterior wall motion delay



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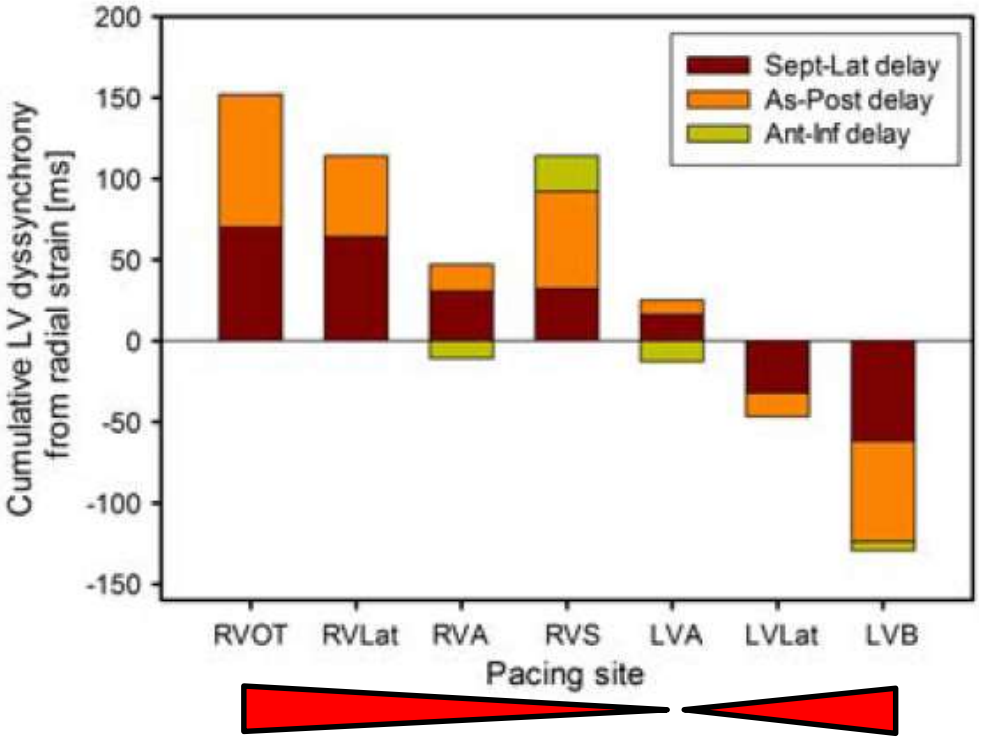
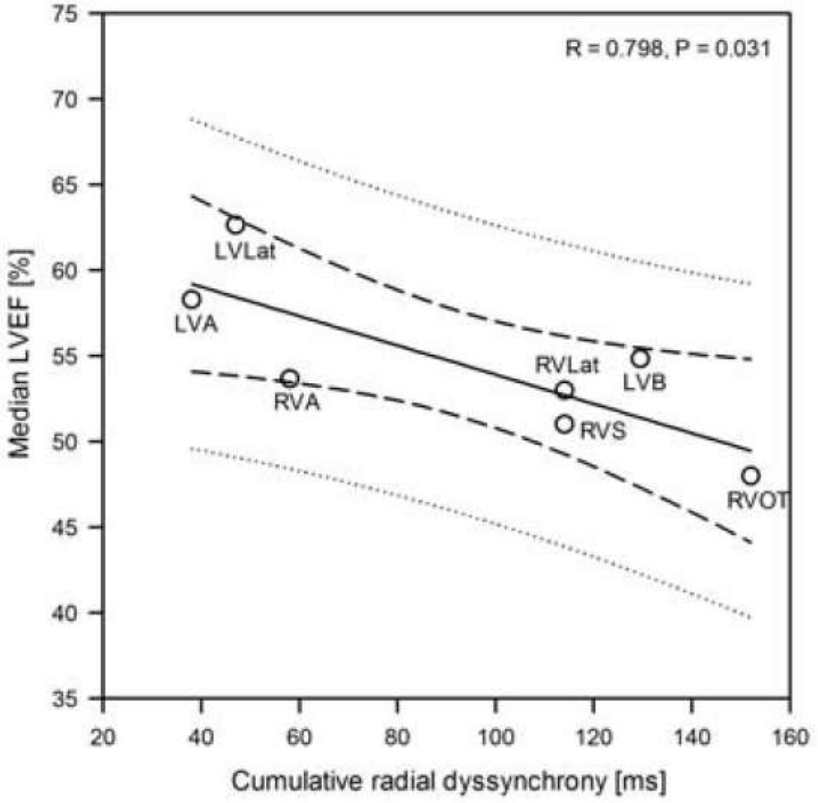
Permanent Cardiac Pacing in Children - Choosing the Optimal Pacing Site: A Multi-Center Study

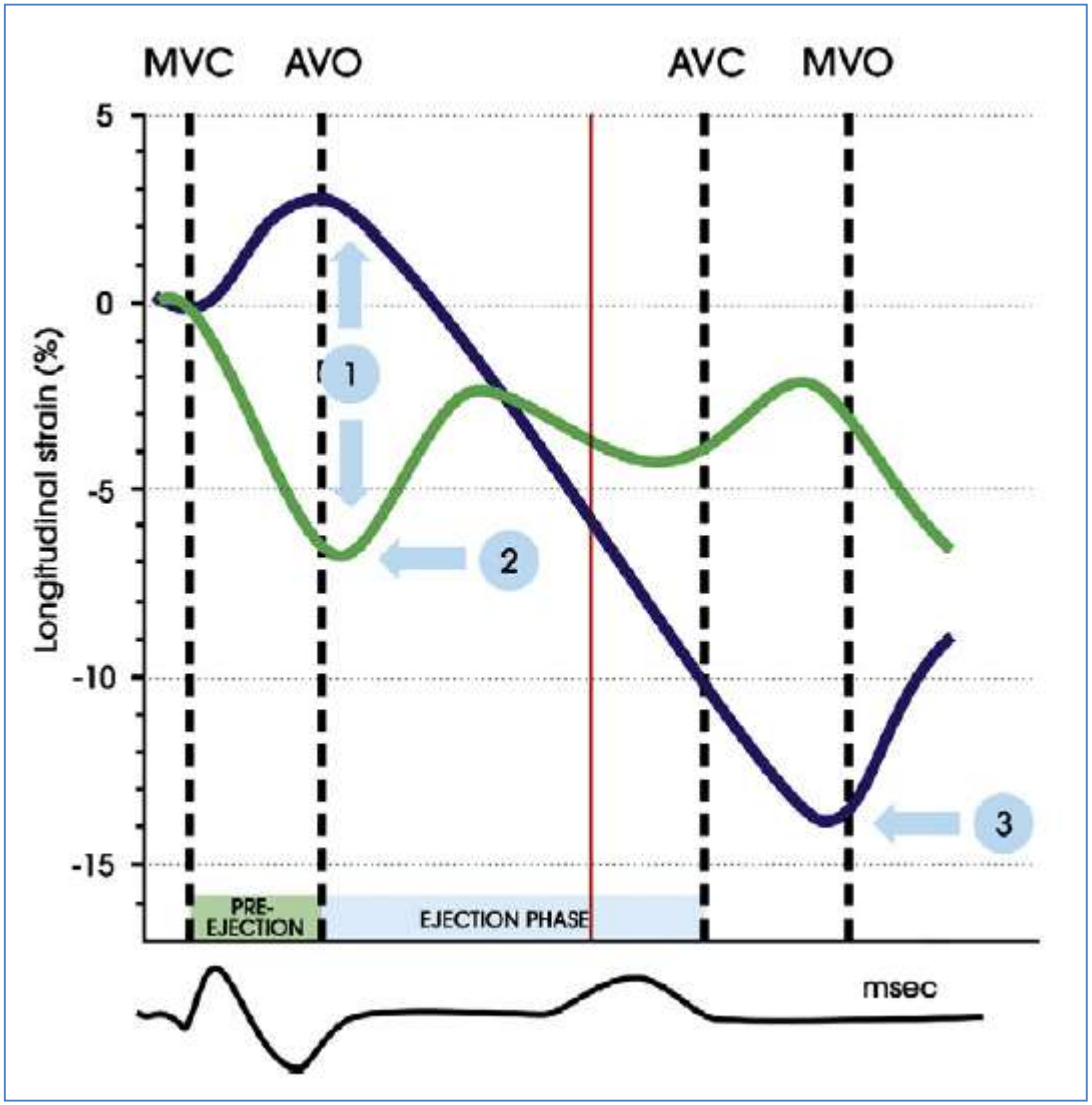
Cumulative LV dyssynchrony
(from radial strain)



LVEF vs LV dyssynchrony



Detekce klasického obrazu dyssynchronie



Predikce pozitivní odpovědi na CRT u pac. s BLTR

- Sensitivita 95 %
- Specificita 91 %

Risum N et.al., Amer.H.J. 2012

Indikace CRT u dětí/VSV

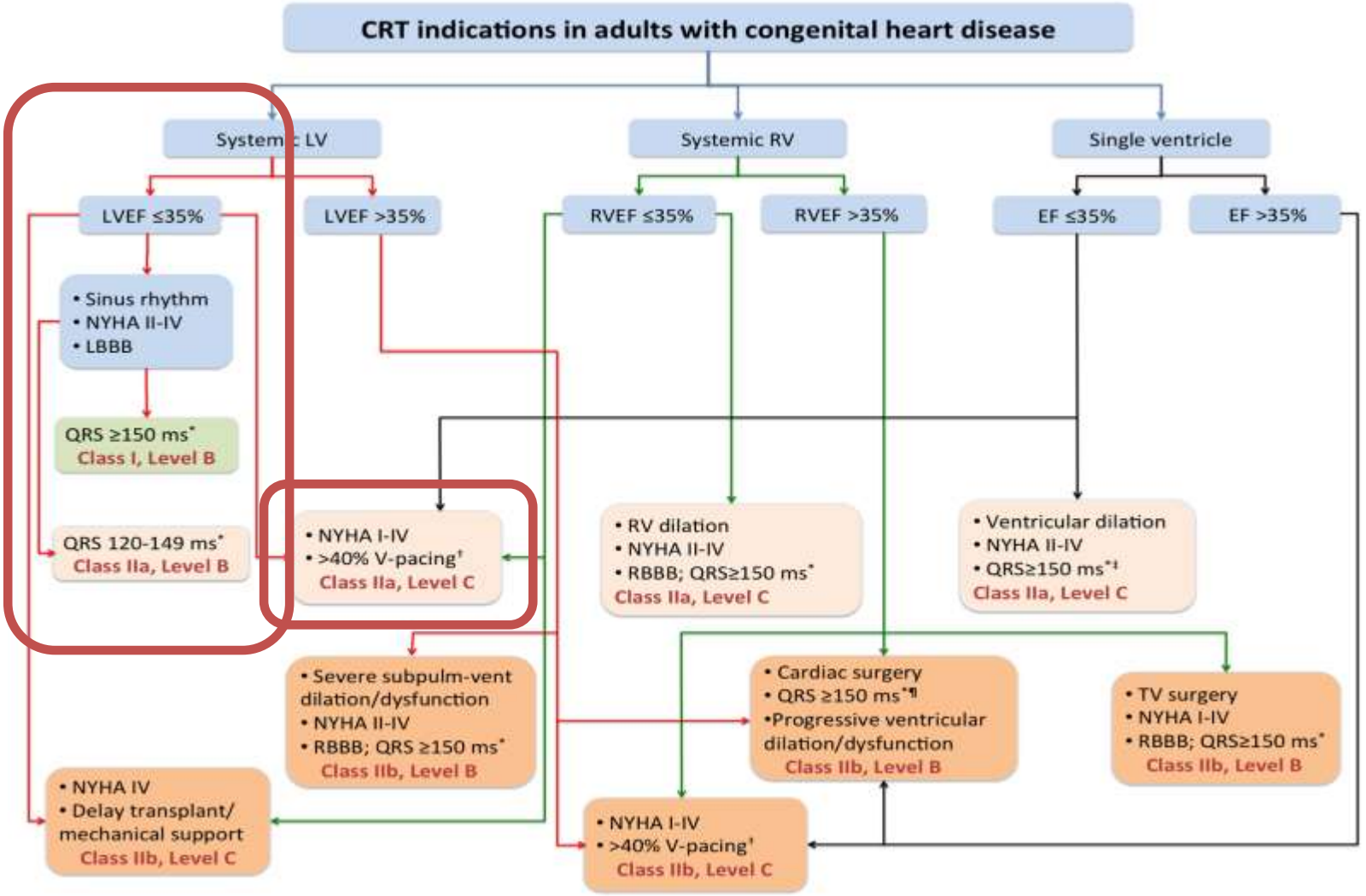
- Systémová LK
  - LBBB
  - Stimulace PK
- Systémová PK
  - RBBB
  - Stimulace LK
- Funkčně společná komora
  - Jakákoli raménková blokáda
  - „Single site“ stimulace
- Subpulmonární PK?
  - RBBB

→ „klasická“ CRT

Ve všech případech:
elektrické aktivační zpoždění
v rámci selhávající komory
nutné pro indikaci CRT!

Specifické pro VSV

Indikace CRT u dospělých s 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*

European Heart Journal
doi:10.1093/eurheartj/eht150

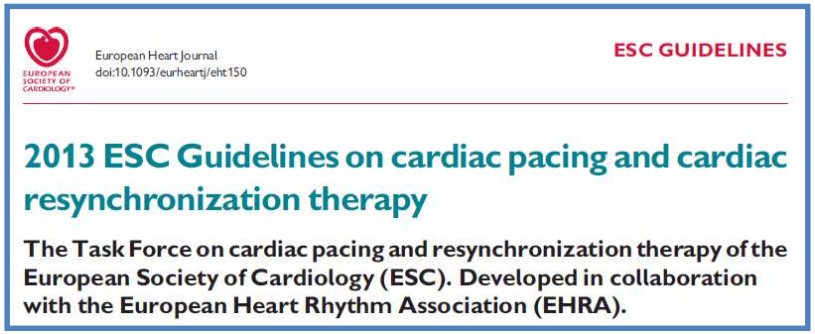
ESC GUIDELINES

2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

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).

3.4 Patients with heart failure and conventional pacemaker indications

For patients with conventional PM who develop HF, upgrading from VVI or DDD to CRT devices represents an important part of the patient population implanted with a CRT device, being 23–28% of the CRT implantations in different registries.[108,w146]



- Pozitivní korelace mezi frekvencí stimulace PK a výskytem nežádoucích účinků[1]
- CRT by mělo být zváženo u pacientů vyžadujících trvalou kardiostimulaci, kteří mají symptomatické srdeční selhání a sníženou (většinou < 40 %) EF[2,3]
  - Subjektivní klinické zlepšení, méně hospitalizací, lepší funkce LK

[1]Sulke N et al. Europace 2007
[2]Leclercq C et al. Pacing Clin Electrophysiol 2007
[3]vanGeldorp IE et al. Europace 2010

European Heart Journal
doi:10.1093/eurheartj/eht150

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- Profit z upgrade na CRT se nabízí u pacientů, u kterých se
  - časně nebo později při konvenční stimulaci vyvinula dysfunkce LK
  - zhoršuje klinický stav přes optimální farmakologický management

Indication for upgraded or *de novo* cardiac resynchronization therapy in patients with conventional pacemaker indications and heart failure

therapy. CRT should be considered in HF patients, reduced EF and expected high percentage of ventricular pacing in order to decrease the risk of worsening HF.	IIa	B	123–130

European Heart Journal
doi:10.1093/eurheartj/eht150

ESC GUIDELINES

2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

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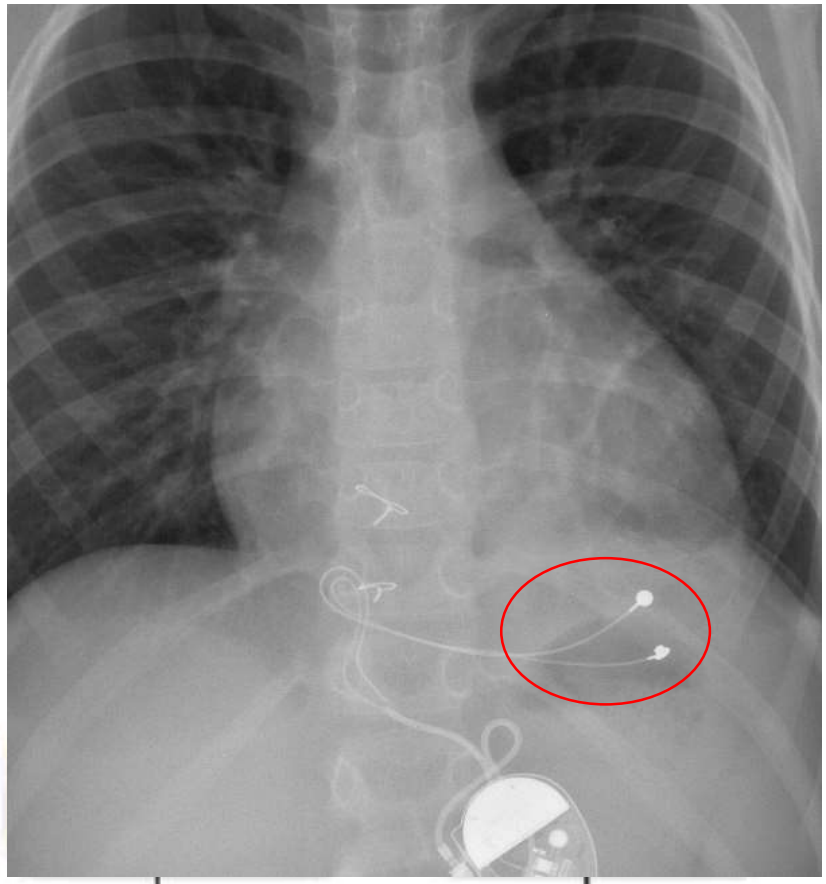

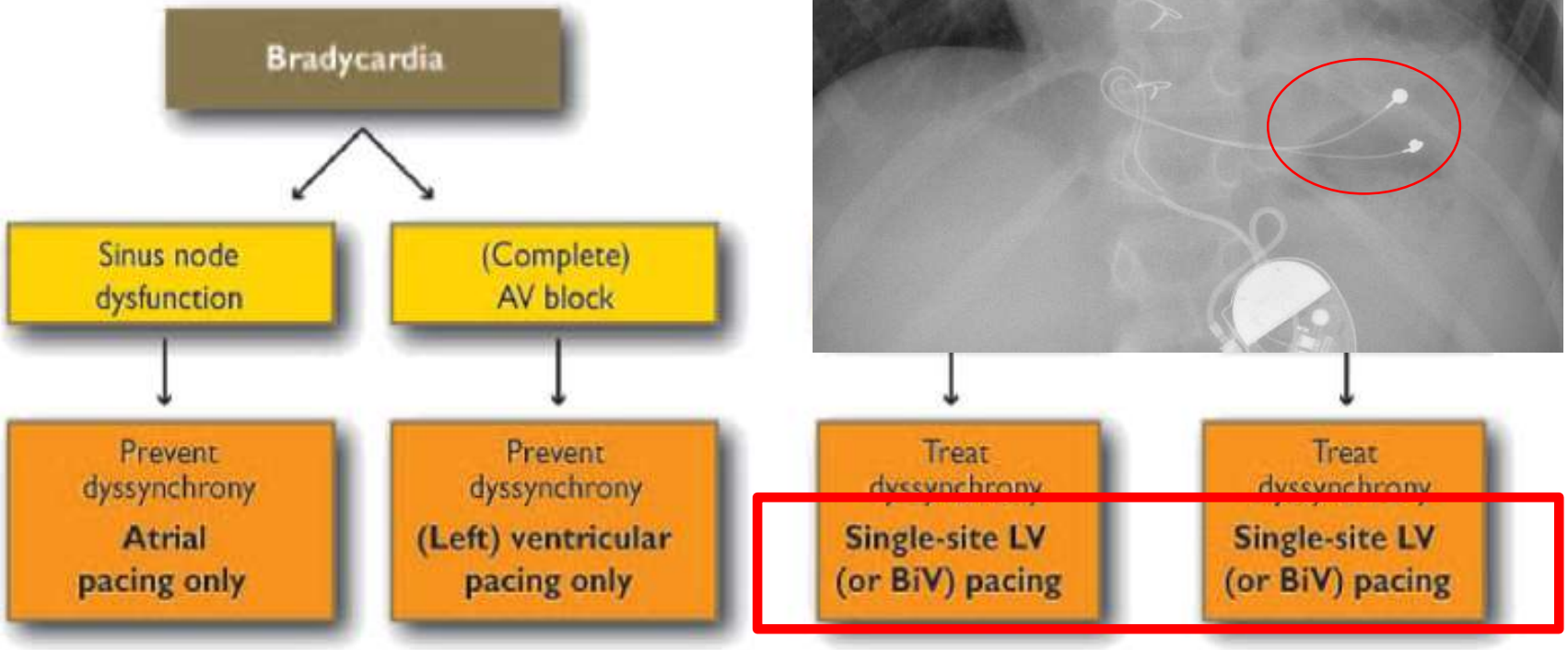

Fig. 6 – Suggested optimal pacing mode in children (modified from van Geldorp I et al).

Shrnutí

- Konvenční (ze subpulmonální komory aplikovaná) stimulace) je spojena s rizikem dyssynchronní KMP
- Dobře definovaný časně a pozdě se aktivující segment systémové komory (z hlediska efektivity upgrade na CRT)
- Optimalizace stimulačního místa
  - Pediatrické studie, pacienti s VSV
    - Hrot systémové komory
    - Specifické substráty (RV CRT)
- Limitovaná evidence pro dospělé pacienty bez VSV