PROFIL KANDIDÁTA K UPGRADE NA CSP SYSTÉM

Národný ústav srdcových a cievnych chorôb, a.s.

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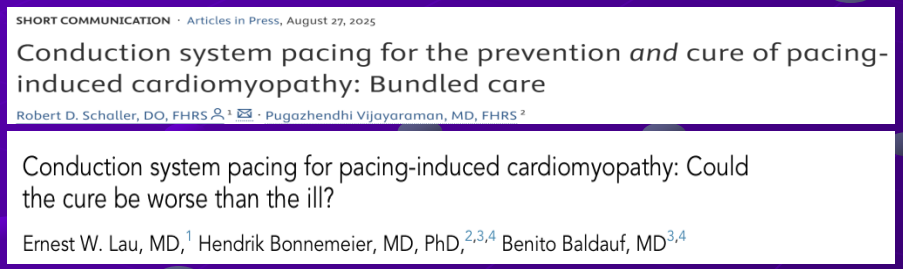
XXII. České a slovenské sympozium o arytmiích a kardiostimulaci, Olomouc- 9-11.11.2025

Úvod

Per aspera ad astra (Through challenge, we have reached a new frontier)



SHORT COMMUNICATION · Articles in Press, August 27, 2025

Conduction system pacing for the prevention *and* cure of pacing-induced cardiomyopathy: Bundled care

Robert D. Schaller, DO, FHRS [1] · Pugazhendhi Vijayaraman, MD, FHRS [2]

Conduction system pacing for pacing-induced cardiomyopathy: Could the cure be worse than the ill?

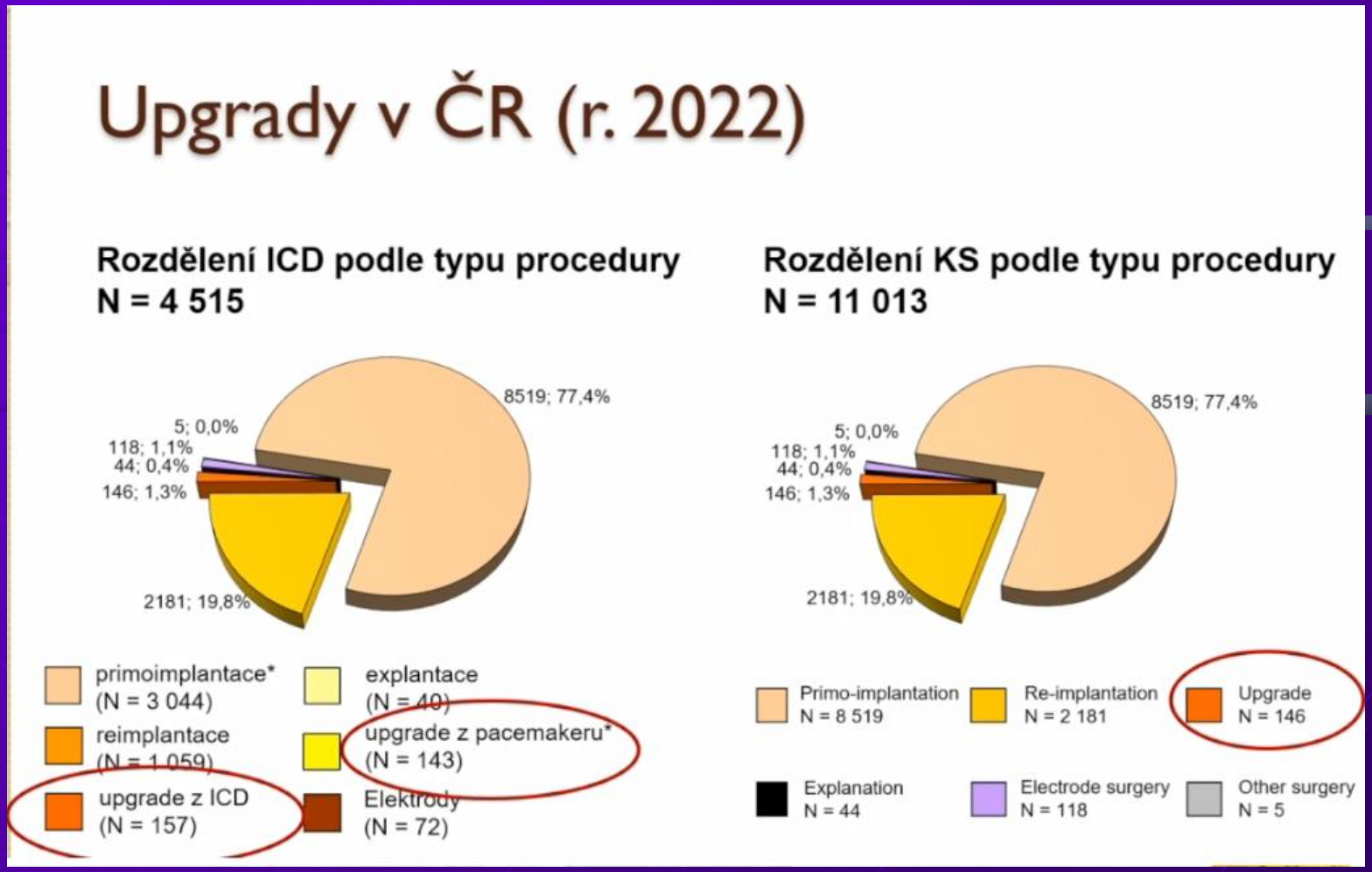
Ernest W. Lau, MD,[1] Hendrik Bonnemeier, MD, PhD,[2,3,4] Benito Baldauf, MD[3,4]

Stimulácia prevodového systému ako jedna z mála procedúr v medicíne replikuje fyziologickú aktiváciu cez unikátny systém, ktorý nam dala „Matka príroda „
Pozorujeme rýchly rozmach tejto metódy-predbehla GL
Vo viacerých oblastiach zatiaľ bez dát z veľkých RKŠ
Chýbajú dlhoročné skúsenosti
Obava z niektorých komplikácií...

UPGRADE- rozšírenie systému KS,ICD,CRT

- Najkomplexnejšie výkony v implantológii
- Spojené s množstvom technických problémov
- Vyšší výskyt komplikácií
- Patria do veľmi skúsených centier
- Primum non nocere...

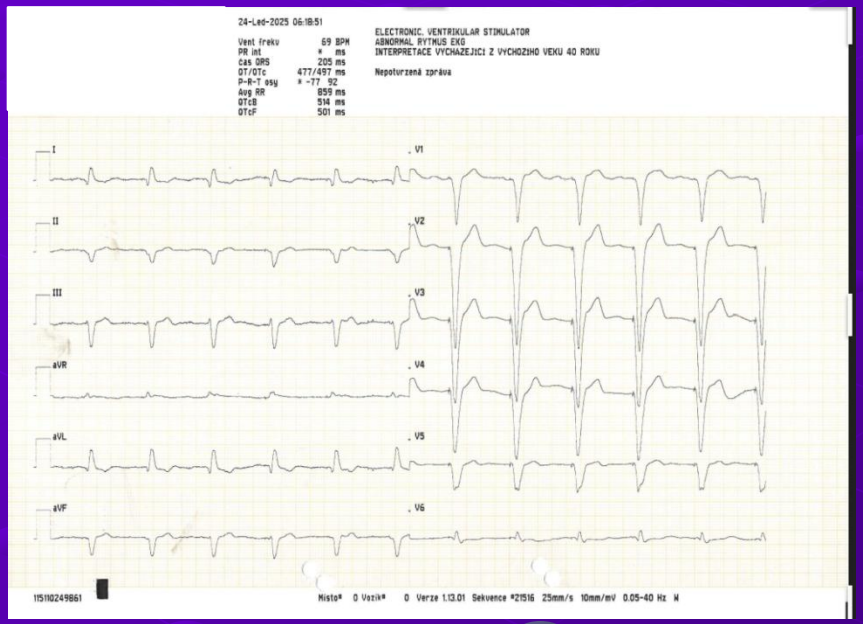
UPGRADY nie sú „in“ ?

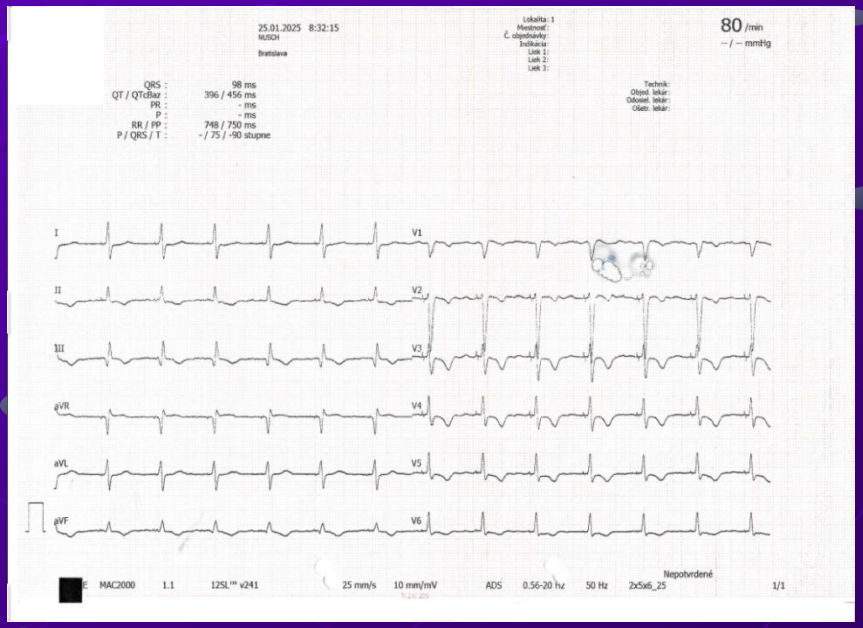


Ale ich robíme... Kazuistika pacientky s Upgrade na CSP

- Pacientka A.E., Ž., 71 rokov
- VCC, stav po korekcii DPS 1959, Ebsteinova anomália
- Clover plastika TCH a anuloplastický ringTCH 2017
- AVB III, PAF implantácia DDD KS
- Prechod do permanentnej FA
- Vývoj PICMP- zhoršenie EF ĽK, sy CHSZ NYHA III-IVa, biomarkery, stim.
- QRS 200 ms, dep., natívne FA s AVB III - QRS úzky, fr.30/min
- Indikovaná na upgrade na CSP
- Uzáver prístupu...., extrakcia nepotrebnej A el., zjednanie prístupu, CSP el.
- 25.1.2025 Implantovaný BIV KS, Sel.stimulácia His-a, A port zaslepený
- Zlepšenie NYHA II, QRS 85 ms, zlepšenie ECHO kg o 10%, zlepšenie bio-markerov SZ

EKG pred a po UPGRADE





UPGRADE na CSP

Čo nám hovoria odporúčania?

Komu?

Kedy?

Ako?

Čo nám hovoria odporúčania?

Recommendation for upgrade from right ventricular pacing to cardiac resynchronization therapy

Recommendations	Class	Level
Patients who have received a conventional pacemaker or an ICD and who subsequently develop symptomatic HF with LVEF ≤35% despite OMT, and who have a significant[a] proportion of RV pacing, should be considered for upgrade to CRT.	IIa	B

CRT = cardiac resynchronization therapy; HF = heart failure; ICD = implantable cardioverter-defibrillator; LVEF = left ventricular ejection fraction; OMT = optimal medical therapy; RV = right ventricular.

[a]A limit of 20% RV pacing for considering interventions for pacing-induced HF is supported by observational data. However, there are no data to support that any percentage of RV pacing can be considered as defining a true limit below which RV pacing is safe and beyond which RV pacing is harmful.

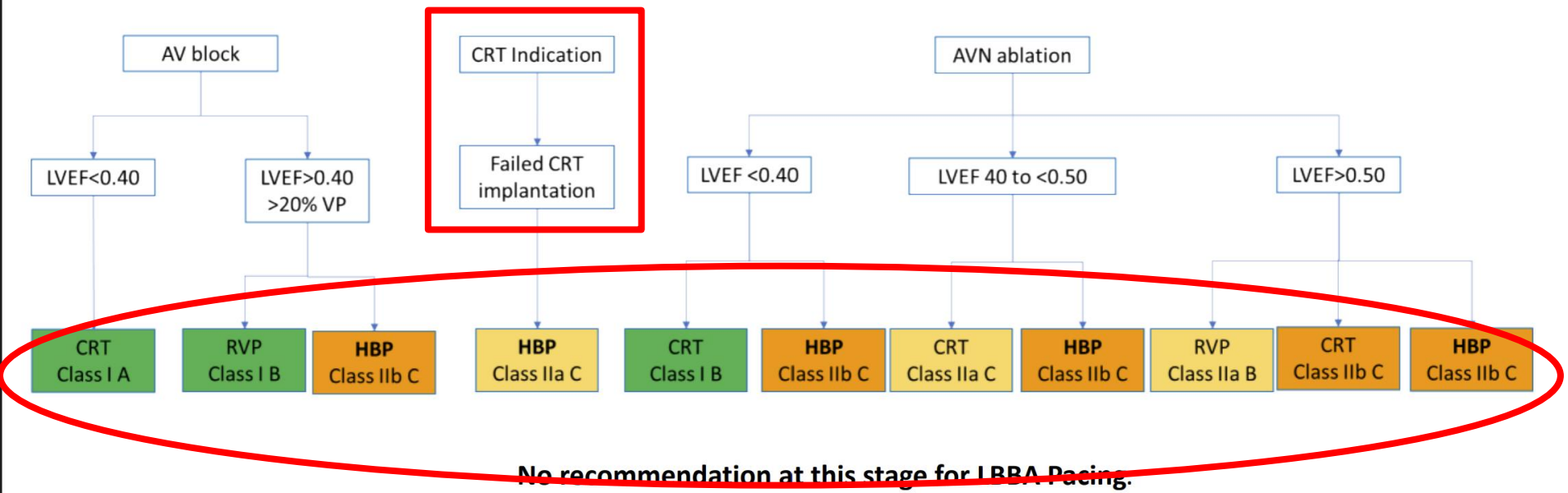
2021 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy
(European Heart Journal 2021 – doi:10.1093/eurheartj/ehab364)

Čo nám hovoria odporúčania?

2021 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

Developed by the Task Force on cardiac pacing and cardiac resynchronization therapy of the European Society of Cardiology (ESC)

EHRA
European Heart Rhythm Association
European Society of Cardiology



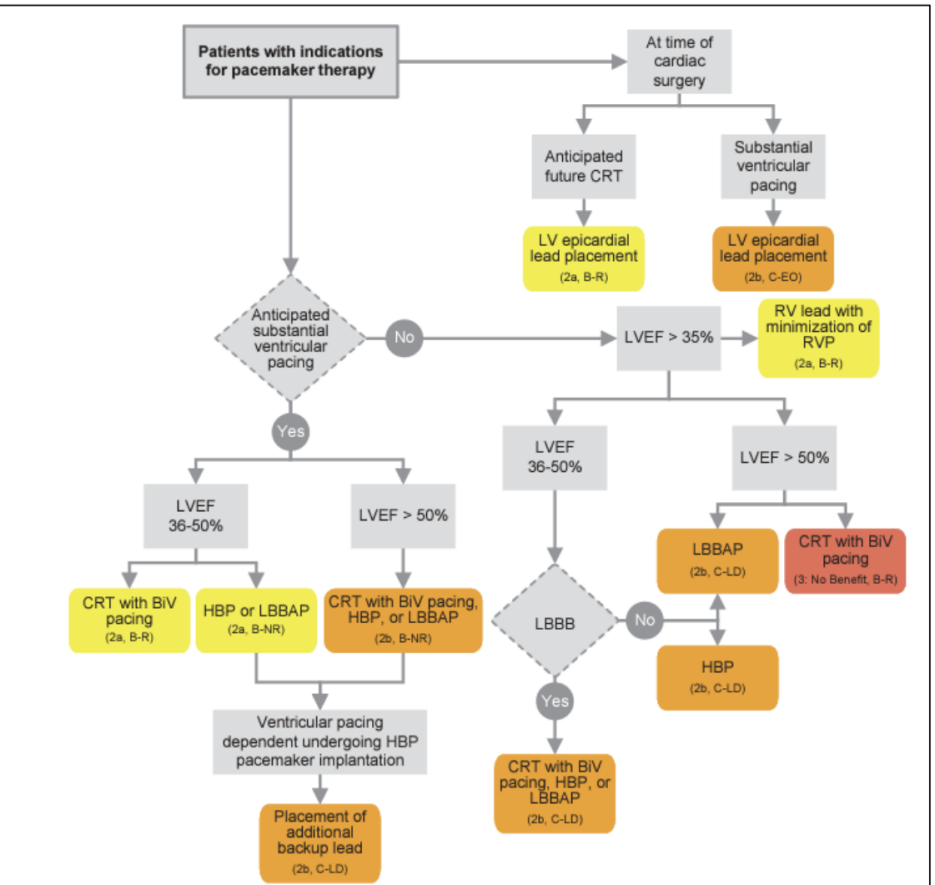
No recommendation at this stage for LBBA Pacing.

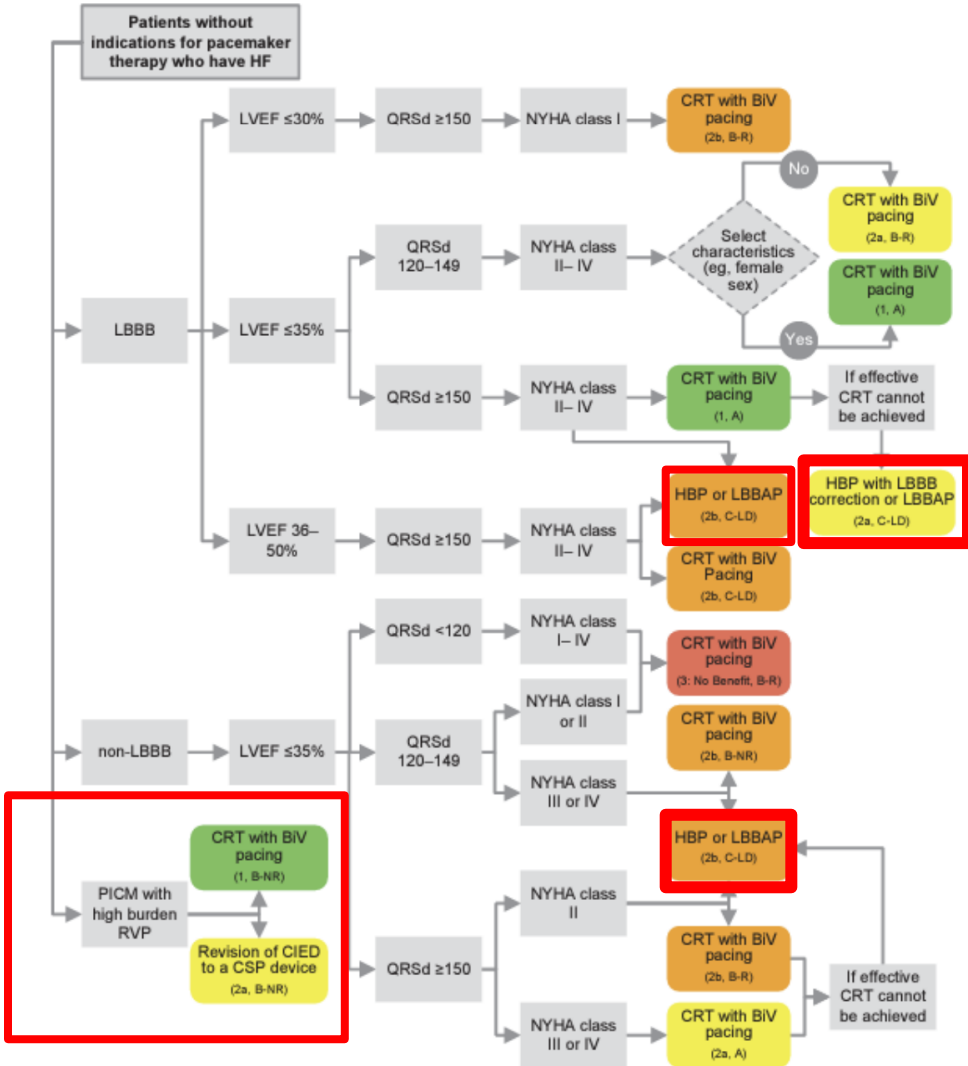
However, conduction system pacing (which includes HBP and left bundle branch area pacing) is very likely to play a growing role in the future, and the current recommendations will probably need to be revised once more solid evidence of safety and efficacy (from randomized trials) is published.

Čo nám hovoria odporúčania?

2023 HRS/APHRS/LAHRS guideline on cardiac physiologic pacing for the avoidance and mitigation of heart failure

Chung et al. Heart Rhythm 2023





ESC European Society of Cardiology

Europace (2025) **27**, euaf050
https://doi.org/10.1093/europace/euaf050

EHRA DOCUMENT

EHRA European Heart Rhythm Association

European Society of Cardiology (ESC) clinical consensus statement on indications for conduction system pacing, with special contribution of the European Heart Rhythm Association of the ESC and endorsed by the Asia Pacific Heart Rhythm Society, the Canadian Heart Rhythm Society, the Heart Rhythm Society, and the Latin American Heart Rhythm Society

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Document Reviewers: Jens Cosedis Nielsen, (Review Coordinator)[25], Lucas Boersma[26,27], Carina Blomström-Lundqvist[28,29], Mads Brix Kronborg[25], Mina K. Chung[30], Hung Fat Tse[31], Habib Rehman Khan[32], Francisco Leyva[33,34], Ulises Rojel-Martinez[35], Marcin Ruciński[10,36], and Niraj Varma[37]

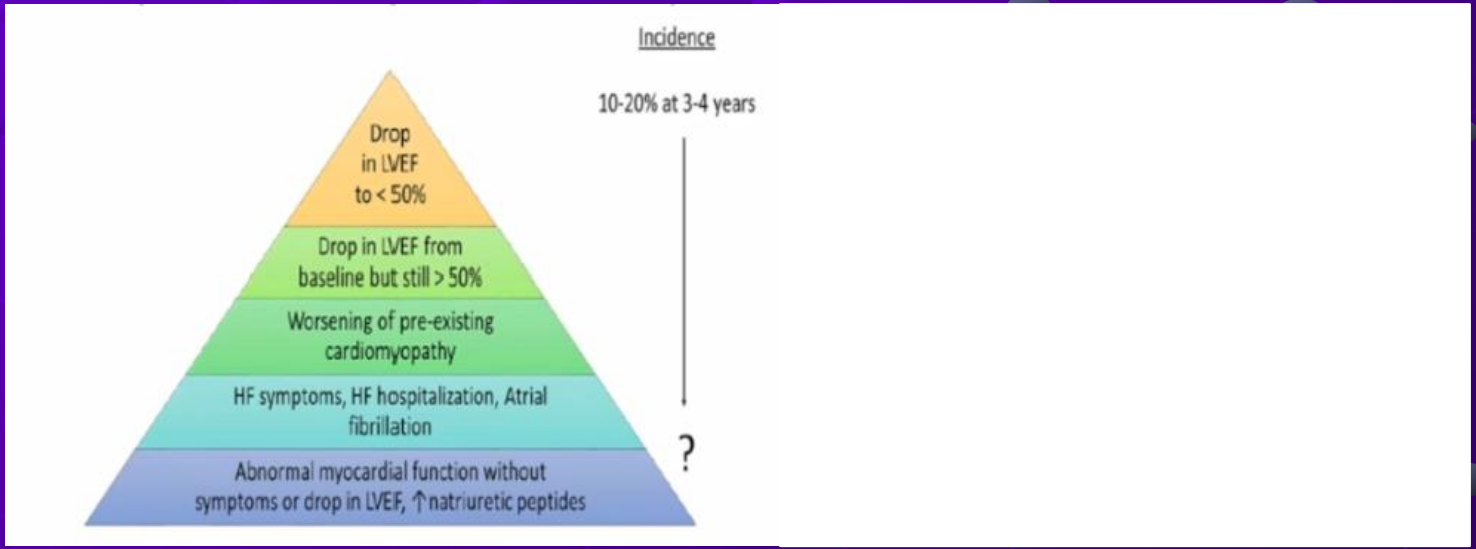
Kto je potenciálny kandidát na UPGRADE na CSP?

- Pacient s pacingom indukovanou KMP (PICMP)
- Pacient po neúspešnej implantácii CRT
- Non responder na CRT ? (HOT a LOT CRT)
- Pacienti s KS zvažovaní na abláciu AV uzla pre FA - arytmiou indukovaná KMP

Temná stránka konvenčnej kardiostimulácie

10-20% pacientov s pôvodne normálnou EFĽK a komorovou stimuláciou môže v priebehu 3-4 rokov dostať PICMP (1)

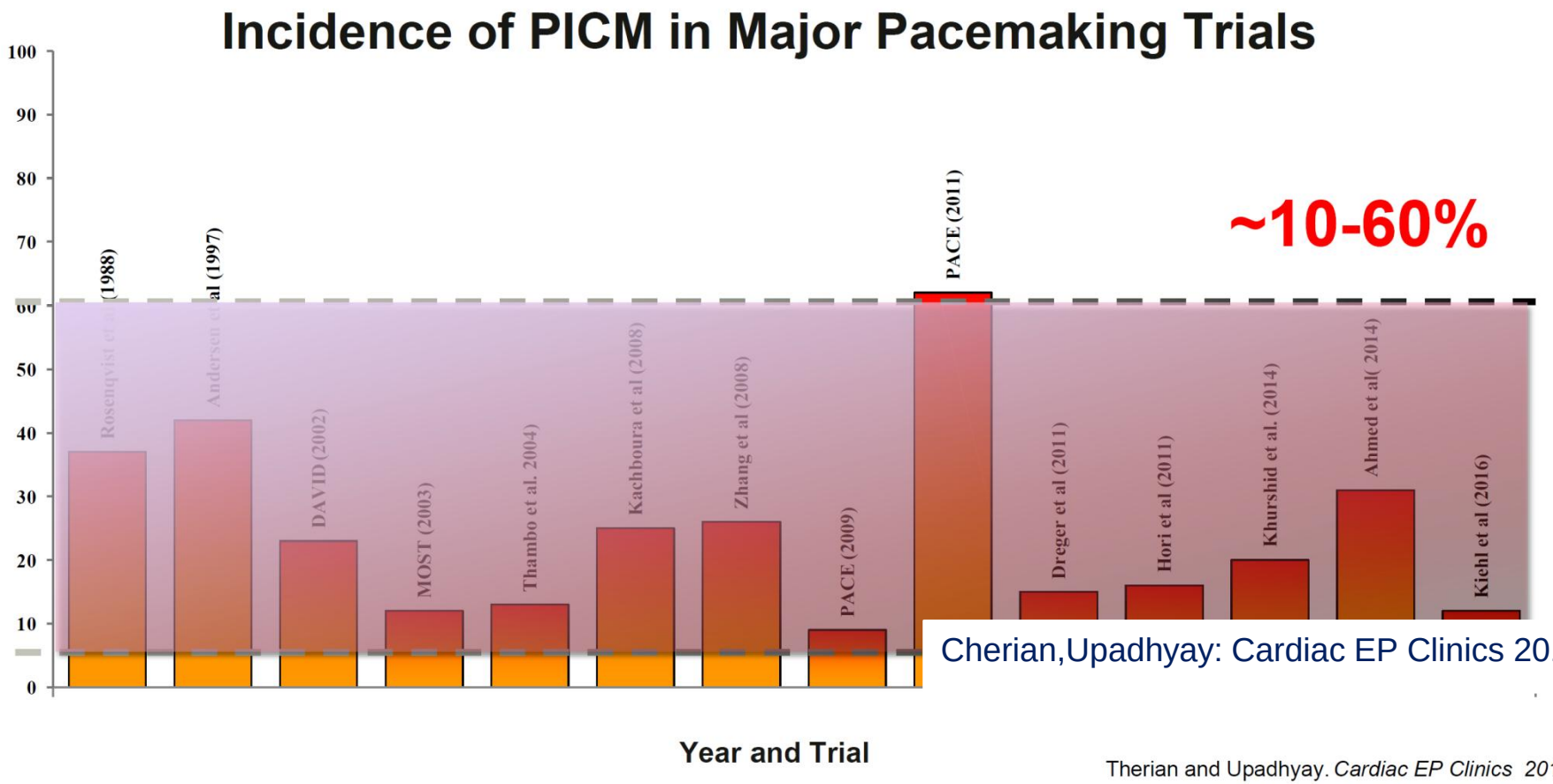
Pri poklese EF≥ 10% bez ohľadu na vých.EF až 39% má PICMP za 3,5r. (2)



1 Merchant FM. J Cardiovasc Electrophysiol. 2020;31:286–292
2 Kaye G et al. Heart Lung Circ 2018; 28:1027-1033

PICM – bežný fenomén-rôzne definície

Pacemaker-induced cardiomyopathy (PICM) is common, but definitions are diverse



Cherian,Upadhyay: Cardiac EP Clinics 2018

Therian and Upadhyay. *Cardiac EP Clinics 2018.*

Výskyt SZ je významný

ESC
European Society
of Cardiology

Incidenc
implanta
Registry-

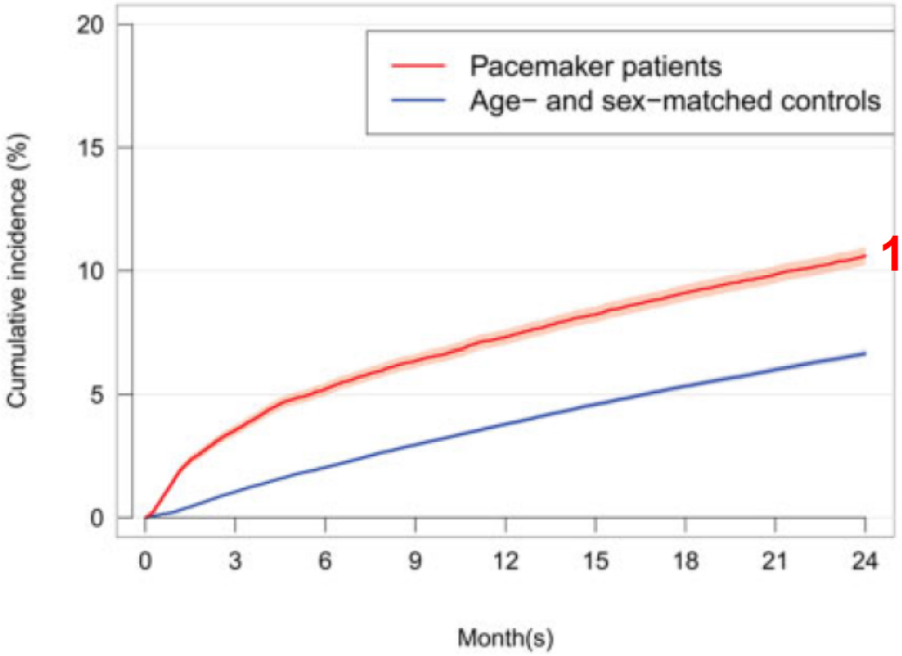
Bhupendar Taya
Christoffer Polc
Niels Risum[8], C

AL RESEARCH
lure/cardiomyopathy

ker

6,7
ay Kragholm[1,2]

2-Year Cumulative Incidence of Heart Failure

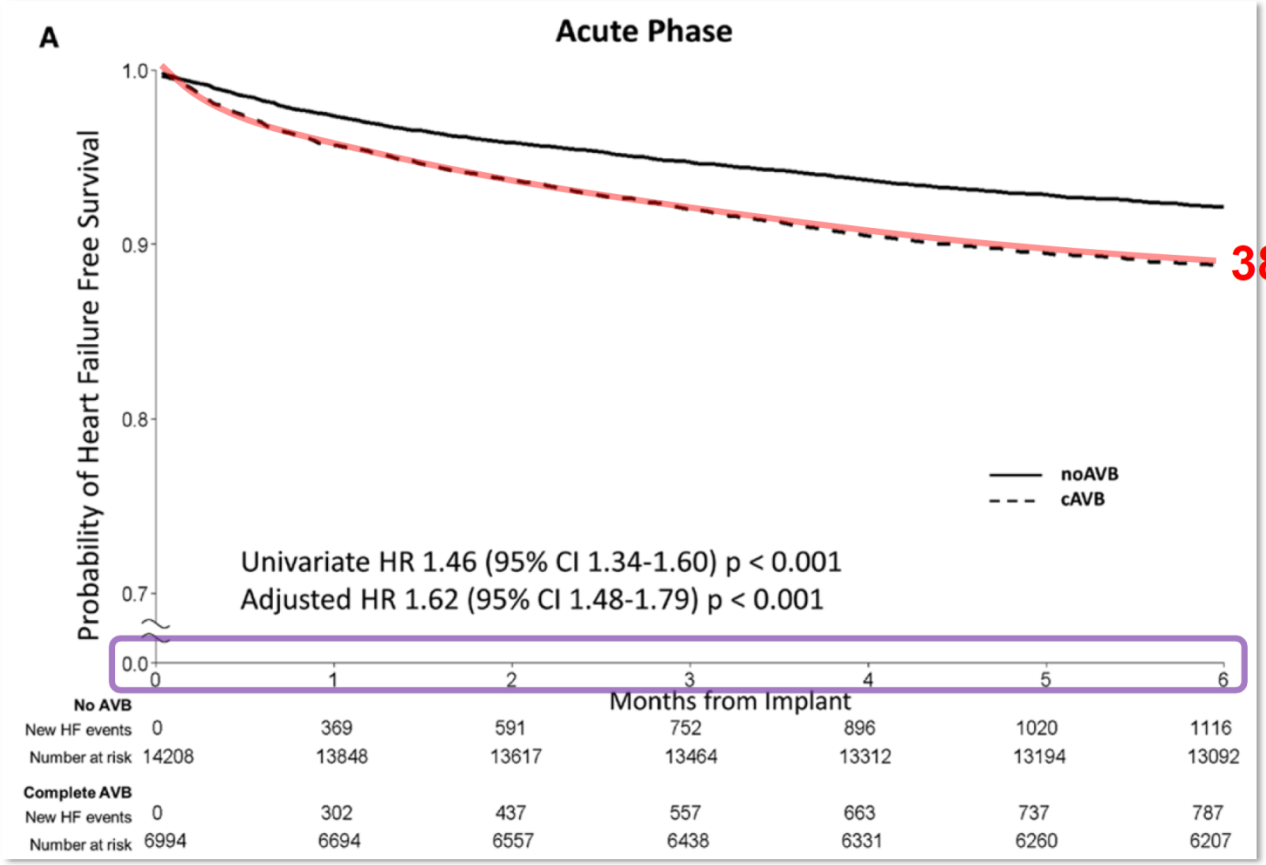


11% incidence of HF

Variables	Control cohort (*n* = 138 520)	Patients with pacemaker (*n* = 27 704)	*P*-value
Age (years)	77.0 (69.0–84.0)	77.0 (69.0–84.0)	0.99

Tayal et al. *European Heart J 2019.*

PICM sa môže objaviť krátko po implantácii u pac. s AVB

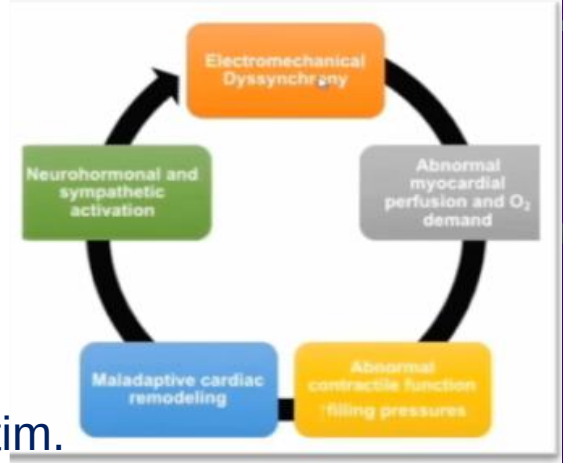


38% ↑ risk of HF

Prediktory vzniku PICMP

- Vyšší vek, mužské pohlavie
- IM v anamnéze
- Natívny QRS >115 ms, natívny LBB
- Fibrilácia predsiení v anamnéze
- Znížená EF ĽK pred implantáciou

- Vysoké percento kom.stim (>20 %)
- Stimulovaný QRS complex ≥ 150ms
- Komorová dysynchrónia pri komorovej stim.



J Cardiovasc Electrophysiol. 2020;31:286–292

ESC European Society of Cardiology

Europace (2023) **25**, 1077–1086
https://doi.org/10.1093/europace/euac188

CLINICAL RESEARCH
Cardiac pacing

Upgrading right ventricular pacemakers to biventricular pacing or conduction system pacing: a systematic review and meta-analysis

Nandita Kaza [1], Varanand Htun[2], Alejandra Miyazawa [1], Florentina Simader [1], Bradley Porter[3], James P. Howard [4], Ahran D. Arnold [1], Akriti Naraen [4], David Luria[5], Michael Glikson [6], Carsten Israel[7], Darrel P. Francis [1], Zachary I. Whinnett [1], Matthew J. Shun-Shin [1]*, and Daniel Keene [1]

[1]National Heart and Lung Institute, Imperial College London, B Block, Hammersmith Hospital, Du Cane Road, London W12 0HS, UK; [2]School of Public Health, Imperial College London, London, UK; [3]Hammersmith Hospital, Imperial College Healthcare NHS Trust, London, UK; [4]Warrington and Halton Hospitals NHS Foundation Trust, Liverpool, UK; [5]Hebrew University Jerusalem, Jerusalem, Israel; [6]Shaare Zadek Medical Center, Jerusalem, Israel; and [7]Bielefeld Hospital, Bielefeld, Germany

Received 16 May 2022; accepted after revision 8 September 2022; online publish-ahead-of-print 10 November 2022

Abstract

Guidelines recommend patients undergoing a first pacemaker implant who have even mild left ventricular (LV) impairment should receive biventricular or conduction system pacing (CSP). There is no corresponding recommendation for patients who already have a pacemaker. We conducted a meta-analysis of randomized controlled trials (RCTs) and observational studies assessing device upgrades. The primary outcome was the echocardiographic change in LV ejection fraction (LVEF). Six RCTs (randomizing 161 patients) and 47 observational studies (2644 patients) assessing the efficacy of upgrade to biventricular pacing were eligible for analysis. Eight observational studies recruiting 217 patients of CSP upgrade were also eligible. Fourteen additional studies contributed data on complications (25 412 patients). Randomized controlled trials of biventricular pacing upgrade showed LVEF improvement of +8.4% from 35.5% and observational studies: +8.4% from 25.7%. Observational studies of left bundle branch area pacing upgrade showed +11.1% improvement from 39.0% and observational studies of His bundle pacing upgrade showed +12.7% improvement from 36.0%. New York Heart Association class decreased by −0.4, −0.8, −1.0, and −1.2, respectively. Randomized controlled trials of biventricular upgrade found improvement in Minnesota Heart Failure Score (−6.9 points) and peak oxygen uptake (+1.1 mL/kg/min). This was also seen in observational studies of biventricular upgrades (−19.67 points and +2.63 mL/kg/min, respectively). In studies of the biventricular upgrade, complication rates averaged 2% for pneumothorax, 1.4% for tamponade, and 3.7% for infection over 24 months of mean follow-up. Lead-related complications occurred in 3.3% of biventricular upgrades and 1.8% of CSP upgrades. Randomized controlled trials show significant physiological and symptomatic benefits of upgrading pacemakers to biventricular pacing. Observational studies show similar effects between biventricular pacing upgrade and CSP upgrade.

Keywords Upgrade • Biventricular pacing • Conduction system pacing • Physiological pacing

Upgrady

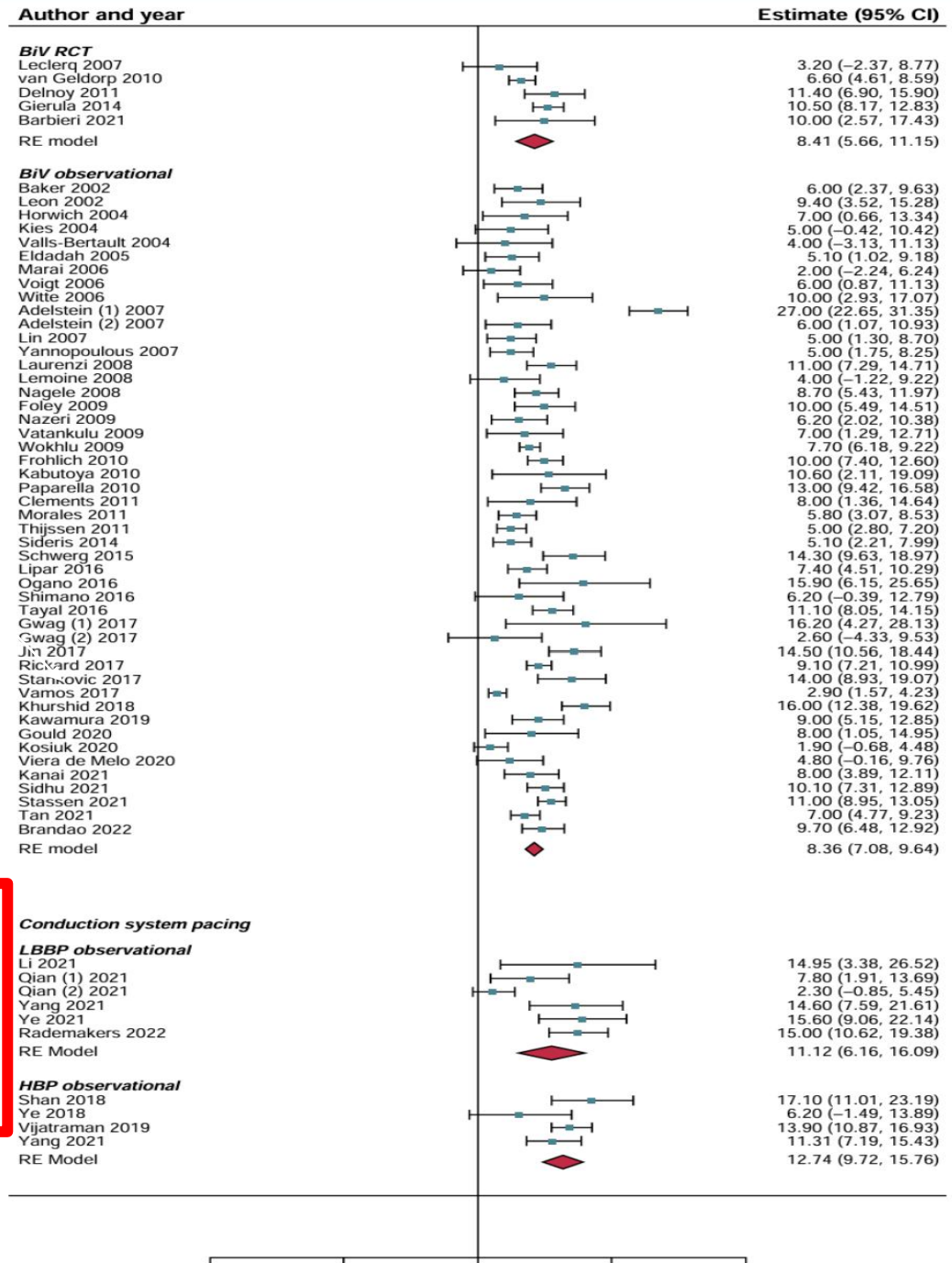
QRS
NYHA

EF ĽK

CSP>CRT

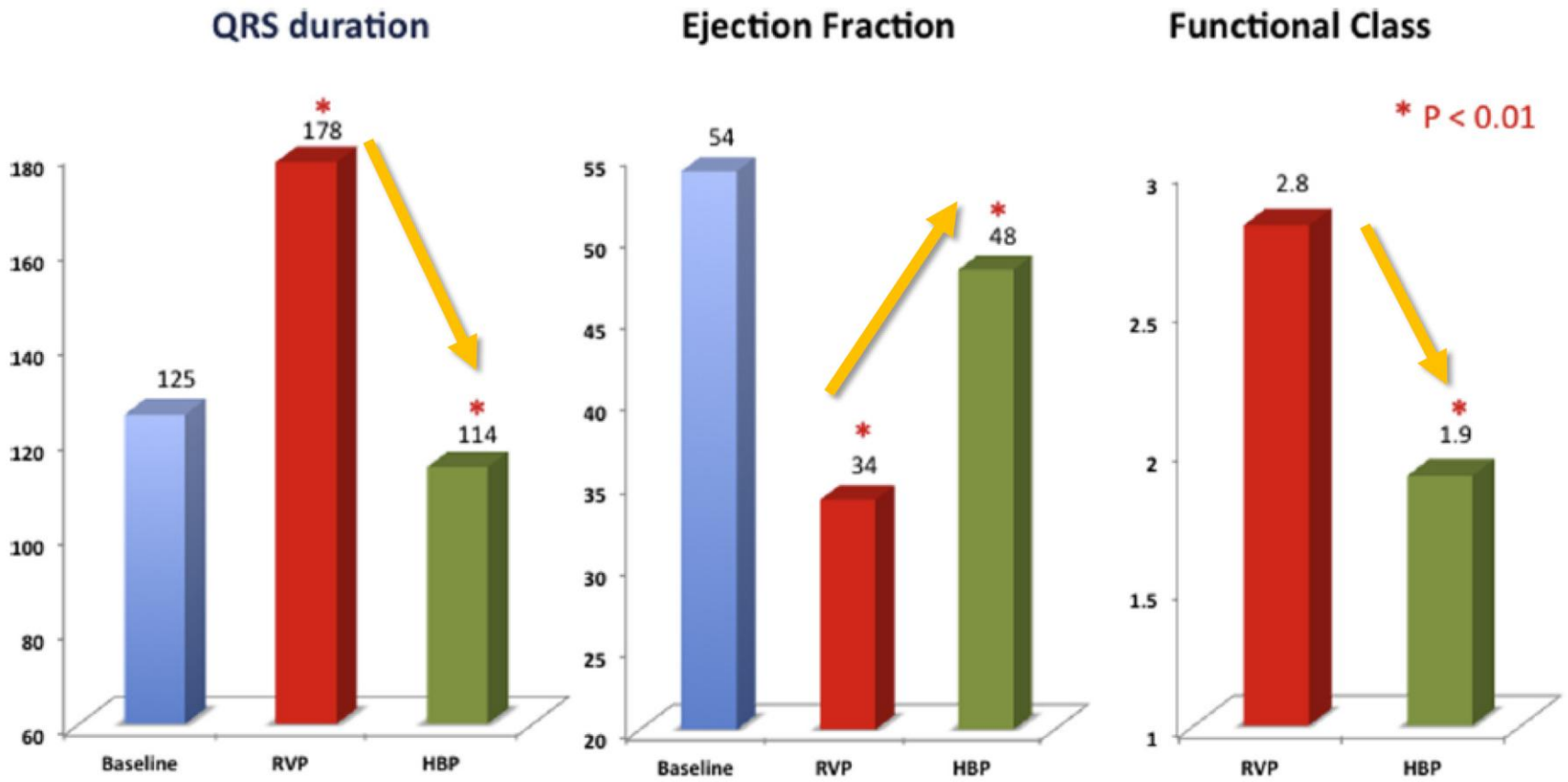
CSP len 217 p

Observ.dáta



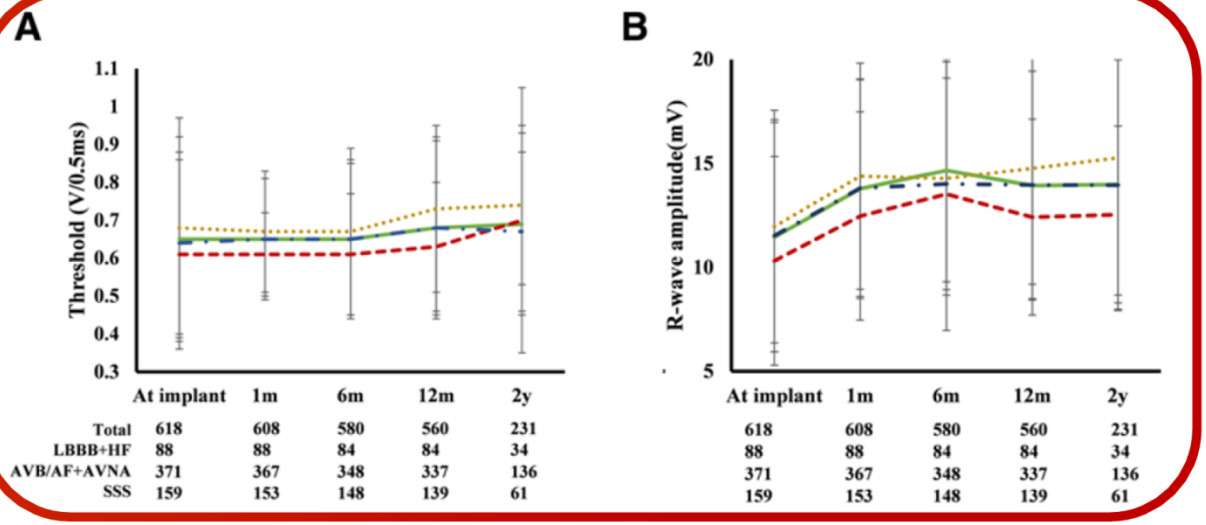
Kaza et al. EP 2023

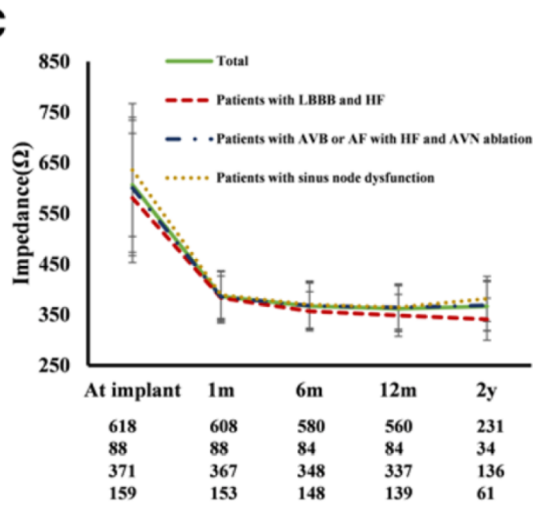
Treating PICM: CSP Upgrade

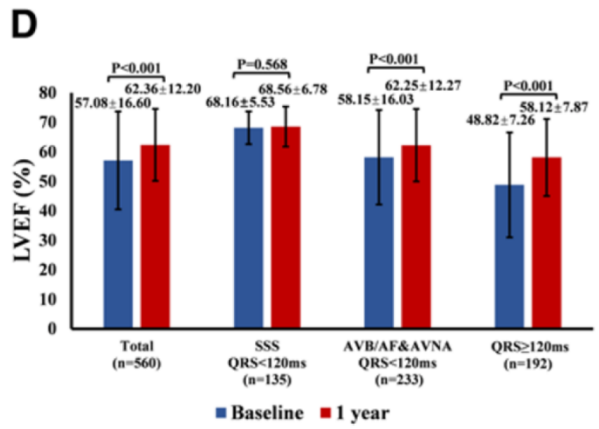


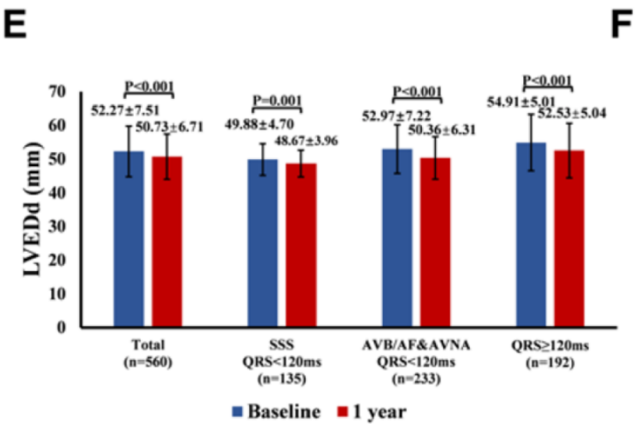
Vijayaraman et al. *Heart Rhythm 2019.*

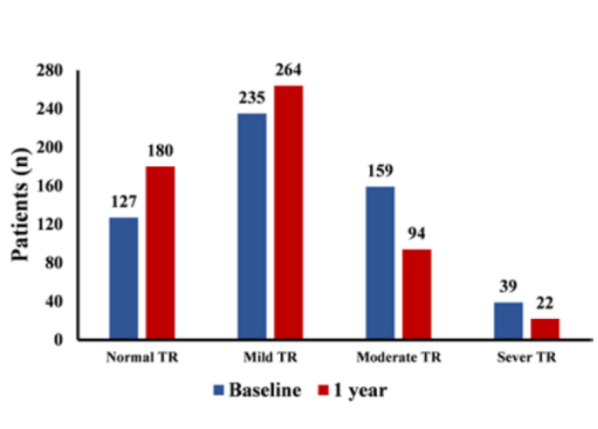
Treating PICM: CSP Upgrade











Qian et al. *PACE 2021*. Su et al. *Circ EP 2021*.

Conduction System Pacing versus Biventricular Pacing in Heart Failure with Reduced Ejection Fraction: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Iuri Ferreira Felix, MD , Michelle Collini, Rafaela Fonseca, Camila Guida, MD, Luciana Armaganijan, MD, MSc, PhD, Jeffrey Sean Healey, MD, MSc, FRCPC, FHRS , Guilherme Carvalho, MD, MSc

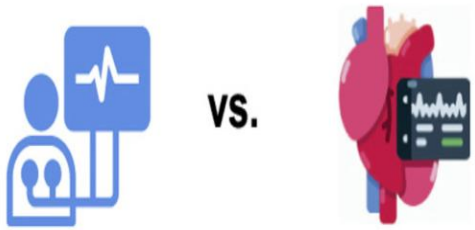
BACKGROUND:

The optimal strategy for cardiac resynchronization in patients with heart failure is still not well-established.

METHODS:

We compared in patients with heart failure with reduced ejection fraction

Biventricular Pacing (BVP) VS. **Conduction system pacing (CSP)**



RESULTS

7 randomized controlled trials with 408 patients

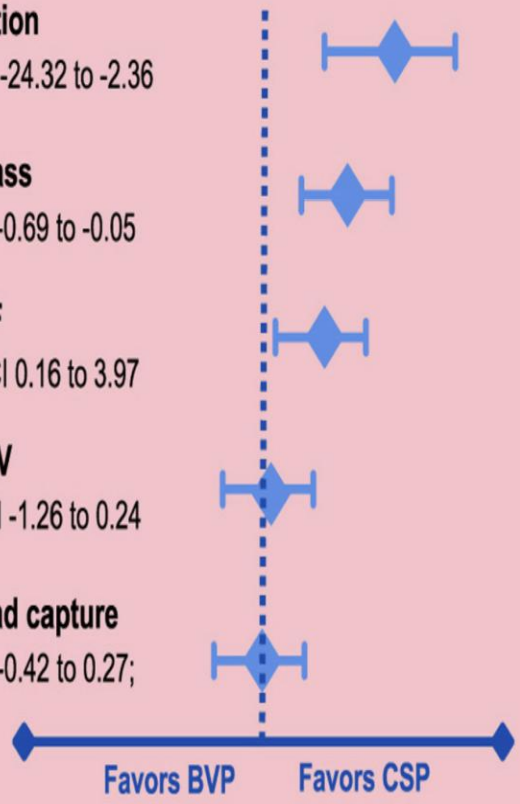
QRS duration
MD-13.34 ms; 95% CI -24.32 to -2.36

NYHA class
SMD -0.37; 95% CI -0.69 to -0.05

LVEF
MD 2.06 %; 95% CI 0.16 to 3.97

LVESV
SMD -0.51; 95% CI -1.26 to 0.24

Threshold for lead capture
MD -0.08 V; 95% CI -0.42 to 0.27;



CONCLUSIONS

There was a significant reduction in QRS duration and in in symptoms with CSP resynchronization.

There was an improvement in left ventricular ejection fraction with CSP.

There was no difference between the groups in terms of left ventricular end-systolic volume and the threshold for leading capture

Heart Rhythm
Volume 21, Issue 6, June 2024, Pages 881-889

UPGRADE TO CSP in PICMP

UPGRADE TO HIS

Study	Year	Design	Total number of patients	Number of patients upgraded to HBP	Follow-up period (months)	Baseline EF (%)	Post HBP EF (%)	Pre HBP QRS duration (ms)	Post HBP QRS duration (ms)	Clinical outcomes
Shan *et al.* [48]	2018	Prospective cohort (HBP)	11	11	24	36	53	156	107	Improvement of NHYA Decreased BNP ($p < 0.01$)
Vijayaraman *et al.* [46]	2019	Retrospective, Case study (HBP *vs.* RVP)	85	79	25	34	48	123	114	Improvement of NHYA ($p < 0.01$)
Gardas *et al.* [47]	2022	Prospective (HBP *vs.* BiV-CRT)	61	39	6	34	48	182	118	Improvement of NHYA ($p = 0.04$)

BiV-CRT, Biventricular pacing cardiac resynchronization therapy; BNP, brain natriuretic peptide; EF, ejection fraction; HBP, His bundle pacing; NYHA, New Work Heart Association; RVP, right ventricular pacing.

UPGRADE TO LBBAP

Study	Year	Design	Total number of patients	Number of patients upgraded to LBBAP	Follow-up period (months)	Baseline EF (%)	Post LBBAP EF (%)	Pre LBBAP QRS (ms)	Post LBBAP QRS (ms)	Clinical outcomes
Qian *et al.* [55]	2021	Retrospective observational Single arm	13	13	10	40	48	174	117	Improvement in NYHA ($p < 0.01$) Decreased Pro-BNP
Yang *et al.* [58]	2021	Retrospective observational Single arm	20	19	12	36	51	176	120	Improvement in NYHA ($p = 0.02$)
Rademakers *et al.* [56]	2022	Retrospective observational Single arm	20	20	44	32	47	193	130	Improvement in NYHA ($p < 0.01$)
Shan *et al.* [57]	2023	Retrospective observational	102	70	12	36	51	149	123	Improvement in NYHA ($p < 0.001$)

BNP, brain natriuretic peptide; EF, ejection fraction; LBBAP, left bundle branch area pacing; NYHA, New Work Heart Association.

Rev. Cardiovasc. Med. **2024**; 25(4): 118
https://doi.org/10.31083/j.rcm2504118

Priame porovnanie RKŠ UPGRADE na CSP vs UPGRADE na CRT

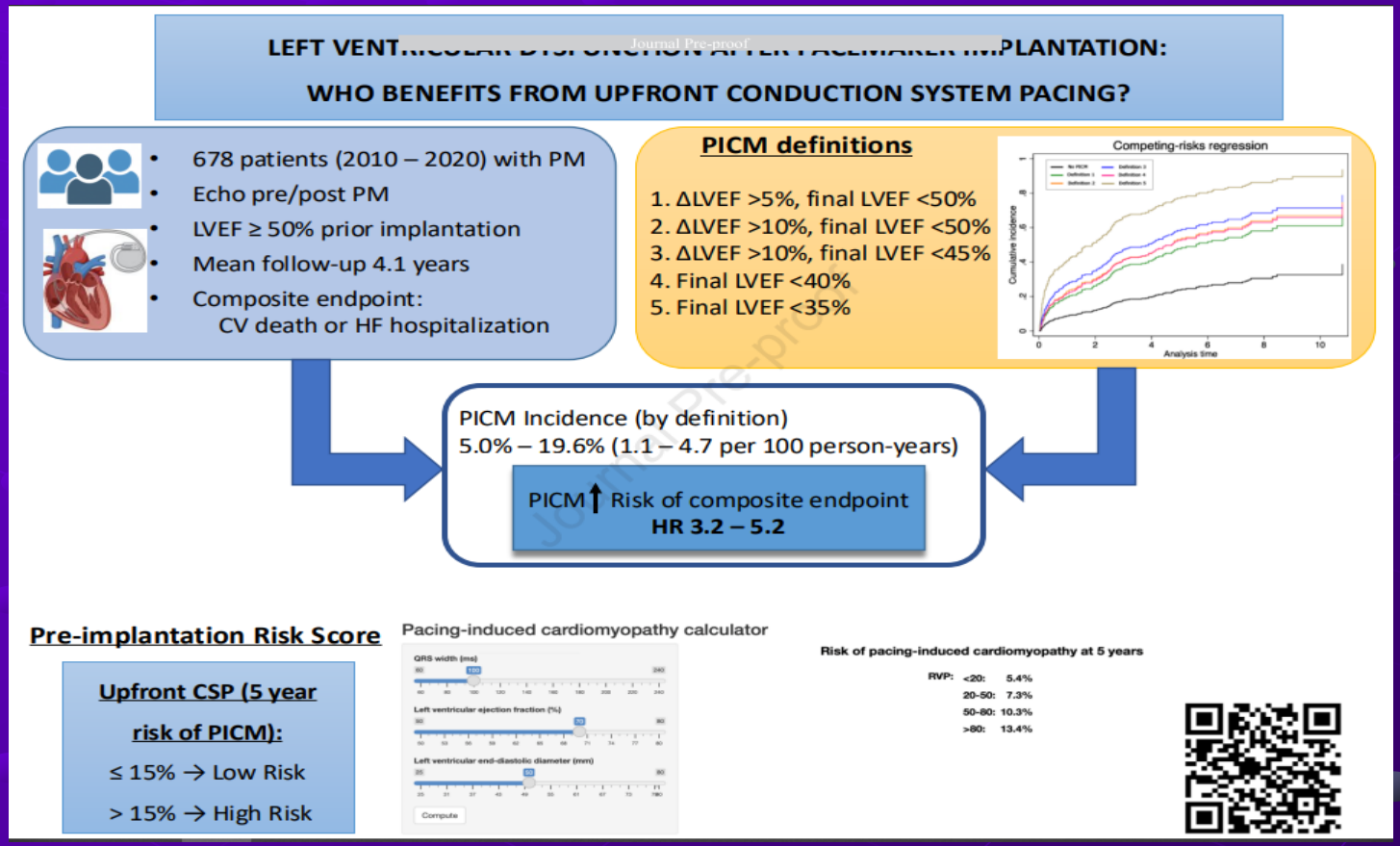
MEDICAL RESEARCH PROJECT

PROTECT-UP: Physiological versus Right ventricular pacing Outcome Trial Evaluated for bradyCardia Treatment Upgrades

Evaluating the benefits of modern pacemakers

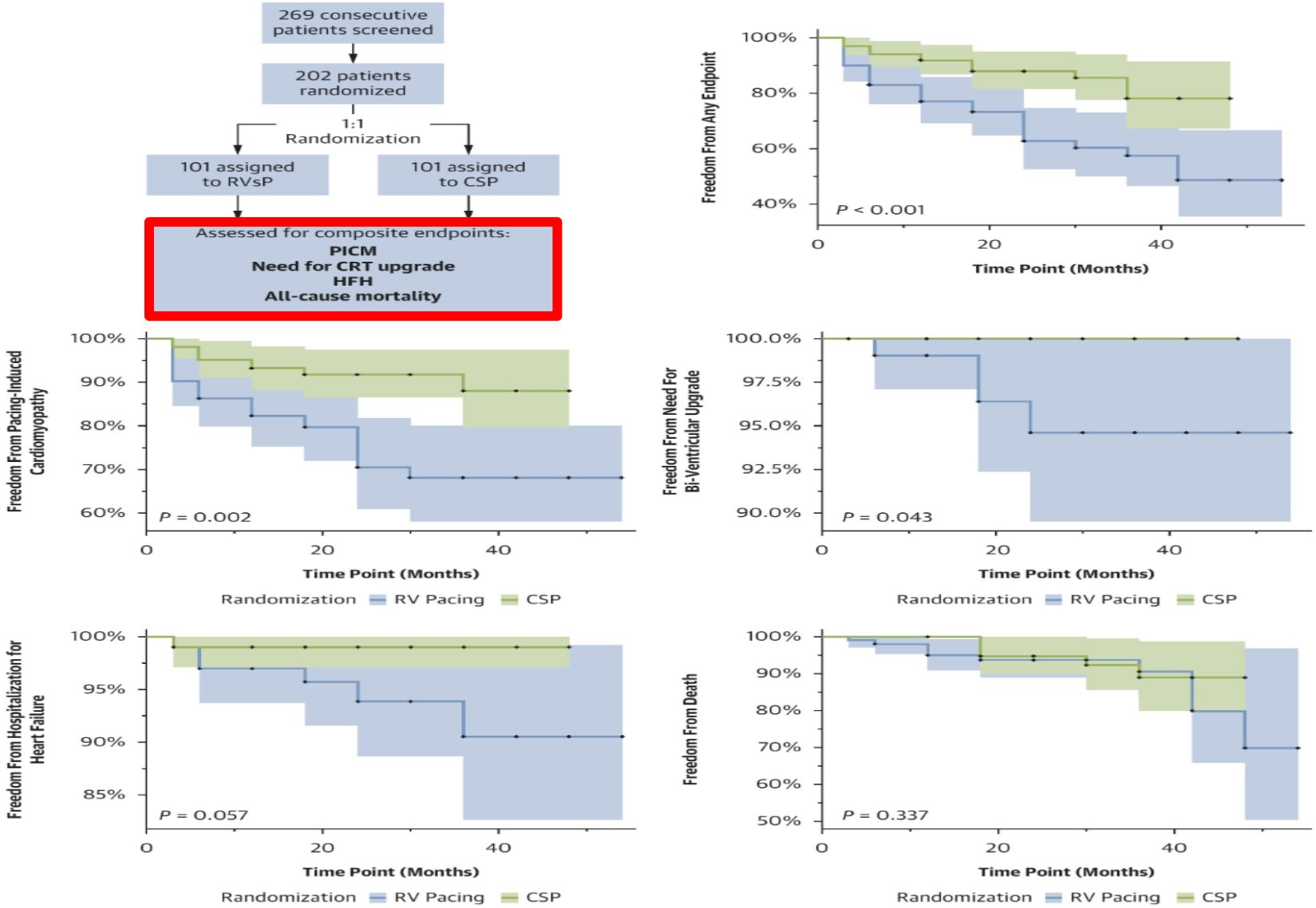
CSP UPGRADE study prebieha

Left ventricular dysfunction after pacemaker implantation: who could benefit from upfront conduction system pacing?



Torres J.L. et al. Heart Rhythm in press

CENTRAL ILLUSTRATION: The CSPACE Trial: Clinical Outcomes of CSP vs RVsP in Atrioventricular Block



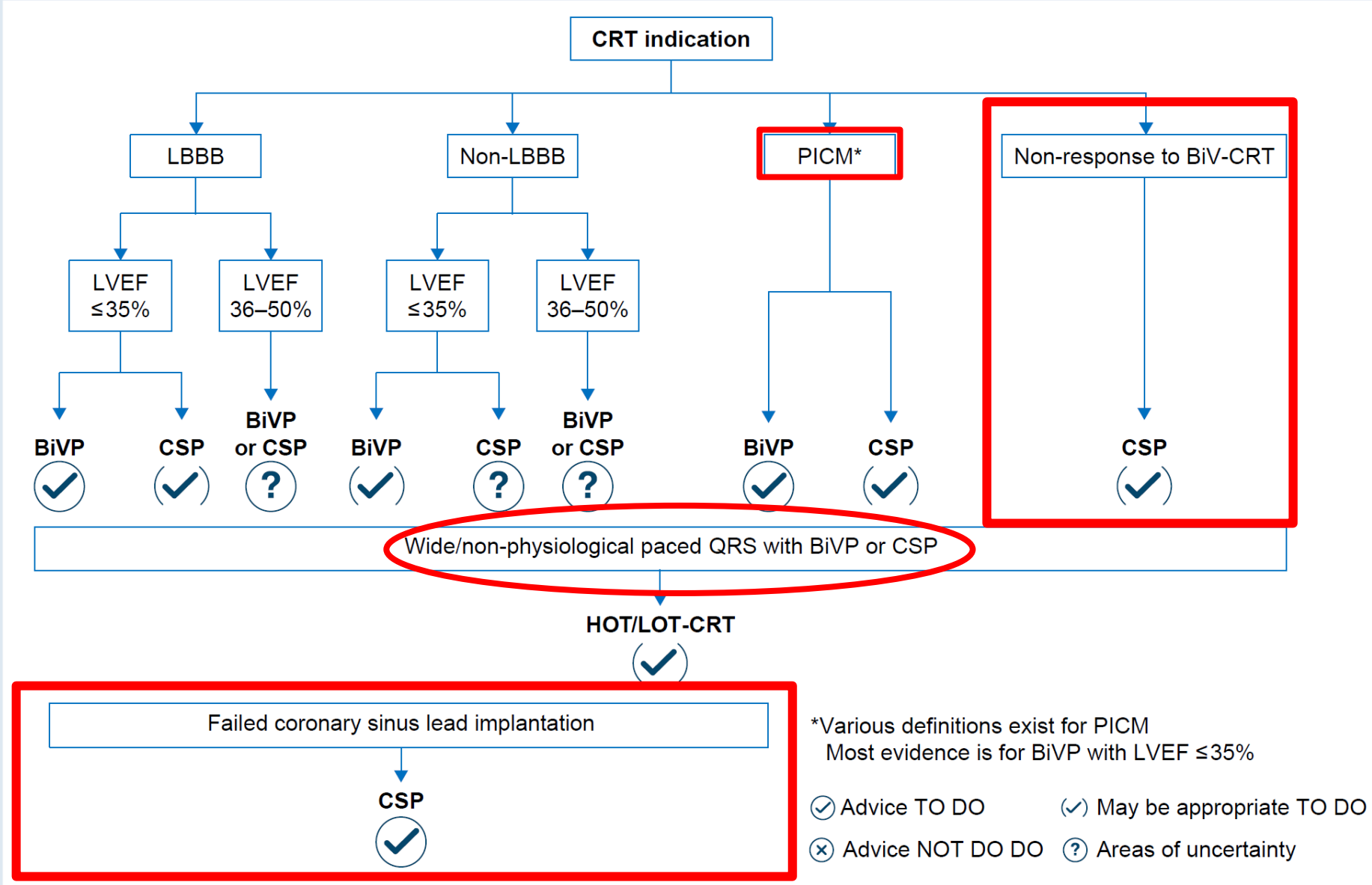
Conclusion: In patients with AV block, CSP resulted in a lower incidence of composite endpoint, primarily driven by lower PICM and need for biventricular CRT upgrade, at the expense of higher requirement for lead revision compared to RVsP. There was no difference in HFH or mortality. This RCT supports the broadening of the indication of CSP as an upfront pacing technique for pacemaker implantation in patients with AV block.

Chow CL(Dominic), et al. JACC. 2025;86(8):563–573.

Odporúčania k UPGRADE na CSP

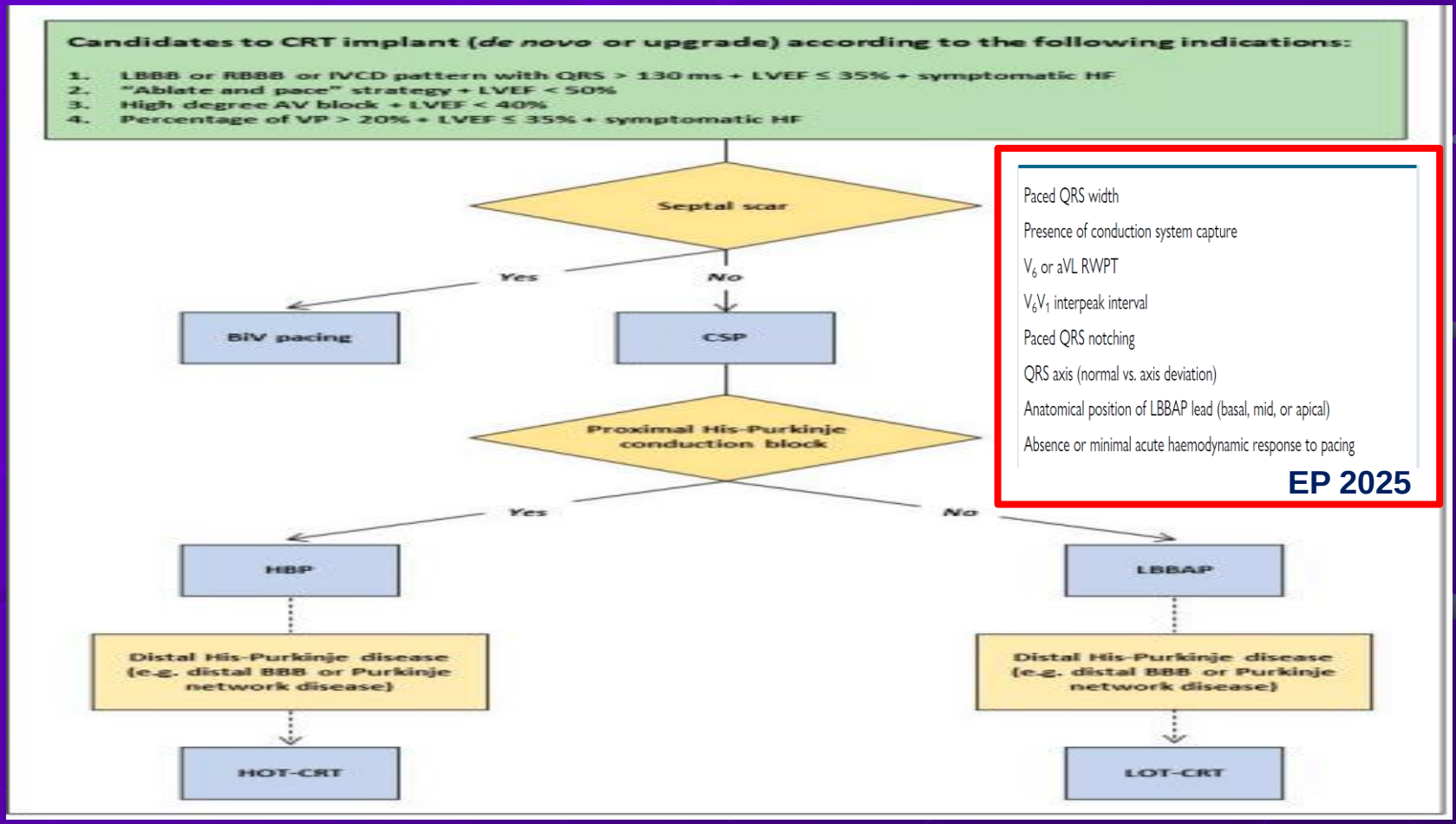
- Pravidelné kontroly KS/ICD počas životnosti s osobitným dôrazom na posúdenie upgrade pred výmenou
- Pravidelné kontroly symptómov SZ, ECHO kg, biomarkerov, podielu komorovej stimulácie, natívneho rytmu, rizika infekcie a stupňa krehkosti
- Ideálny pac. na UPGRADE na CSP pri PICMP má úzky QRS nat. rytmu! Očakávame zlepšenie symptómov SZ a ECHO parametrov
- Pri upgrade je žiadúce zapojiť všetky elektródy do prístroja (MRI kondic.)

EHRA 2025



Glikson et al.2025

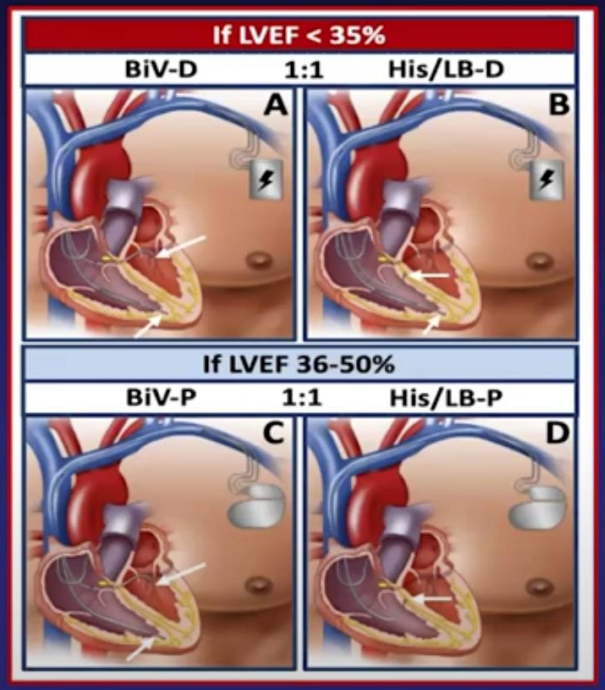
Ako postupovať pri „komplexných scenároch“?



J. Clin. Med. **2023**, *12*, 6288. https://doi.org/10.3390/jcm12196288

Left vs Left RCT

Co-PIs: Mihail G. Chelu and Kenneth A. Ellenbogen



2136 patients
55 US and 10 Canada

LVEF ≤35% vs. 36-50%
LBBB vs non-LBBB

Primary outcomes

Efficacy
Death + HFH

Safety
% Complications

Strauss criteria:

- QRSd>140 ms (men) or 130 ms (women)
- QS or rS in leads V1, and V2
- mid-QRS notching or slurring in >2 of leads V1, V2, V5, V6, I, and aVL.

Take home message

- V čase výmeny EIG treba prehodnotiť indikáciu elektroimpulzoterapie- zvážiť UPGRADE
- Upgrade na CSP sa má zvážiť u pacientov s vývojom PICMP
- Upgrade na CSP sa má zvážiť u pacientov po neúspešnej implantácii CRT alebo pri novej AV prevodovej poruche vrátane dlhého AVB I, významnom rozšírení QRS
- Upgrade na CSP sa môže zvážiť **u kandidátov ablácie AV uzla**, najmä v skupine starších pacientov s permanentnou FP významne symptomatických hospitalizovaných pre SZ
- Upgrade na CSP sa môže zvážiť u non responderov na CRT
- Upgrade na CSP patrí do skúseného centra
- Presné postavenie jednotlivých stratégií nám určia RKŠ

Ďakujem za pozornosť