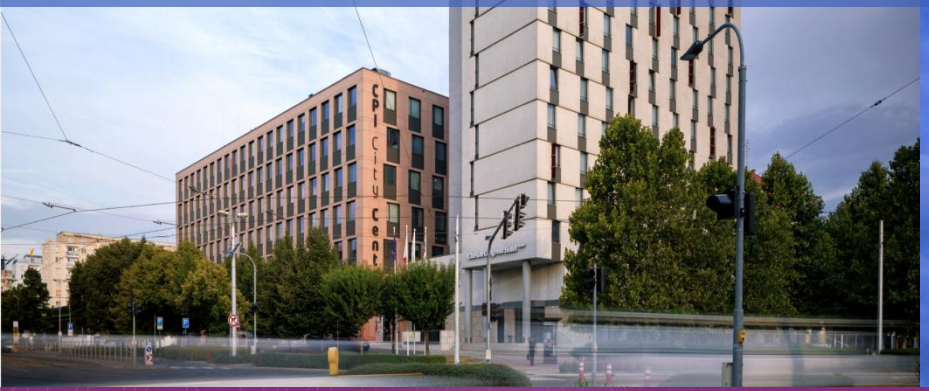
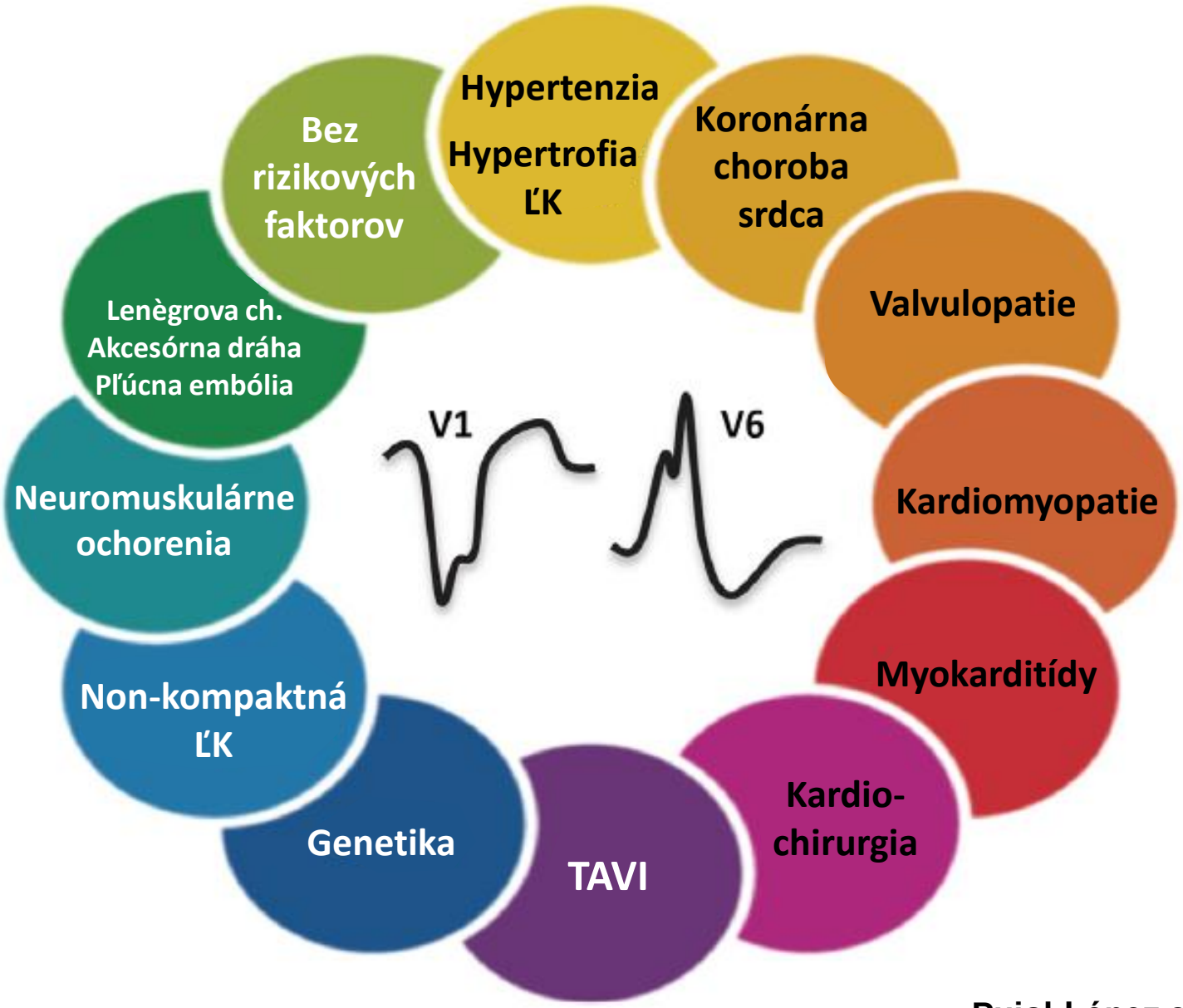
Asymptomatický blok ľavého Tawarovho ramienka



Martin Svetlošák

Klinika arytmológie LFUK a NÚSCH , Bratislava

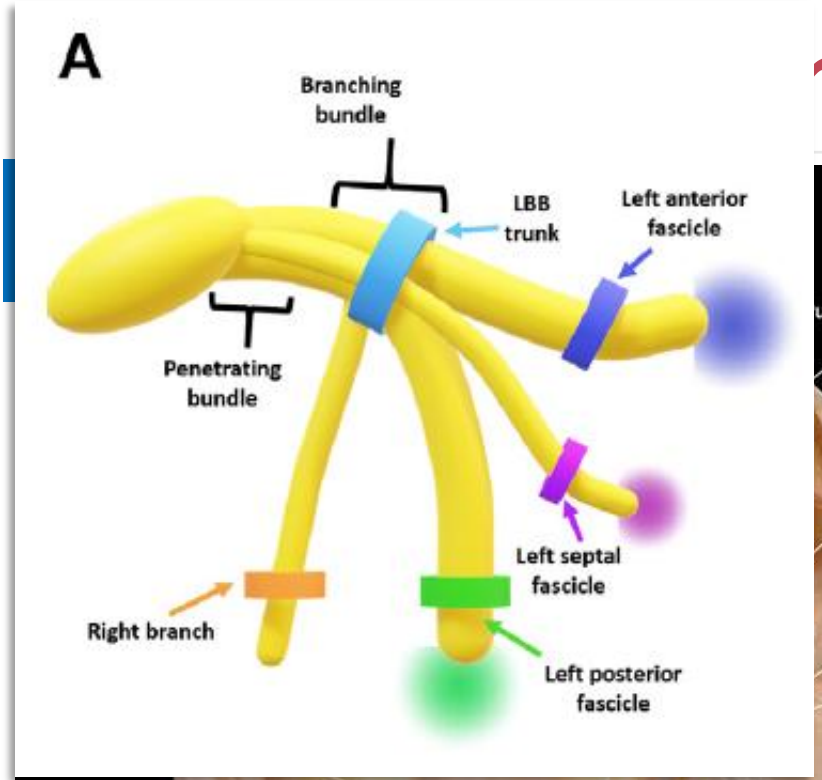
Blok ľavého Tawarovho ramienka

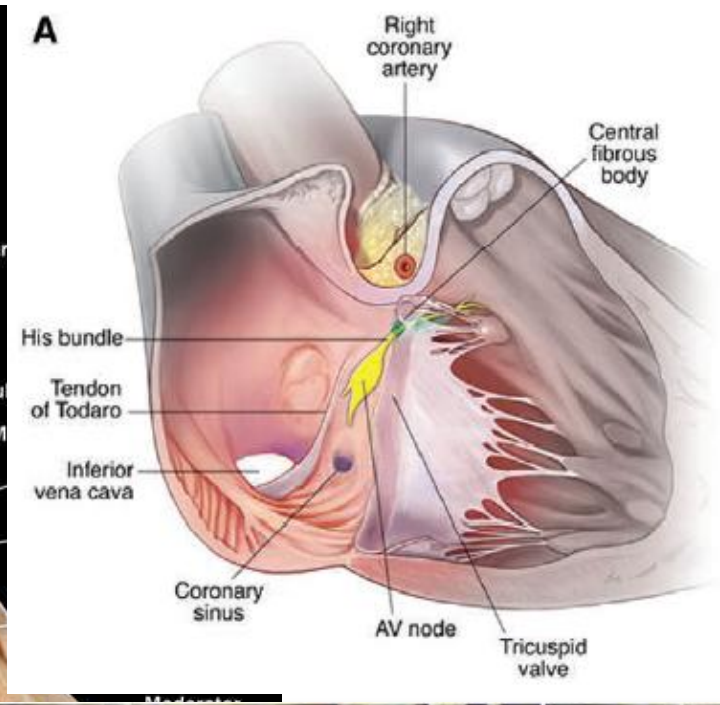


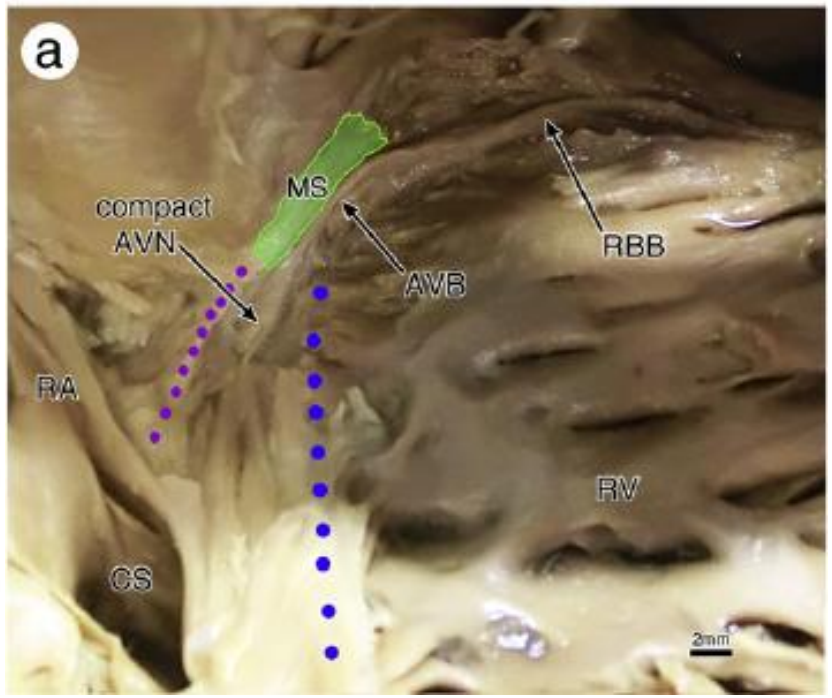
- **často súčasne štrukt. ochorenie prevodového systému / srdca**
- **Incidencia:**
  - muži 3,2 /10 000 ročne (ϕ 69±10r)
  - ženy 3,7 /10 000 ročne (ϕ 68±11r)
  - rastie s vekom
- **Prevalencia:**
  - 0,1 – 0,8 % asymptomatickí dospelí
  - 1% vo veku 50 rokov
  - 6% vo veku 80 rokov
  - zriedkavo pod 35 rokov

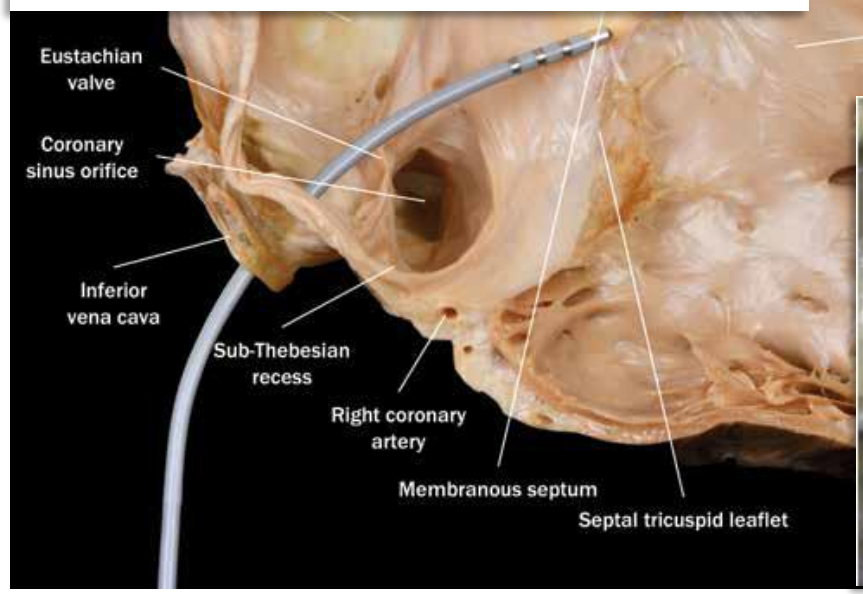
Pujol-López et al., *Cardiac electrophysiology clinics 2021*, 13 (4): 671-84.

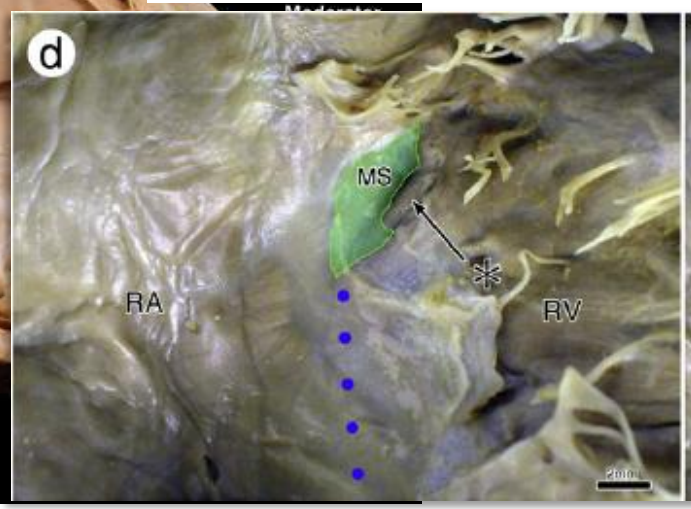
ia – AV uzol a Hisov zväzok

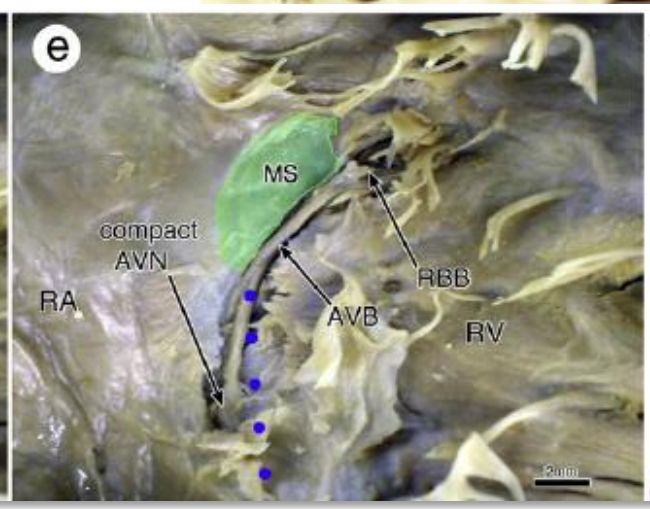


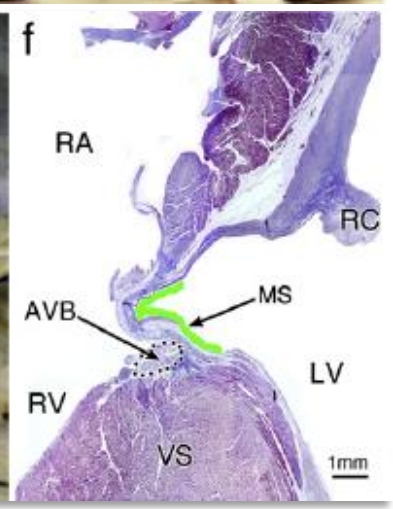






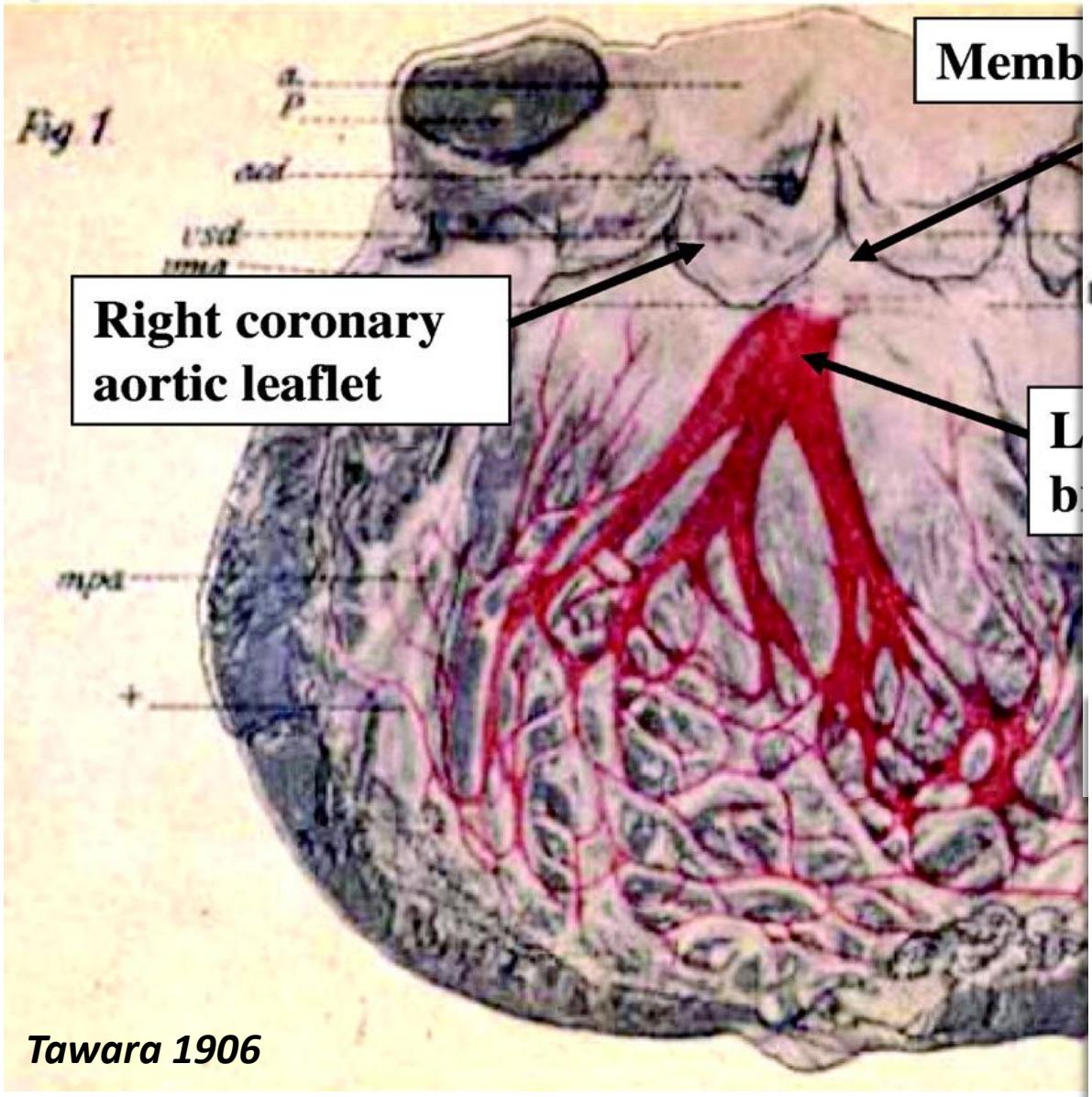


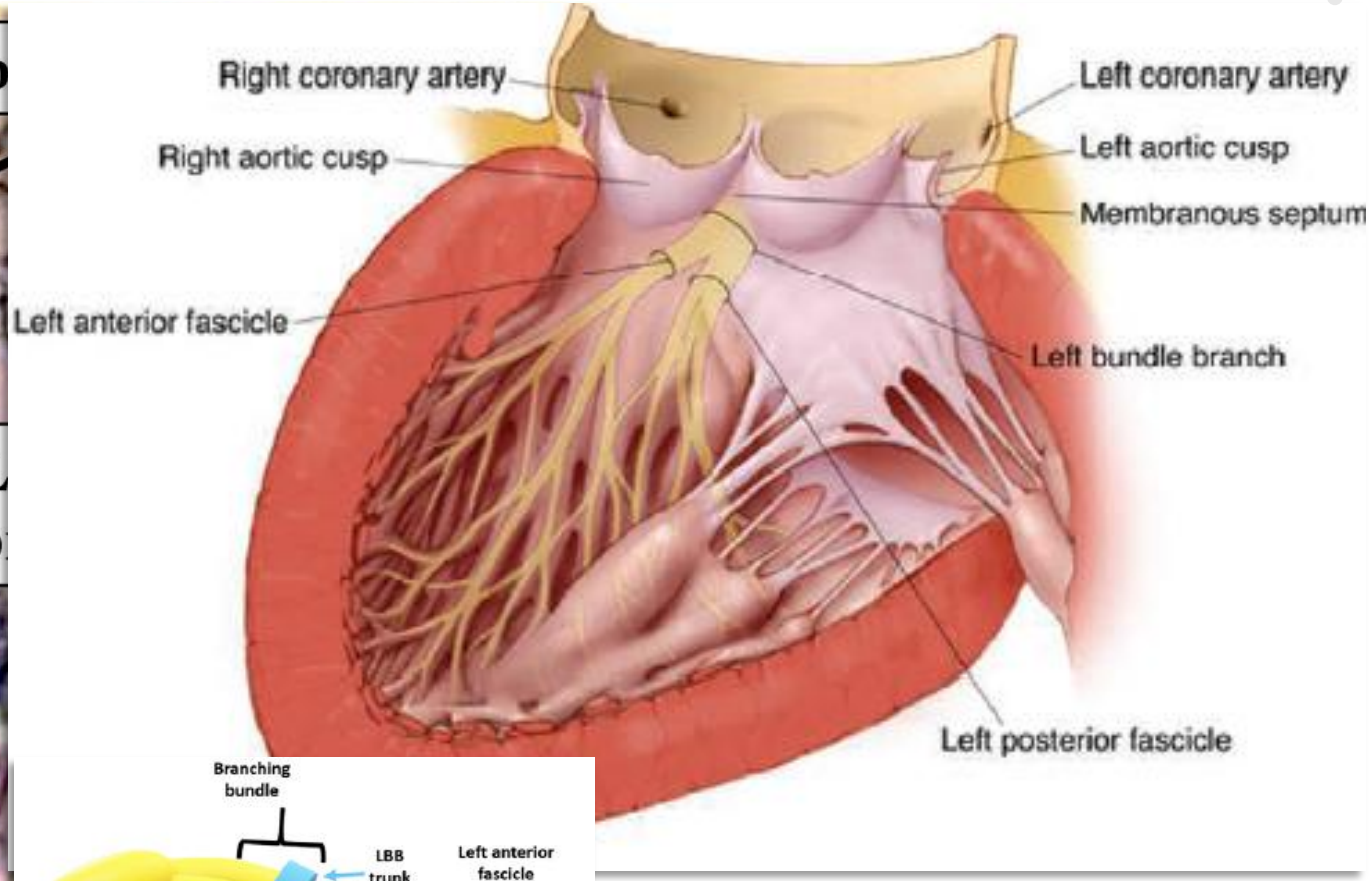


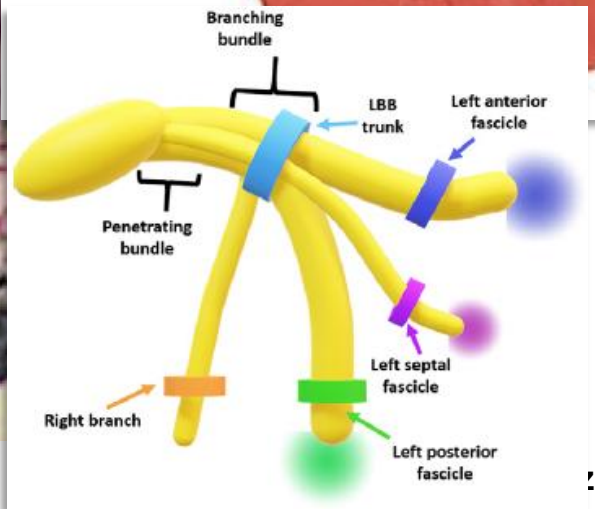


Mori et al., *Atlas of Cardiac Anatomy 2022*., **Tan et al.**, *Circ. Arrh. Electr. 2020*, 13 (4): e008239.**Kawashima et al.**, *Int. J Card. 2014*, 174 (1): 1-6.

Anatómia – Ľavé Tawarovo ramienko

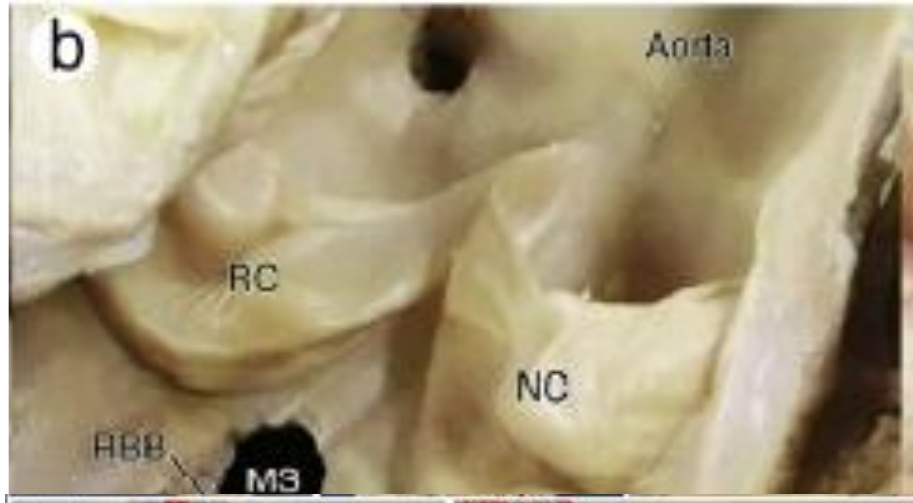


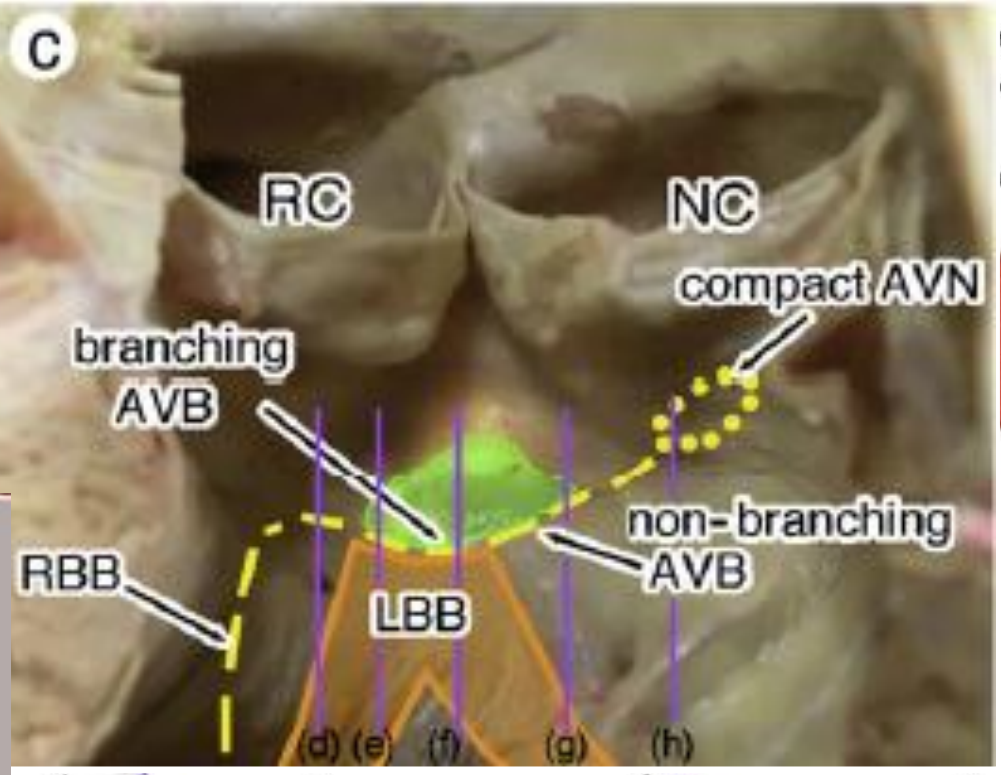


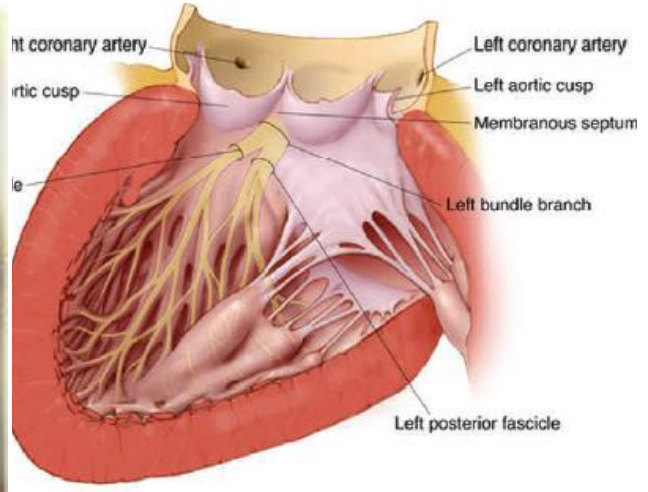


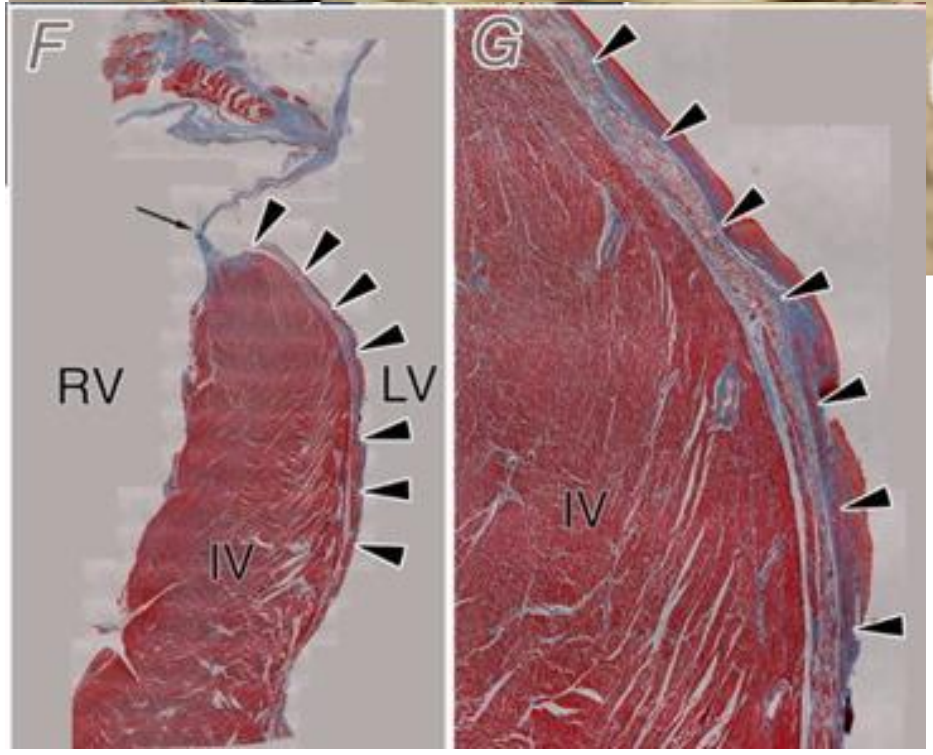
Tan et al., *Circ.Arrh.Electr. 2020*, 13(4)
Kawashima et al., *Int.J.Card. 2014*, 174(1):1-6.
: et al., *Card. Electroph. Clin.2021*, 13(4):671-84.

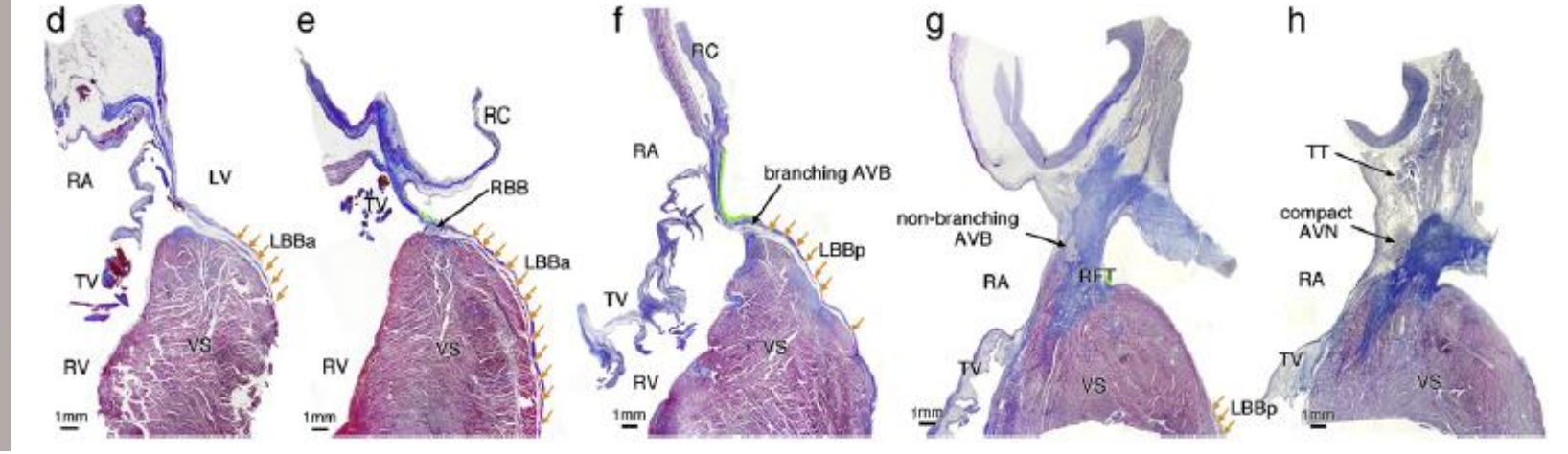
Anatómia – Ľavé Tawarovo ramienko











Tvorba a prevod vzruchov

- **SA uzol → internodálne dráhy:**

  predná (Jamesov trakt), stredná (Wenckebachov trakt), zadná (Thorelov trakt) → AV uzol

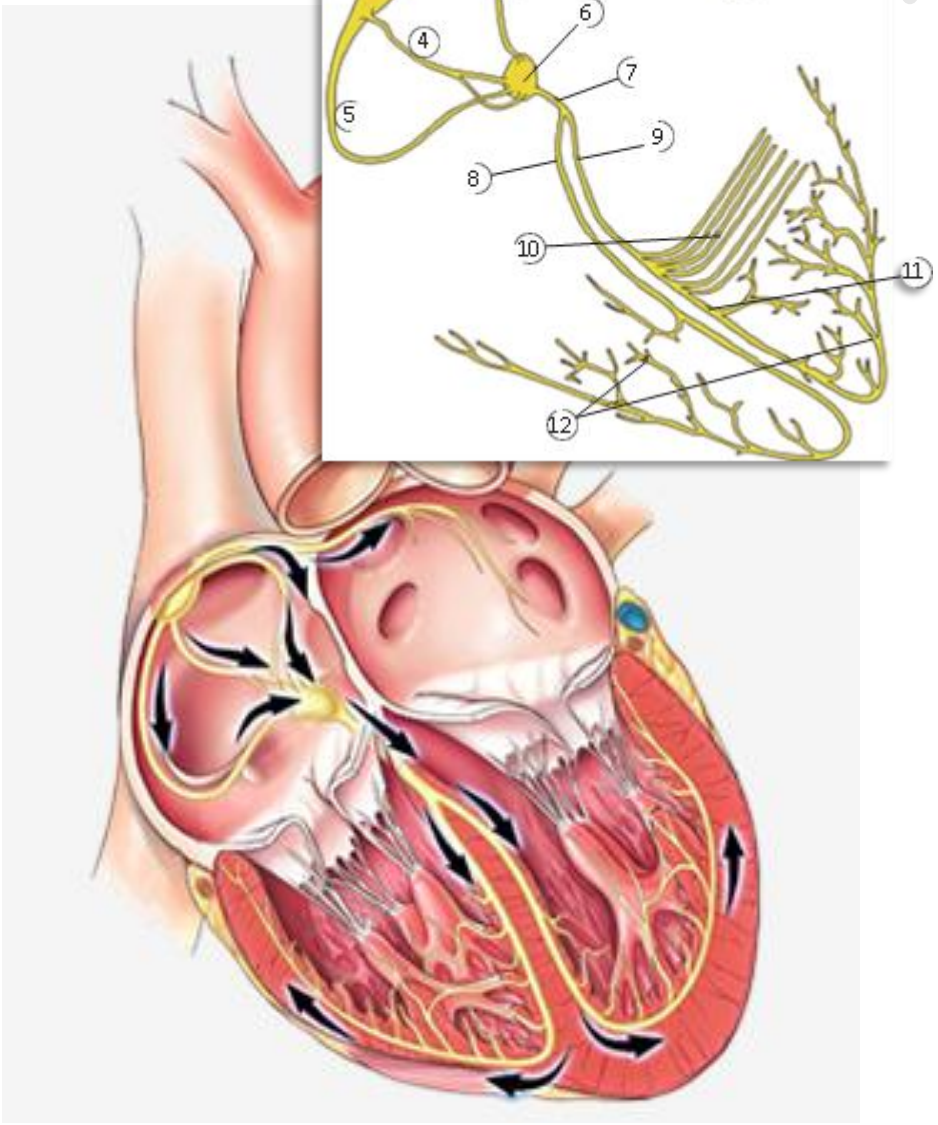
- **PTR + ĽTR → Purkyňové bunky**

- **Bunky prevodového systému**

  - vedú impulz ~ 6x rýchlejšie ako pracovný myokard (1,2 - 4 ms^{-1} vs. 0,3 - 1 ms^{-1})[1]
  - sú schopné automaticity:

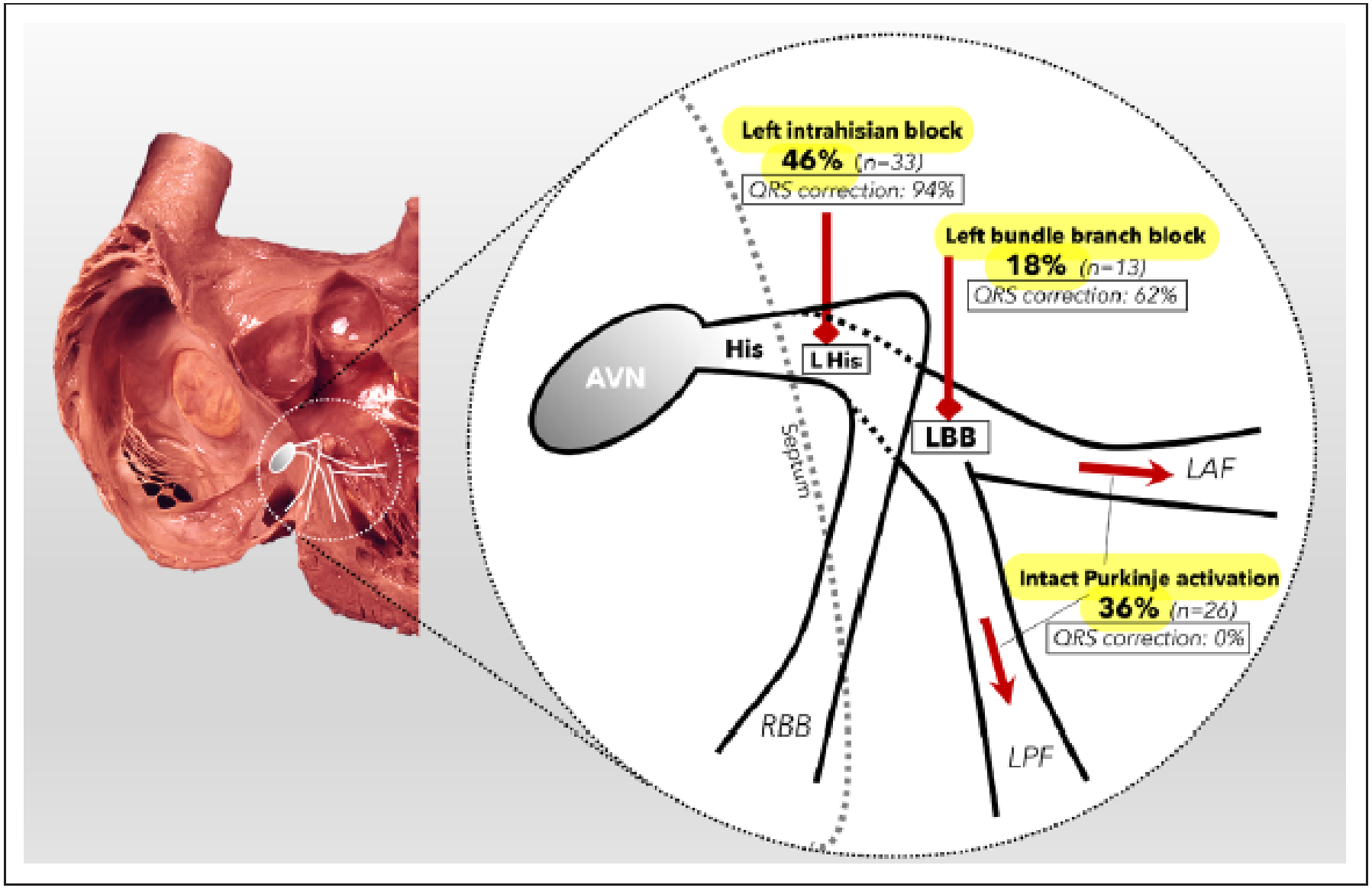
    AV uzol: 40-55/min

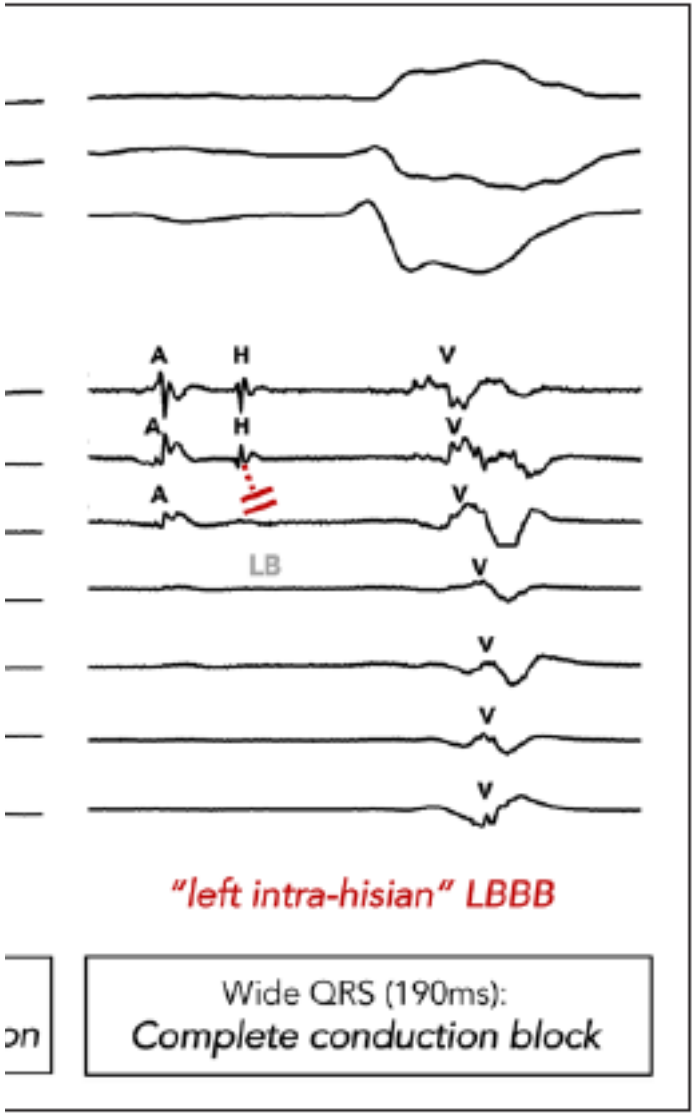
    Tawarove ramienka: 25-40/min



1) Physiology of the Heart, 3rd edition. Philadelphia: Lippincott, Williams, and Wilkins, 2001.

Miesto bloku pri KBĽTR (intrakardiálna aktivácia)

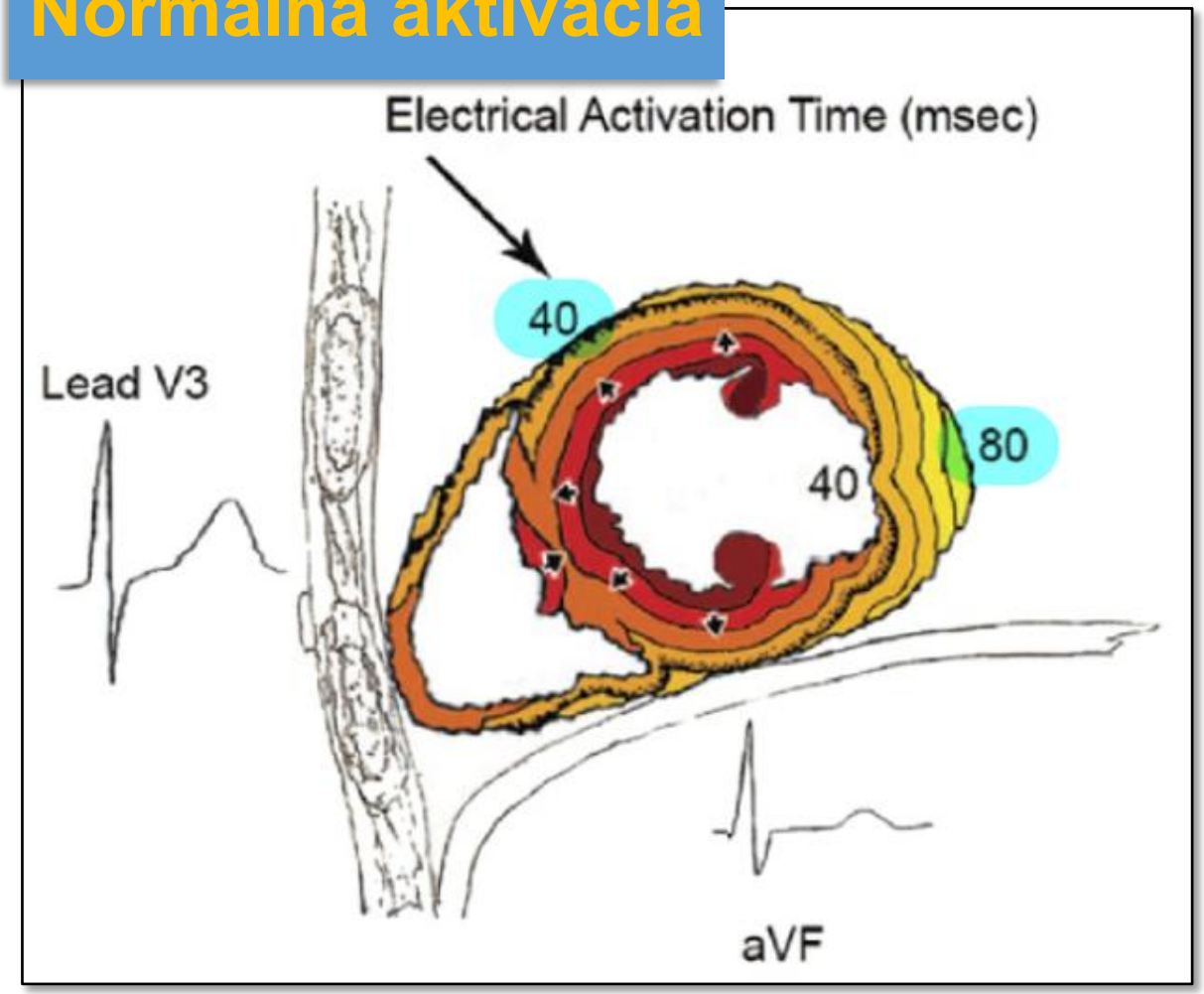




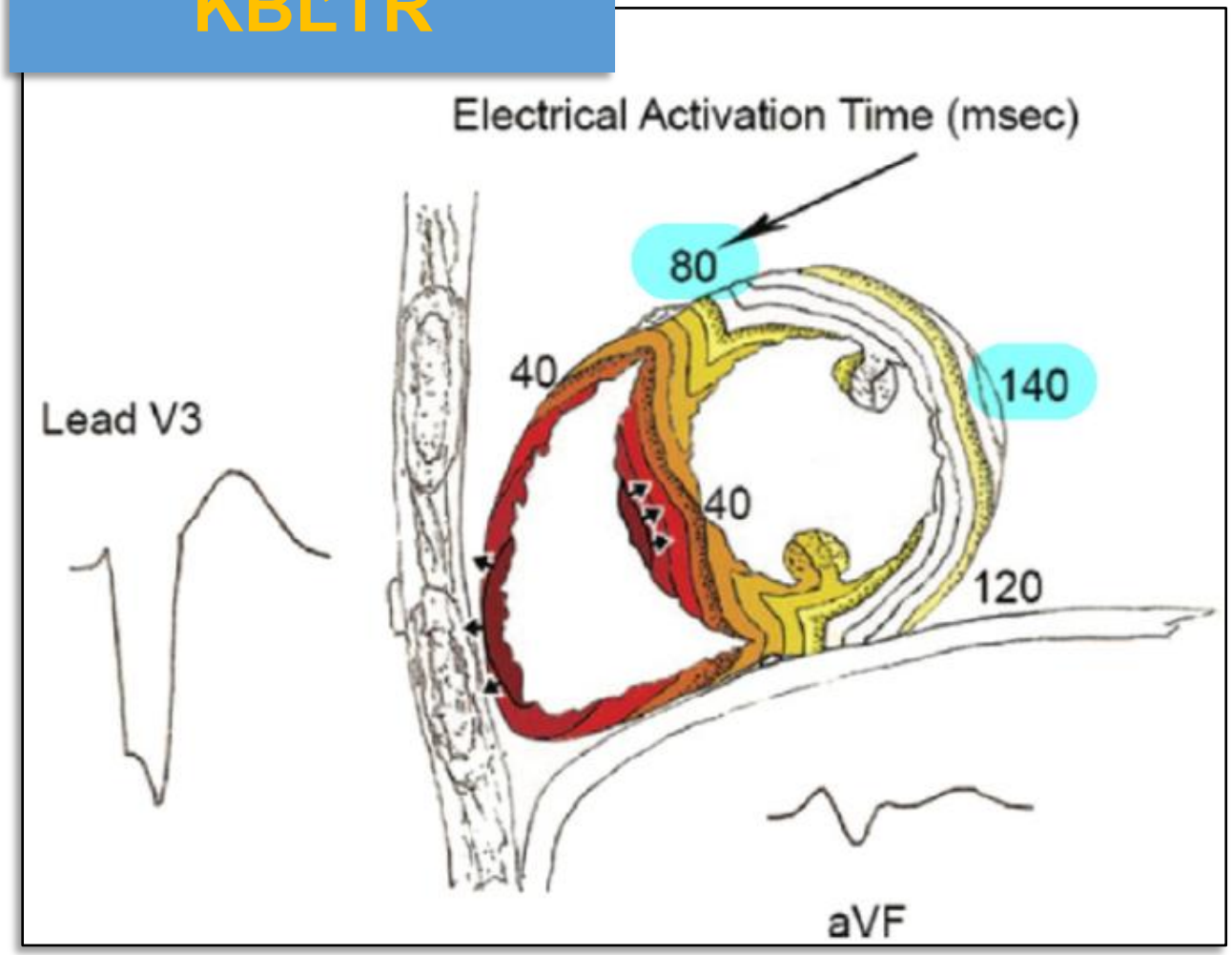
Upadhyay et al., *Circulation 2019*, 139 (16): 1876-88.

Šírenie elektrickej aktivácie srdca

Normálna aktivácia

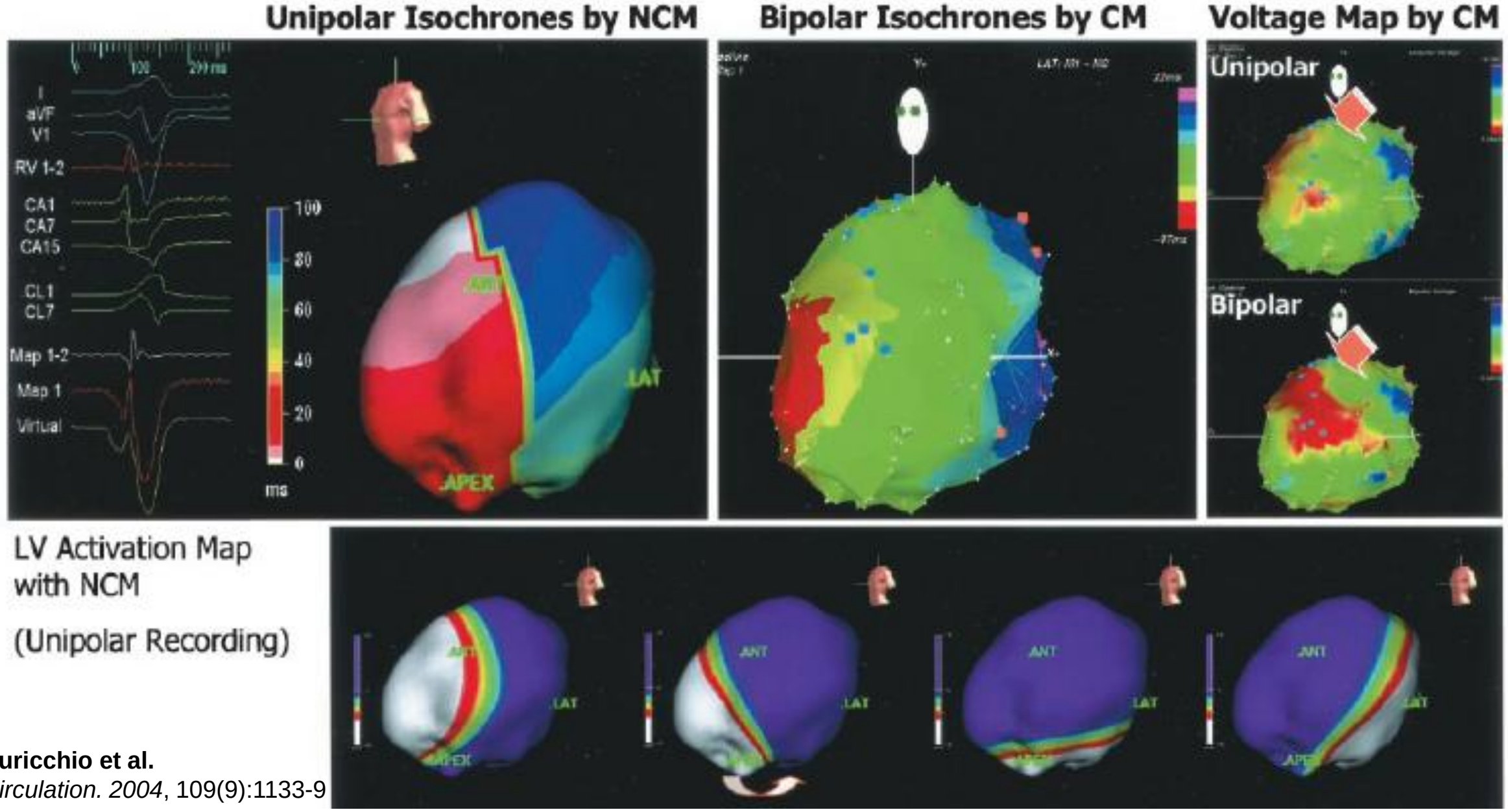


KBĽTR



Strauss et al., *Am J Cardiol 2011*, 107 (6): 927-34.

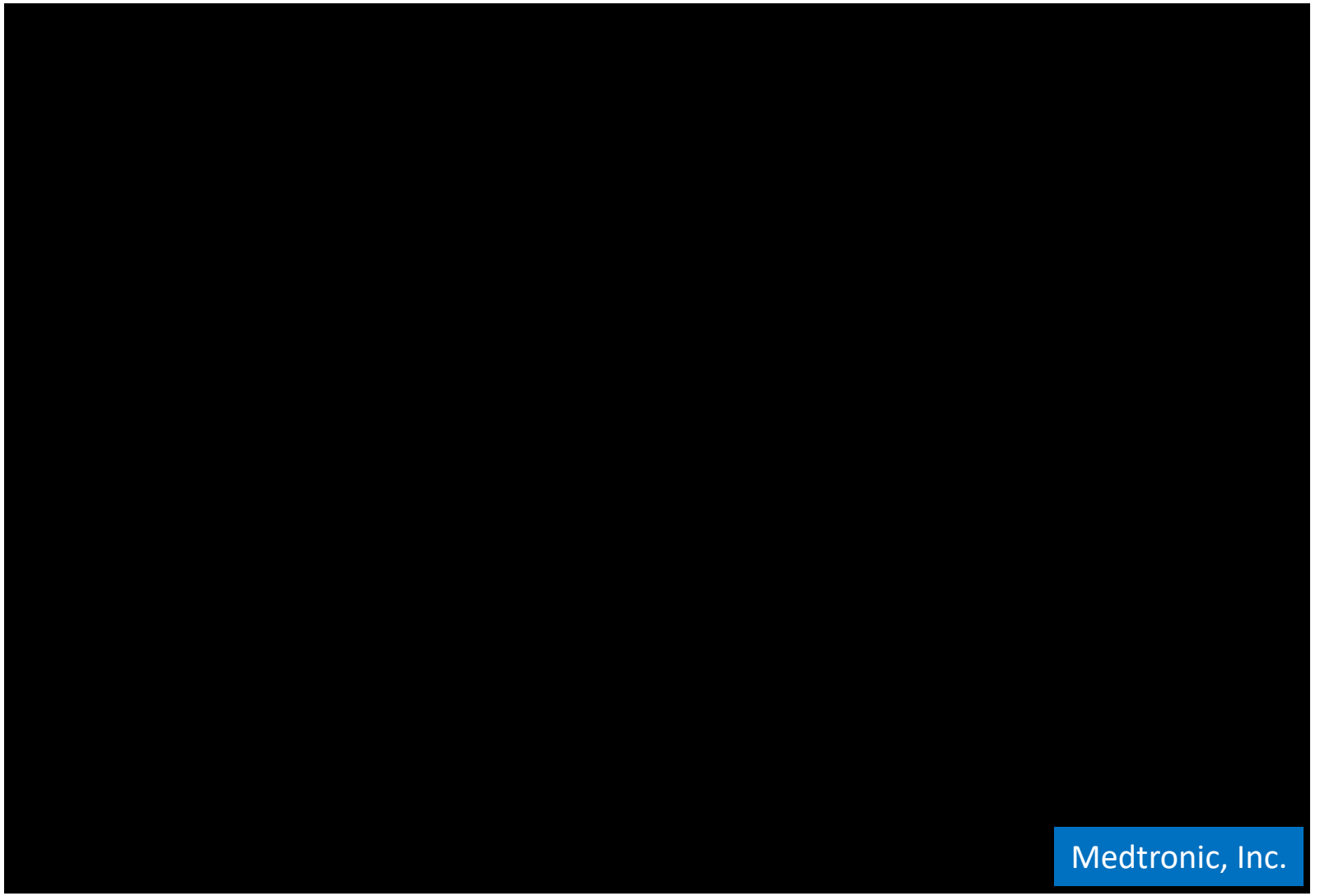
Šírenie aktivácie pri KBĽTR (intrakardiálna aktivácia)



Auricchio et al.
Circulation. 2004, 109(9):1133-9

Komorová dysynchrónia – hemodynamické dôsledky

- oneskorená depolarizácia LS
- paradoxný pohyb IVS & strata podielu IVS na EF
- postsystolická kontrakcia niektorých segmentov
- ↓ diastolického času plnenia (DFT)
- ↓ kontraktilita
- ↓ tlak v ĽK
- ↑ mitrálnej regurgitácie (MR)



↓ vývrhového objemu ĽK → progresia SZ

Komorová dyssynchrónia – ďalšie dôsledky

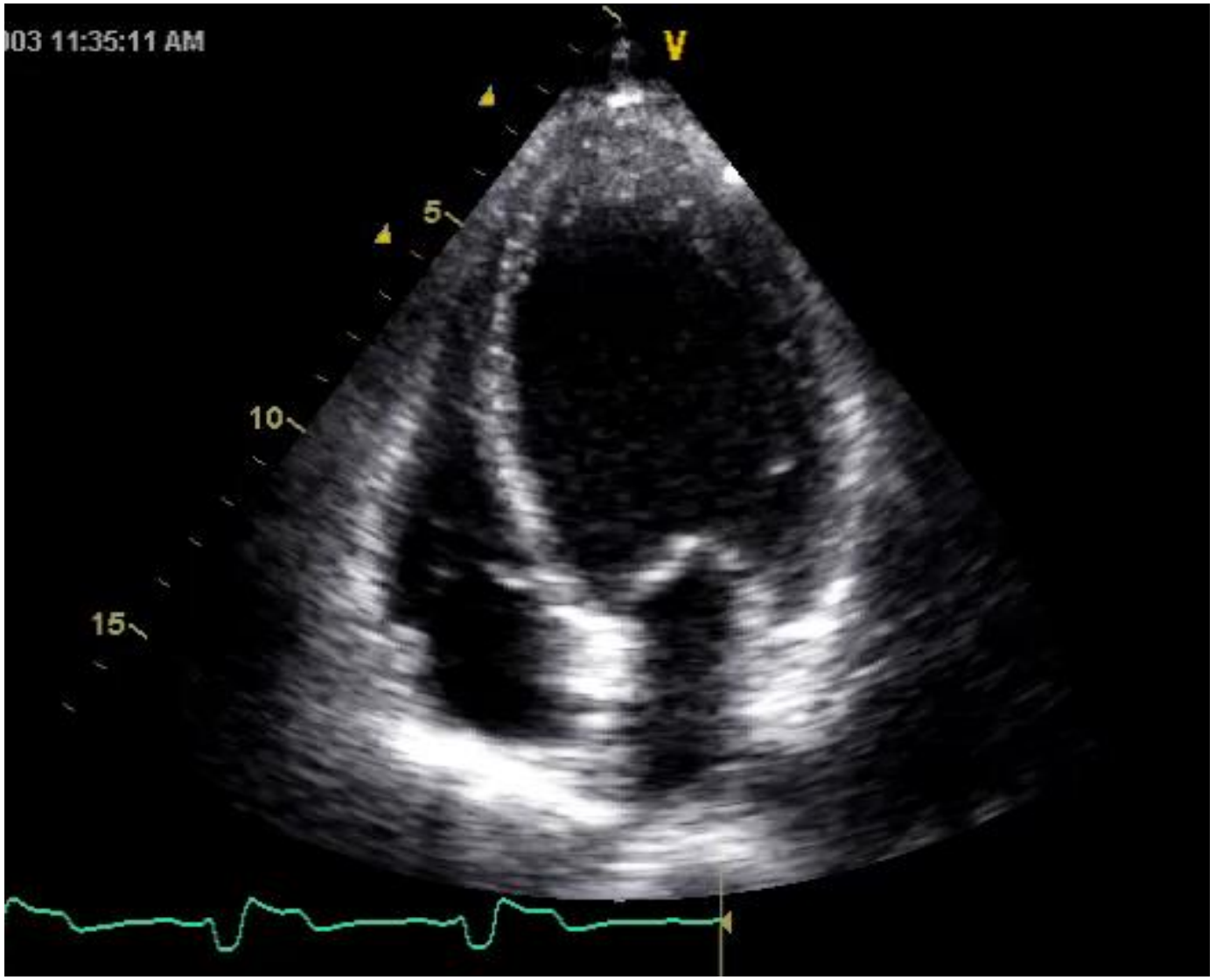
- nerovnomerné rozdelenie regionálneho pracovného zaťaženia
- chronické preťaženie laterálnej steny

↓

- regionálne zmeny perfúzie
- regionálne rozdiely v metabolizme myokardu
- zmeny expresie génov (napr. stresových kináz p38 MAPK)

↓

progresia remodelácie srdca



Vzťah medzi KBĽTR a zhoršenou prognózou pacienta

- ↑ KV morbidita
- ↑ mortalita
- ↑ náhla smrť

Natural history of left bundle-b

SIMON W RABKIN, FRANCIS A L MATHEV

From The University of Manitoba Followup Study: Departme
Social and Preventive Medicine, University of Manitoba

SUMMARY The purpose of this study was to examine f
complete left bundle-branch block and the prognosis in a
clinical evidence of ischaemic or valvular heart disease. Tw
without clinical evidence of ischaemic heart disease were noted in the Man
under observation since 1948. The most frequent electrocardiographic findi
left bundle-branch block was a normal electrocardiogram; left ventricular hype
was the only abnormality significantly more common than in the rest of the
of left bundle-branch block was associated with distinct leftward shift of the frontal plane mean QRS
axis. The most frequent clinical cardiovascular event observed after development of the block was
sudden death without previous clinical evidence of ischaemic heart disease. The five-year incidence
of sudden death as the first manifestation of heart disease was 10 times greater in men with left bundle-
branch block than in those without it.

Natural History of Isolated Bundle Branch Block

Gerard J. Fahy, MB, Sergio L. Pinski, MD, Dave P. Miller, MS, Noeleen McCabe, RGN, Carol Pye, RGN, Michael J. Walsh, MD, and Killian Robinson, MD

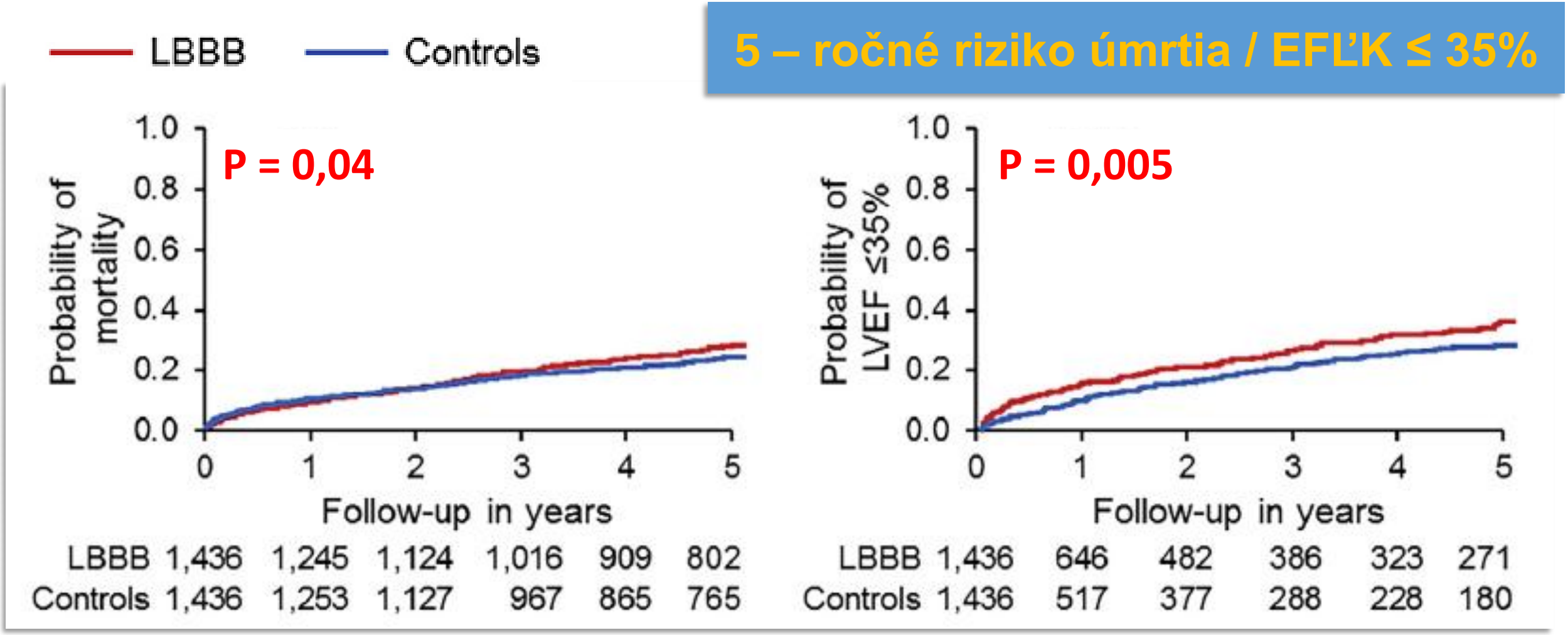
The purpose of this study was to determine the long-term outcome of patients with bundle branch block (BBB) who have no clinical evidence of cardiovascular disease. Among 110,000 participants in a screening program, 310 subjects with BBB without apparent or suspected heart disease were identified. Their outcome after a mean follow-up of 9.5 years was compared with that of 310 similarly screened age- and sex-matched controls. Among the screened population, isolat
than isolated left
<0.001), and the
creased with age
was no different for those with left BBB or right BBB and their respective controls. Cardiac mortality, however, was increased in the left BBB group when compared with their controls (p=0.01, log rank test). Left BBB, but not right BBB, was associated with an increased prevalence of cardiovascular disease at follow-up (21% vs 11%; p=0.04). In the absence of clinically overt cardiac disease, the presence of left BBB or right BBB is not associated with increased overall

Vzťah KBĽTR – KMP:

- prvá zmienka Barker 1930
- koncept “latentnej KMP” - Kühn 1978

Prognóza KBĽTR pri redukovanej EF ĽK

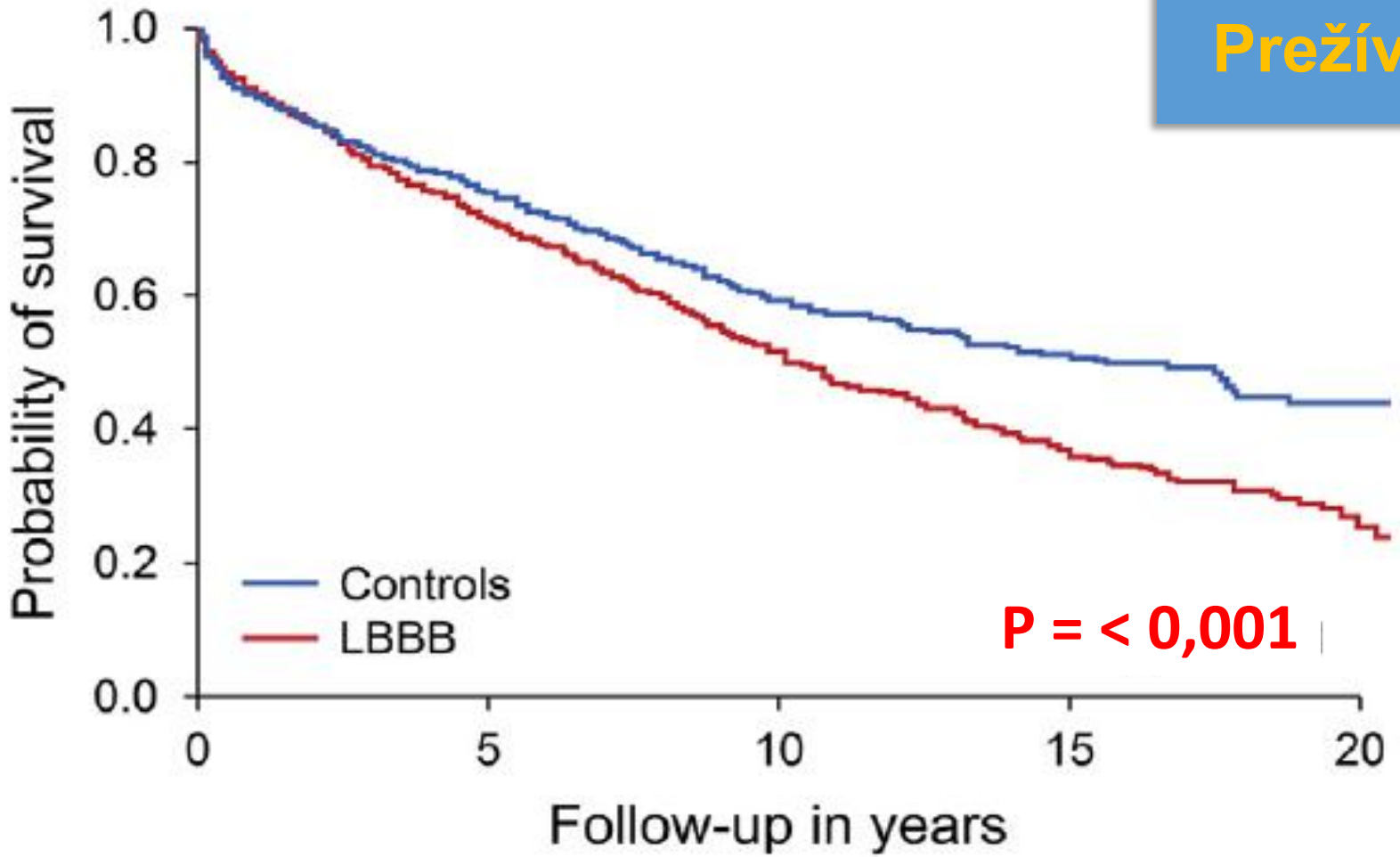
5 – ročné riziko úmrtia / EFĽK ≤ 35%



Witt et al., *JACC. Heart failure 2016*, 4 (11): 897-903.

Prognóza KBĽTR pri EF ĽK 36 – 50%

Prežívanie počas 20 rokov

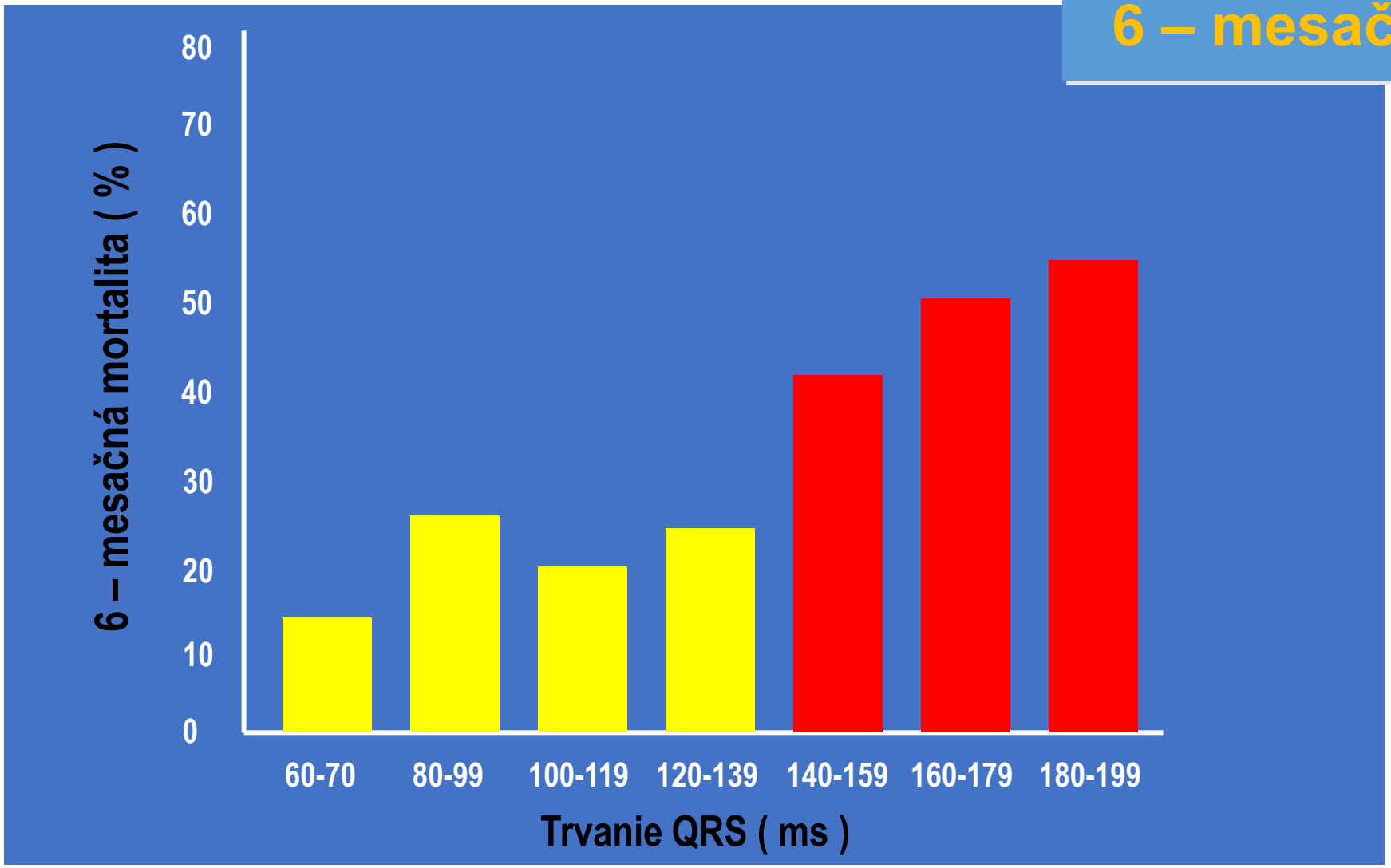


Controls	1,436	802	408	182	24
LBBB	1,436	765	351	132	17

Witt et al.
JACC. Heart failure 2016, 4 (11): 897-903.

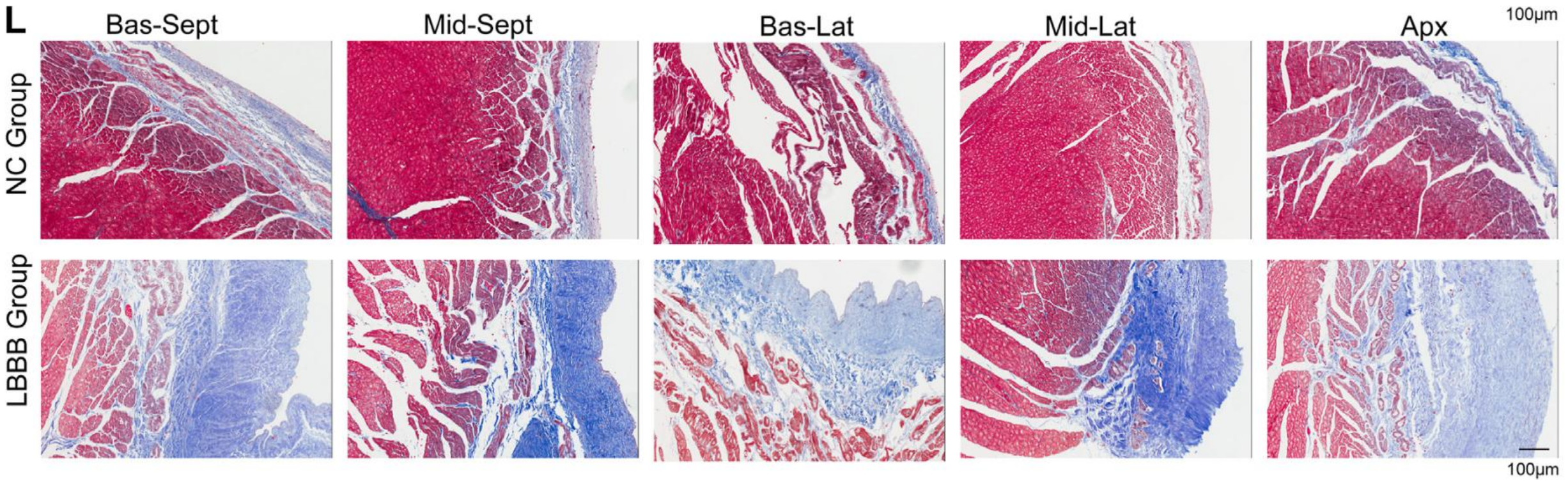
Mortalita pri SZ a poruche vnútrok. vedenia ↑ s trvaním QRS

6 – mesačná mortalita:



Shamin W. *Int J.Cardiol* 1999

Zvierací model (psy): rozvoj KBĽTR indukovanej KMP

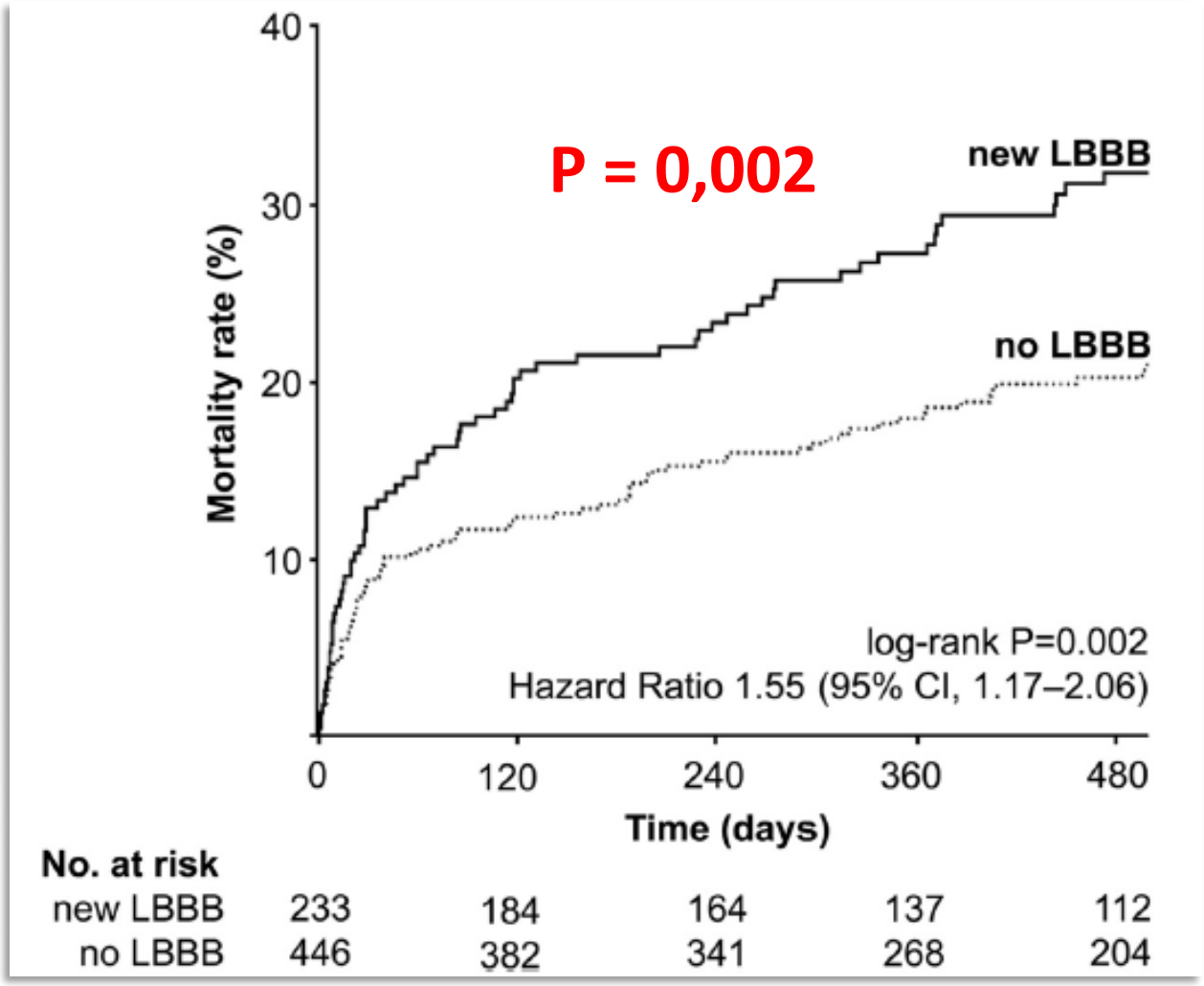


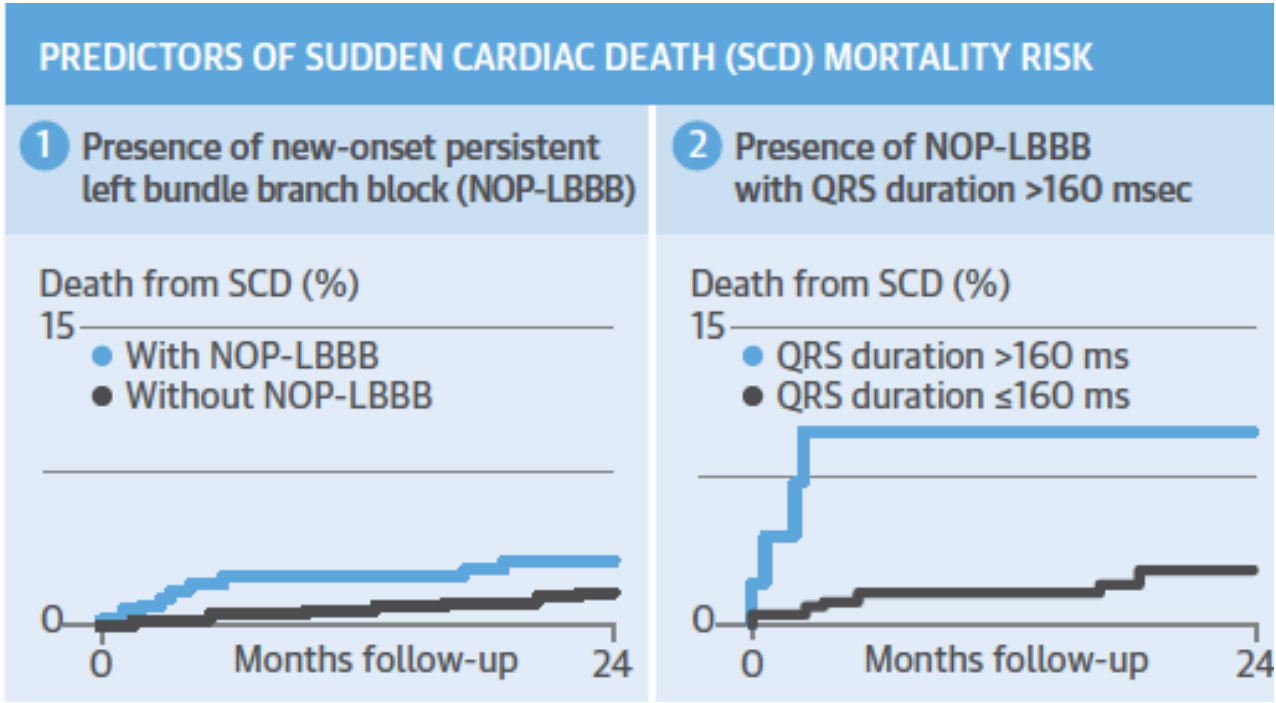
	Baseline	1st month LBBB	3rd month LBBB	6th month LBBB	12th month LBBB
LVEDV, mL	20.78 ± 1.42	20.86 ± 0.88	21.07 ± 1.11	24.86 ± 1.62	26.71 ± 2.12*
LVESV, mL	8.36 ± 0.48	8.93 ± 0.36	9.50 ± 0.59	11.50 ± 0.78**	14.14 ± 1.32**
LVEF, %	59.17 ± 1.45	56.97 ± 1.17	55.17 ± 0.84	53.79 ± 0.51*	47.69 ± 1.44**

*$P < .05$, **$P < .01$ vs baseline parameters.

Wang X. et al., *Heart Rhythm 2024*;21:1370–1379

Prognóza KBĽTR po TAVI





↑ riziko náhlej srdcovej smrti:

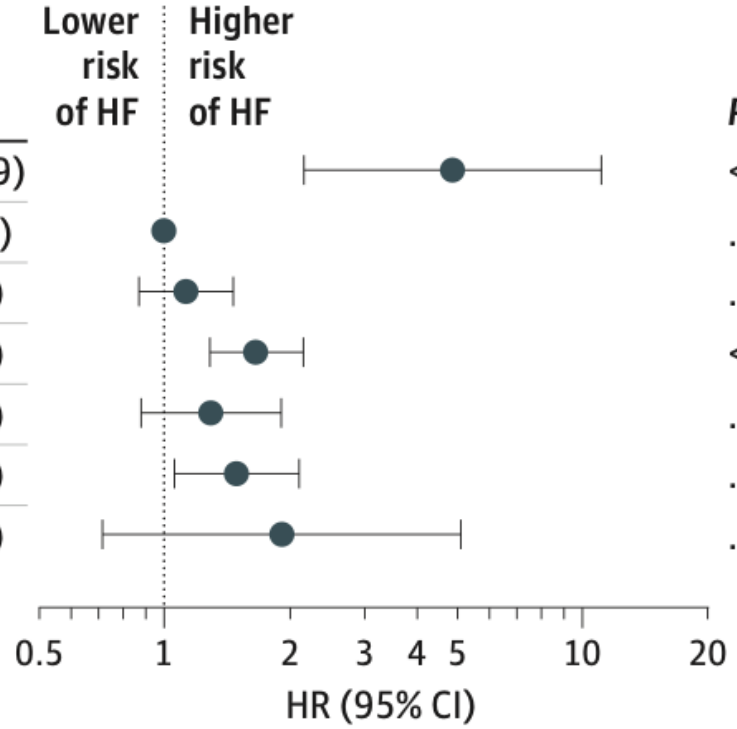
- **novo vzniknutý pretrvávjúci blok ĽTR**
- **novo vzniknutý pretrvávjúci KBĽTR a QRS >160 ms**
- **HR: 4.78, 95% CI: 1.56 to 14.63; *P* = 0.006**

Houthuizen P et al., *Circulation. 2012*; 126:720.

Urena M et al., *J Am Coll Cardiol. 2015*; 65(5):437–48.

Prognóza asymptomatického KBĽTR – rozvoj srdového zlyhávania

Risk factor	HR (95% CI)	P value
Left bundle branch block	4.98 (2.18-11.39)	<.001
Age (per 1-y increase)	0.99 (0.96-1 .02)	.38
Male	1.13 (0.87-1.47)	.36
Hypertension	1.67 (1.29-2.17)	<.001
Diabetes	1.30 (0.88-1.92)	.19
Coronary artery disease	1.50 (1.06-2.12)	.02
Atrial fibrillation	1.93 (0.71-5.21)	.20



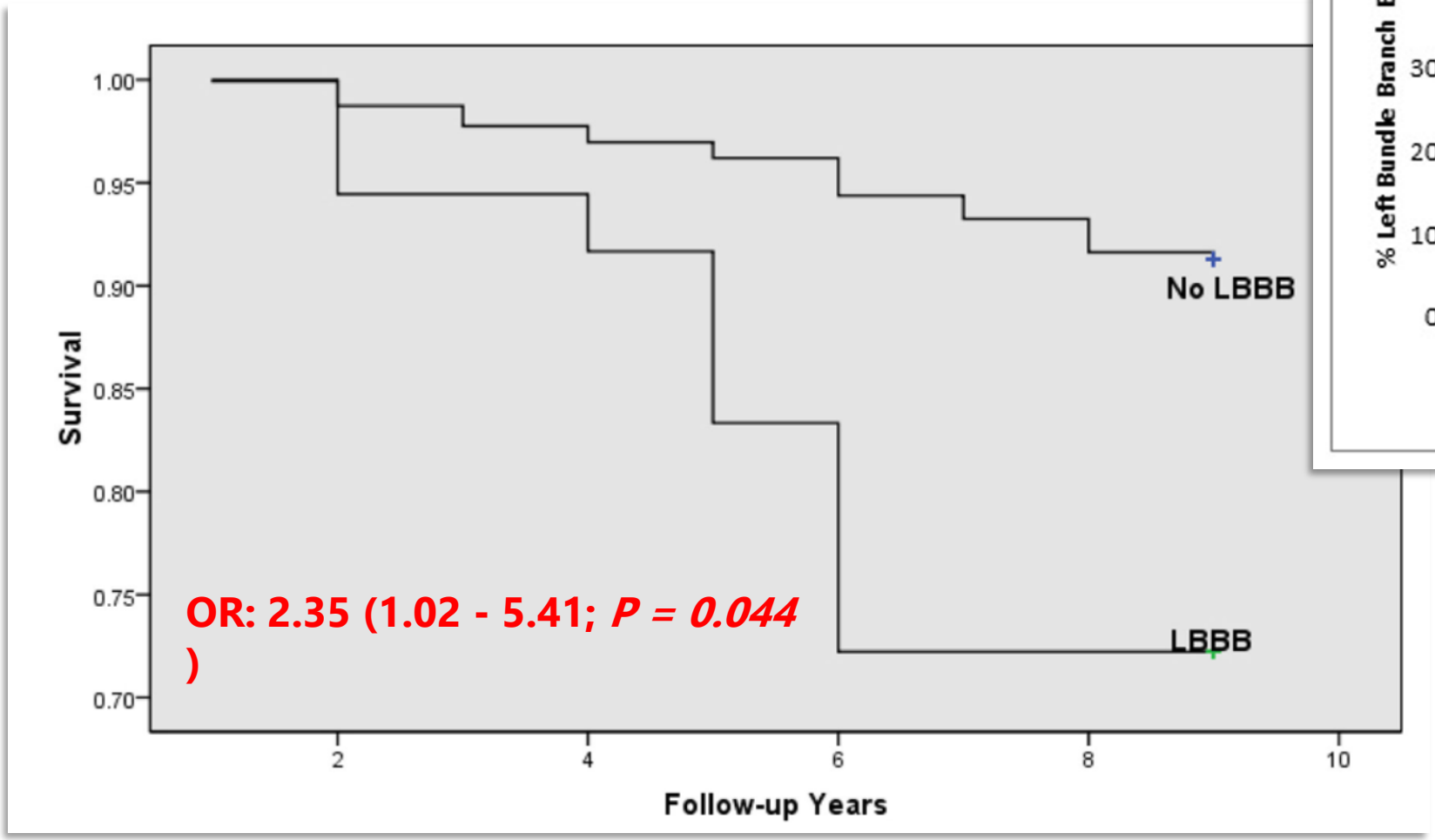
Time to event, y

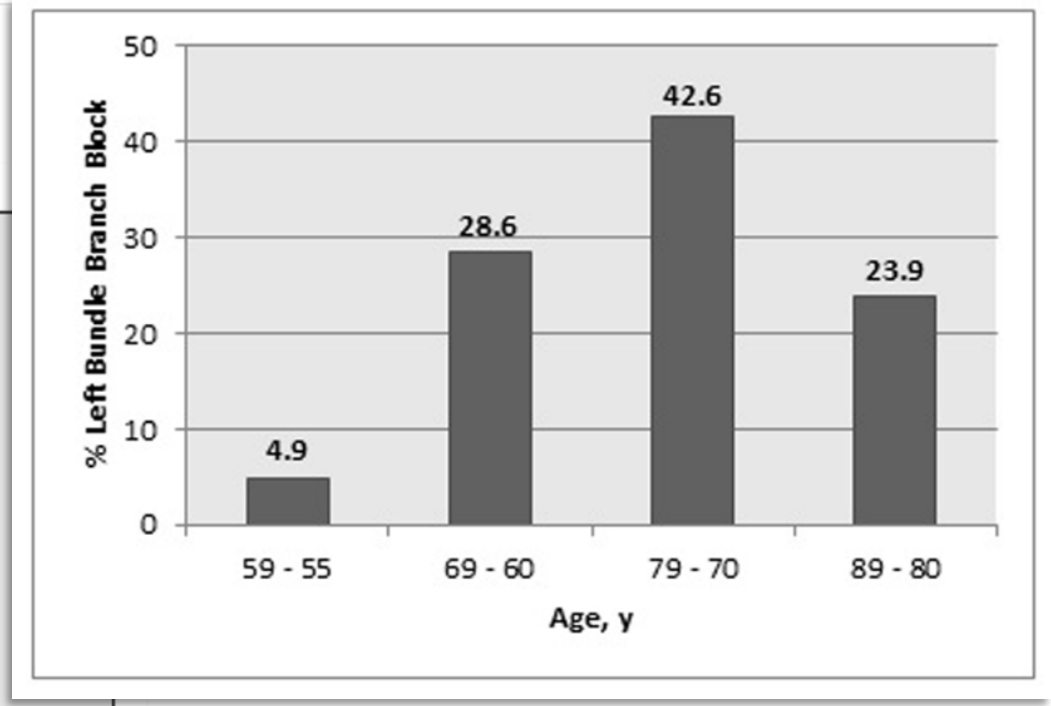
No. at risk				
No LBBB	4497	3782	2735	1720
LBBB	44	30	15	3

Characteristics	Participants, No. (%) (N = 4541)		P value
	Left bundle branch block (n = 44)	No left bundle branch block (n = 4497)	
Age, mean (SD), y	74.5 (5.7)	72.6 (5.5)	.02

Thein AS et al., *JAMA Netw Open 2025*, 8 (8): 1-11

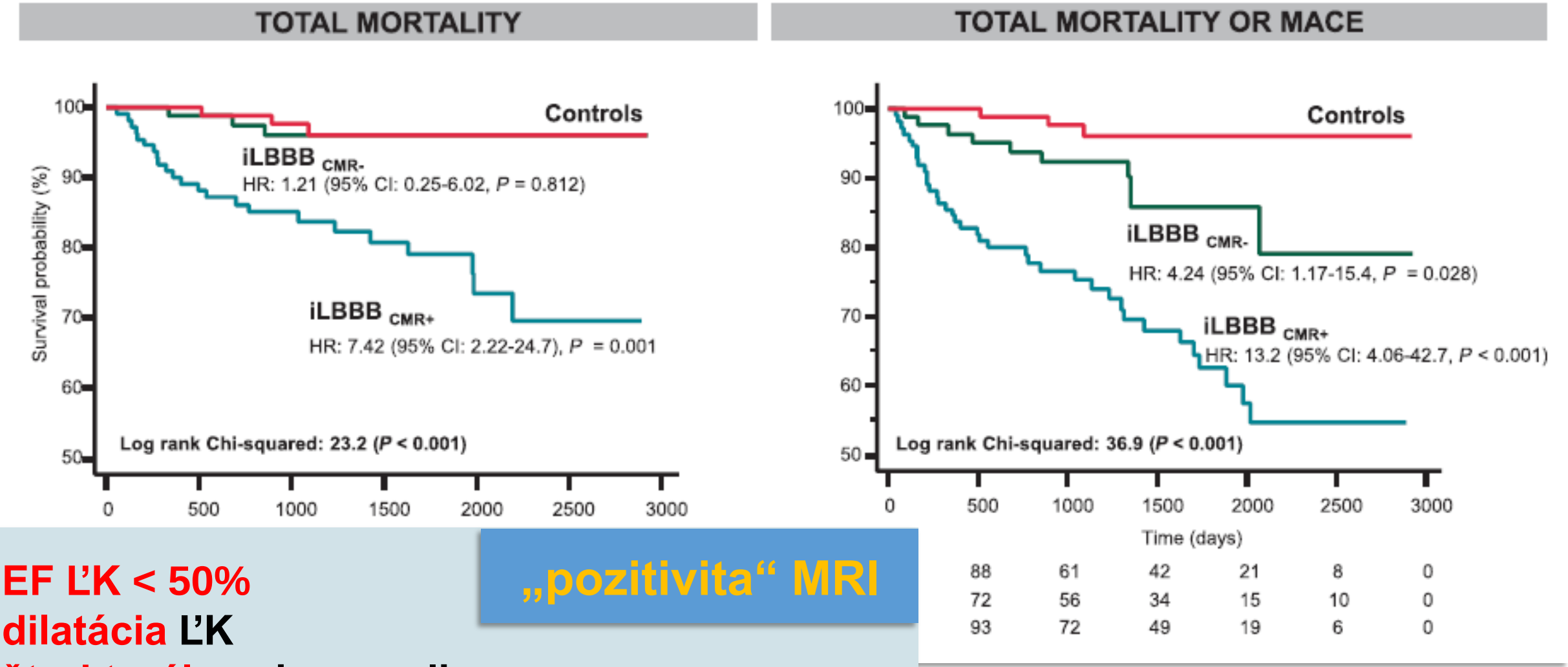
Prognóza asymptomatického KBĽTR – celková mortalita





Azadani PN et al., *Cardiol Res 2012;*3(6):258-263

Prognóza novozisteného KĽTR (+ MRI srdca)



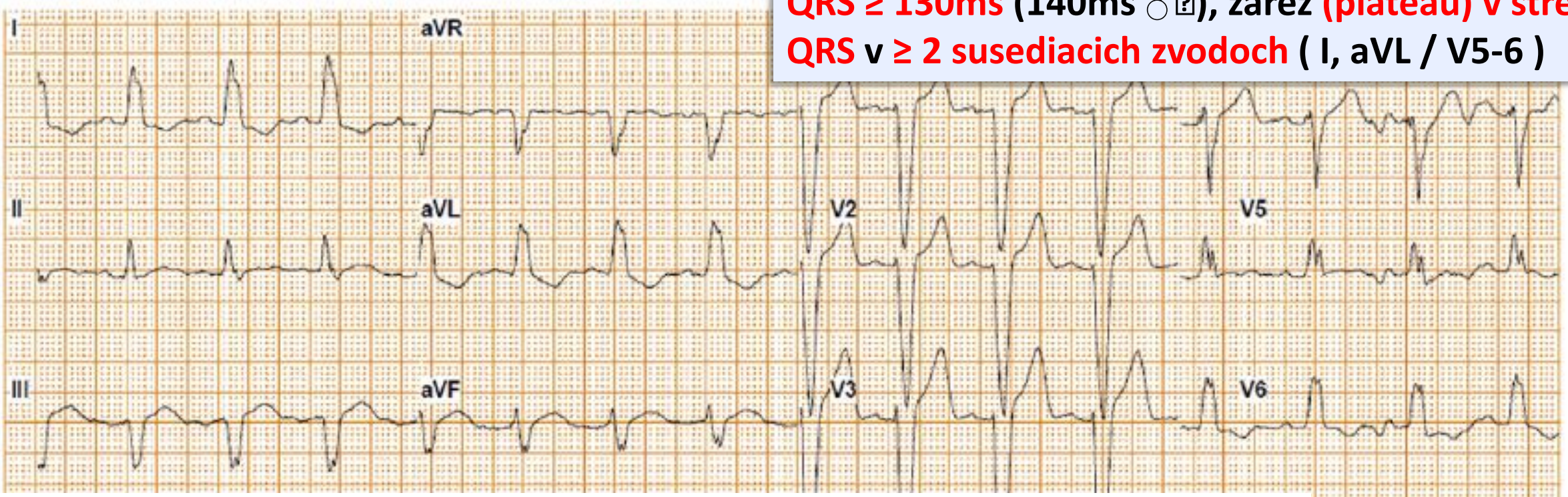
- **EF Ľ.K < 50%**
- **dilatácia Ľ.K**
- **štrukturálne abnormality**
  (hypertrofia Ľ.K, nekompaktnosť Ľ.K, oblasti fibrózy)

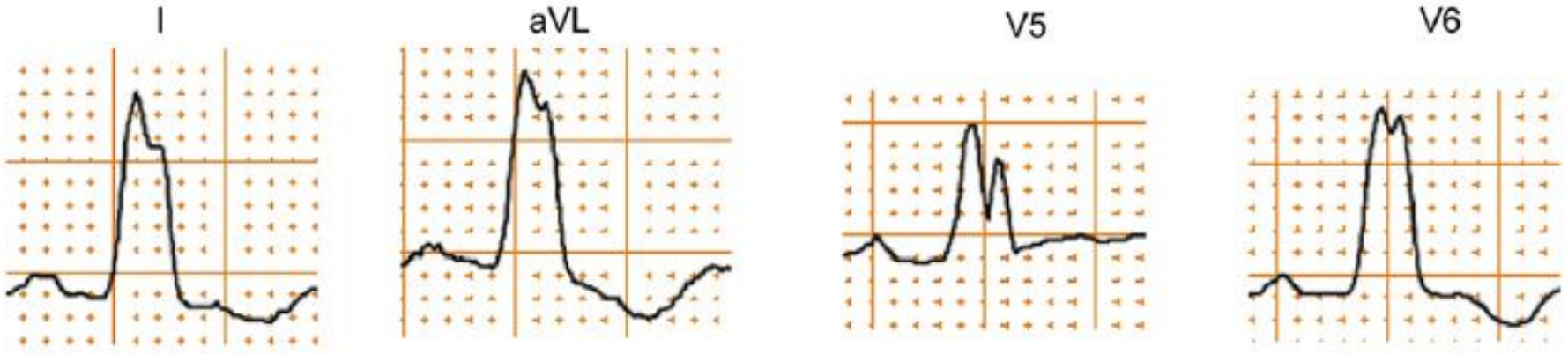
„pozitivita“ MRI

Zegard et al., *Europace 2020*, 22 (6): 956-63.

EKG - Typický kompletný BĽTR (Strauss et al.)

QRS ≥ 130ms (140ms ♂), zárez (plateau) v strede
QRS v ≥ 2 susediacich zvodoch (I, aVL / V5-6)





Strauss DG et al., *Am J Cardiol* 2011, 107:927–934.

EKG kritériá pre diagnózu typického KBĽTR

		De Luna 2006	AHA/ACC/HRS 2009	Strauss 2011
QRS duration (m/f, ms)		≥120/≥120	≥120/≥120	≥140/≥130
QRS notching or slurring		-	Broad notched/slurred R wave in leads I, aVL, V5, and V6	Mid-QRS notching/ slurring in ≥ 2 of leads V1, V2, V5, V6, I, and aVL
QS or rS in leads V1 and V2		+	-	+
Delayed intrinsicoid deflection (>60 ms)		Present in leads V6 and I	Present in leads V5 and V6 absent in leads V1, V2, and V3	-
Usually discordant ST and T wave		+	+[a]	-
QS pattern with a positive T wave in aVR		+	-	-
Q waves in leads I, V5, and V6		-	Absent	May be present in patients with concomitant anterior and/or apical infarct
ECG pattern	V1, V2			
	V5, V6			

Surkova et al., *Europace. 2017*, 19 (8): 1251-71.

EKG kritériá pre diagnózu typického KBĽTR

ESC 2013 criteria

1. QRS duration ≥120 ms
2. QS or rS in V1
3. Broad (frequently notched or slurred) R waves in I, aVL, V5 or V6
4. Absent Q waves in V5 and V6

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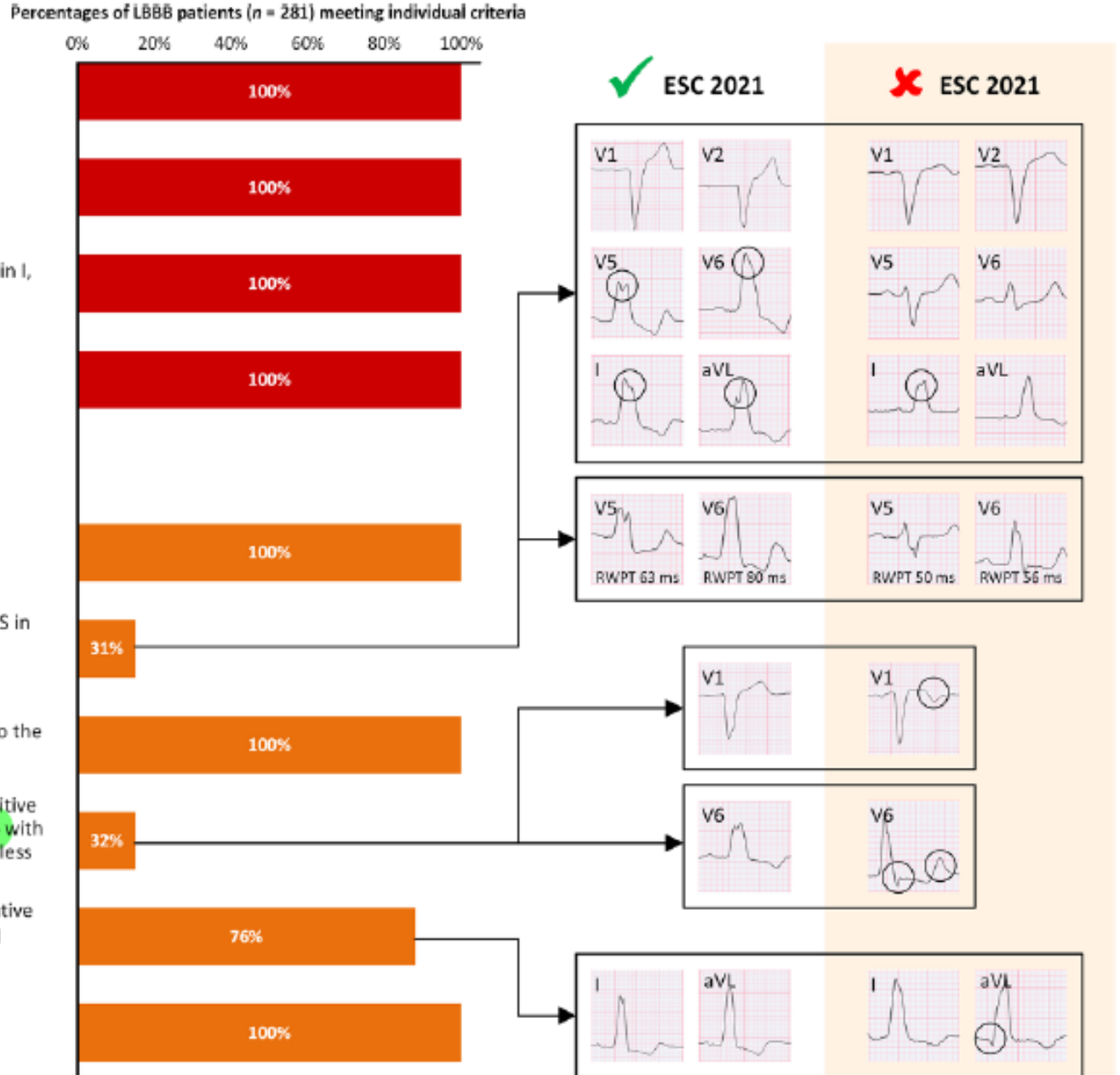
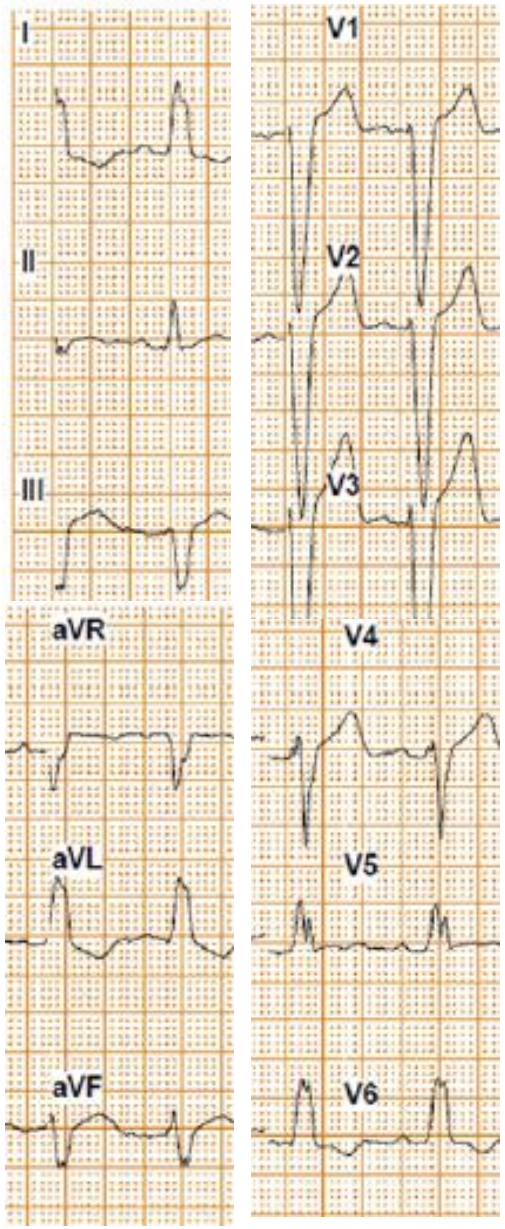
1. QRS duration ≥120 ms
2. Notching/slurring in the middle third of the QRS in ≥2 leads: V1, V2, V5, V6, I and aVL with R-wave peak time (RWPT) >60 ms in V5-V6
3. Generally, the ST segment is slightly opposed to the QRS polarity
4. QS or rS in V1 with ST slightly elevated and positive asymmetrical T wave, and unique R wave in V6 with negative asymmetric T wave. When the QRS is less than 140 ms, the T wave in V6 may be positive
5. Exclusive R wave in I and aVL often with a negative asymmetrical T wave, slight ST depression, and usually QS in aVR with positive T wave
6. The QRS axis is variable

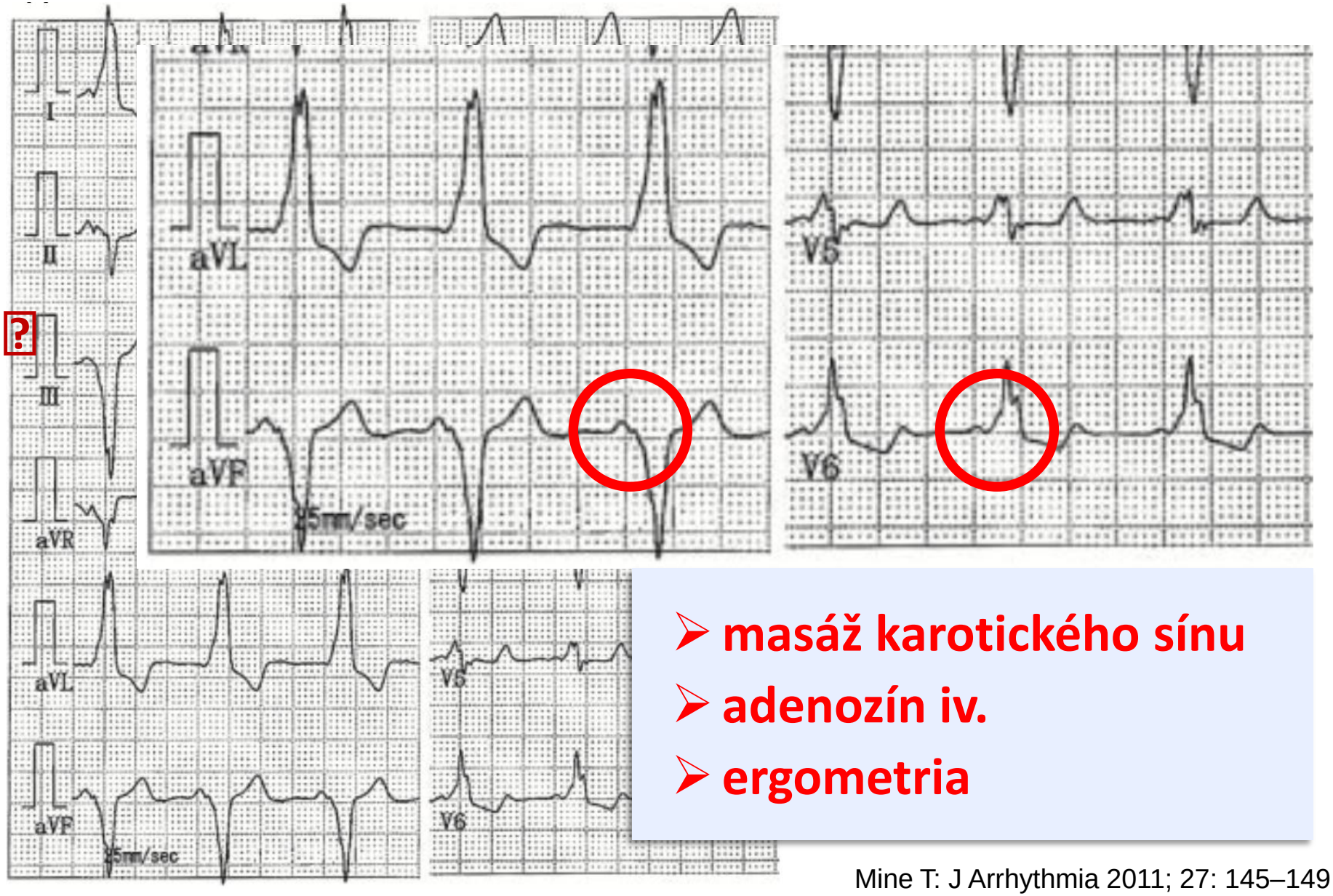


Calle et al
Netherlands heart journal 2022
30 (11): 495-8.

KBĽTR vs. WPW



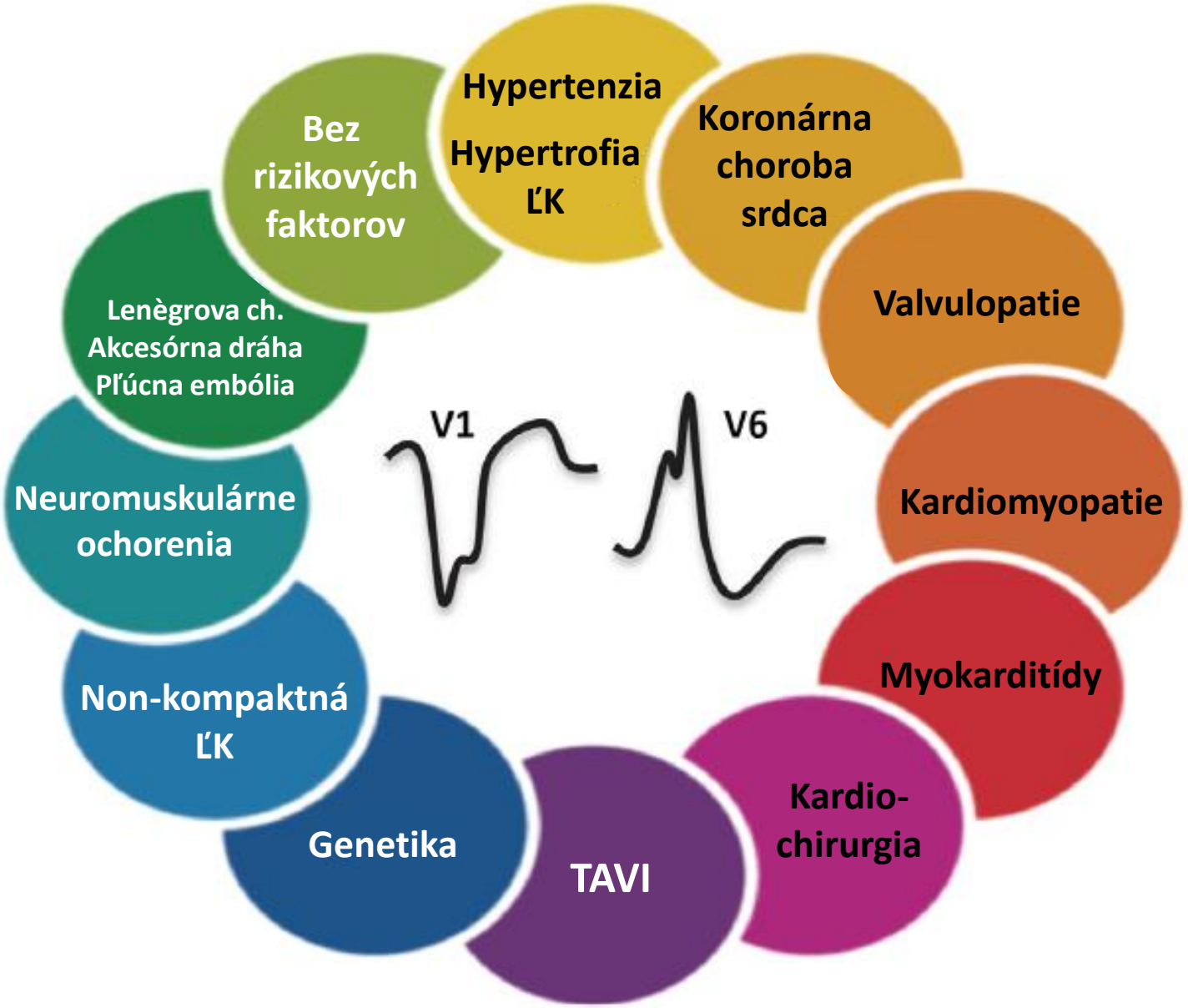
↔?



- masáž karotického sínu
- adenozín iv.
- ergometria

Mine T: J Arrhythmia 2011; 27: 145–149

Pátranie po štrukturálnom ochorení srdca

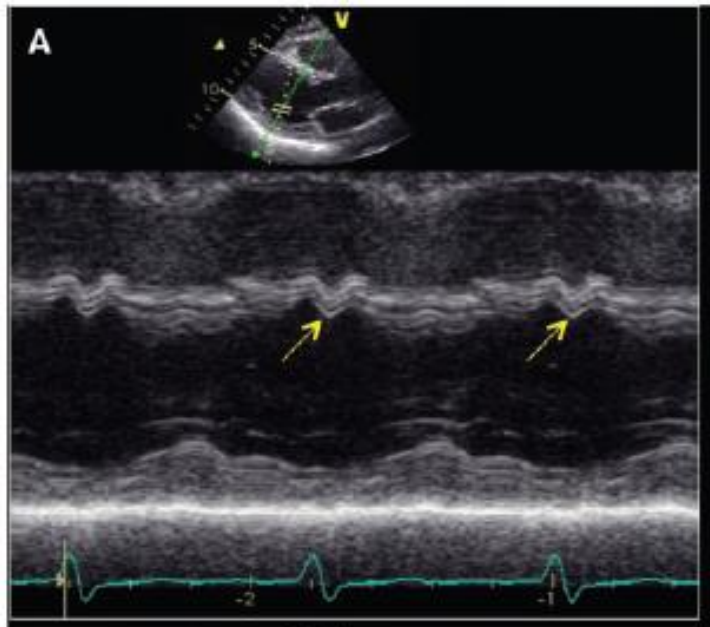


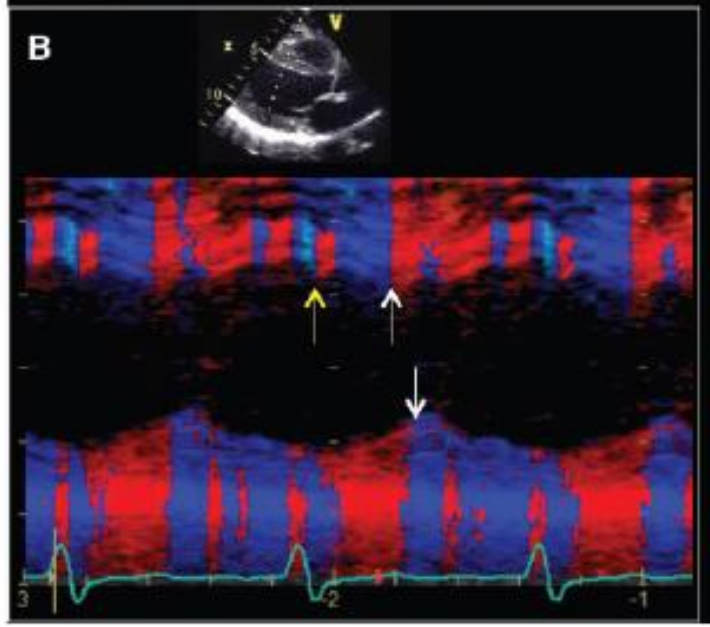
- ➢ **často** súčasne **štrukt. ochorenie prevodového systému / srdca**
- ➢ **ECHOKG**
- ➢ **Zobrazovacie vyšetrenia**

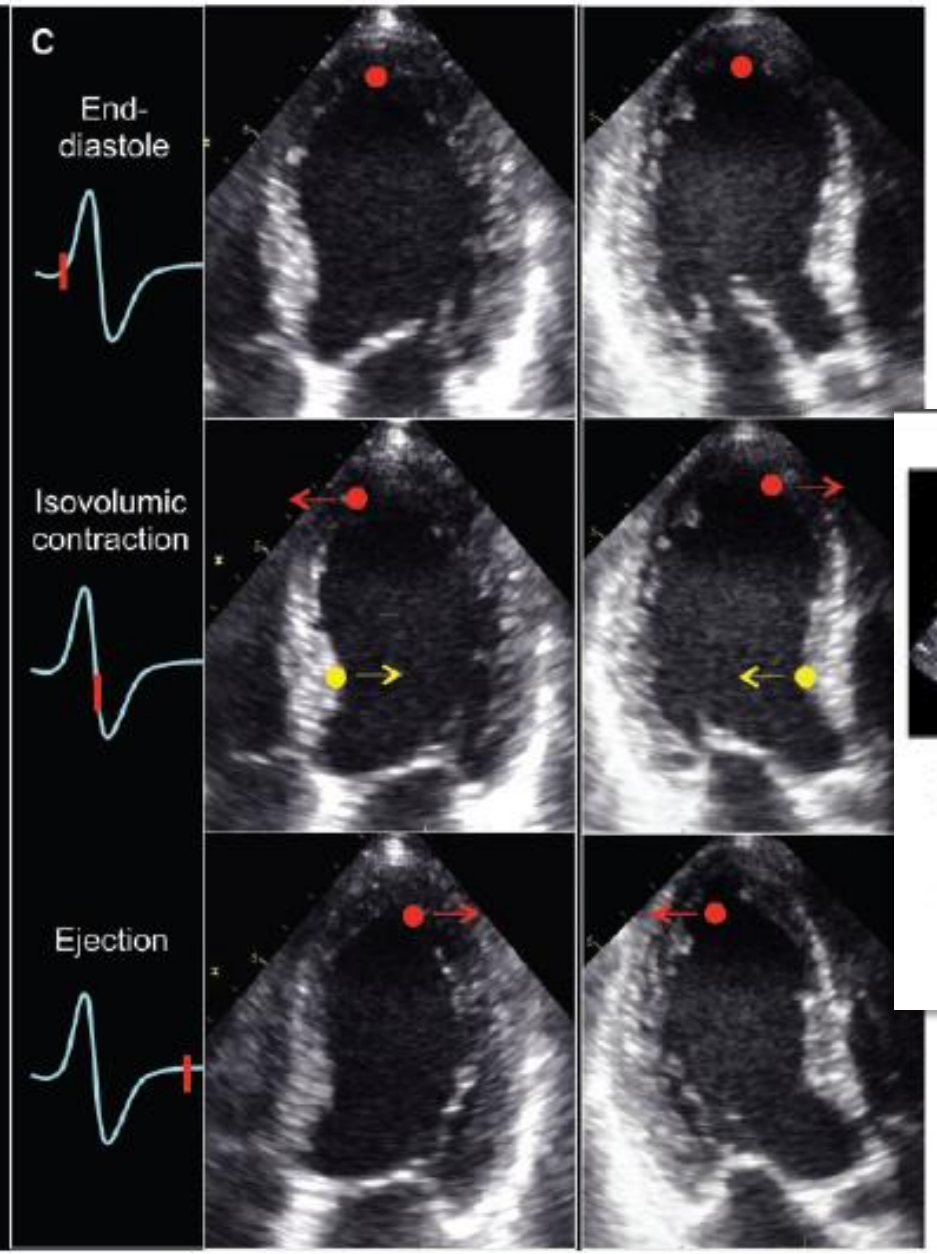
  → MRI srdca
- ➢ **Rodinná anamnéza**

  → náhla smrť / štrukturálne/ elektrické chorenia srdca v blízkom pokrvnom príbuzenste
- ➢ **? Genetické vyšetrenie**
- ➢ **? Špeciálne vyšetrenia**

ECHOKG - Dyssynchrónia kontrakcie ĽK pri KBĽTR



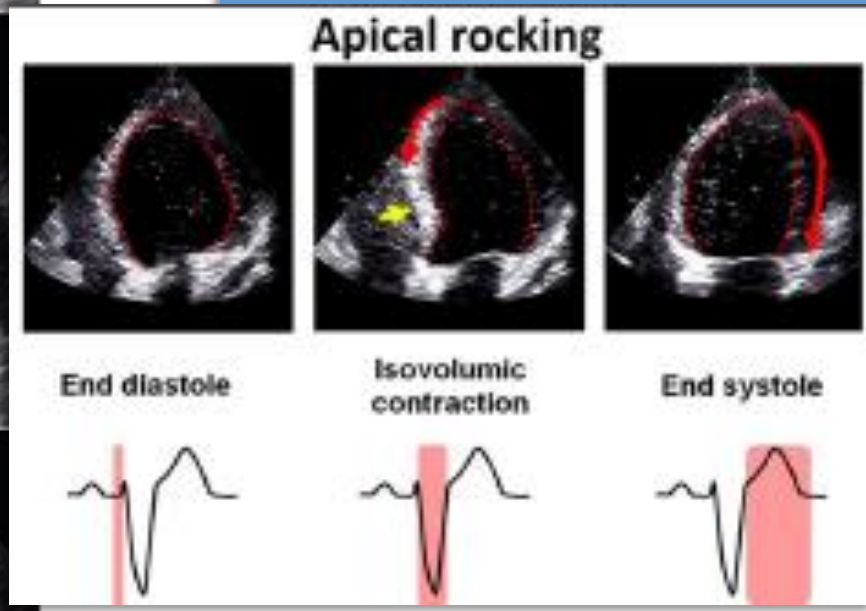




- **Septal Flash**

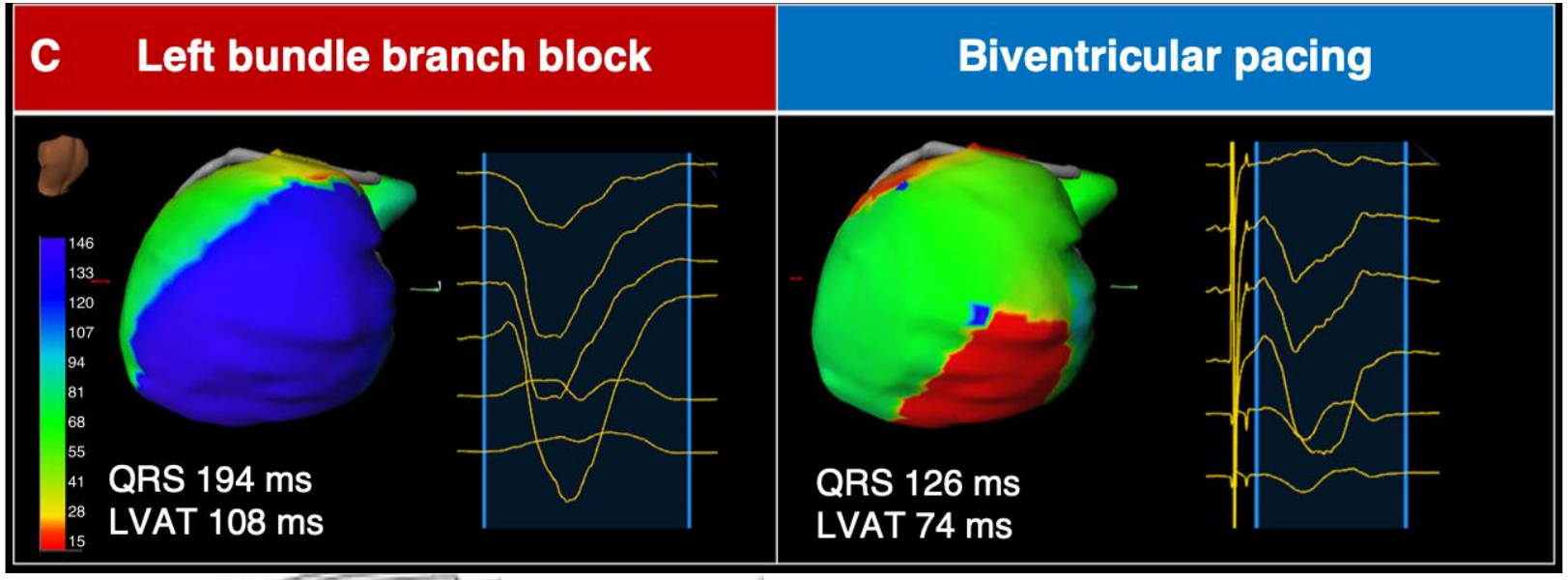
(Septal beak)

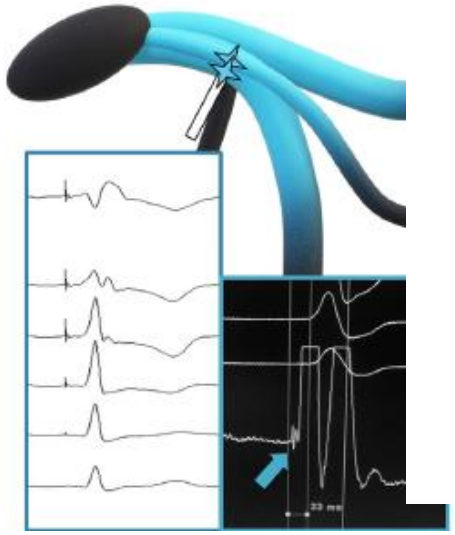
- **Apex Rocking**

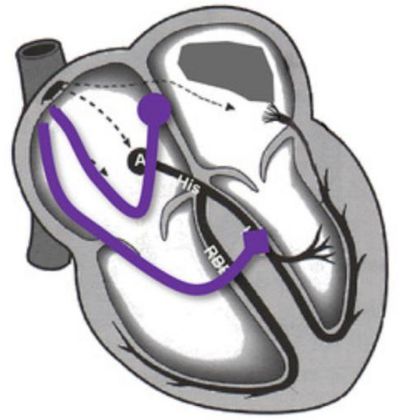


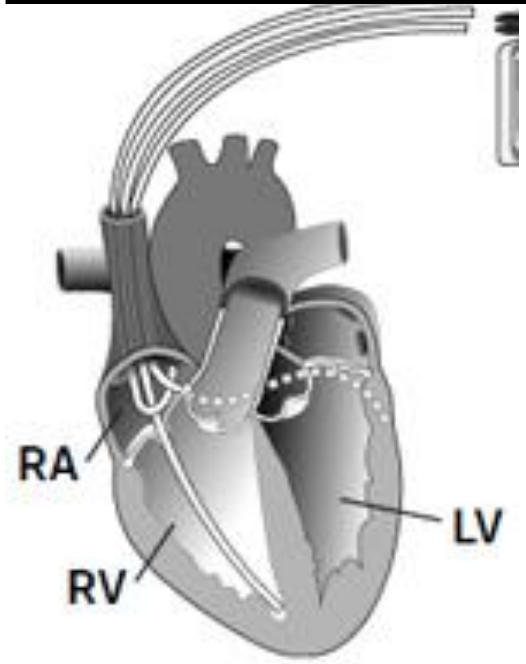
Smiseth et al., *Trends in Card. Med. 2019*, 29 (6):335-42.
Surkova et al., *2017*, 19 (8): 1251-71.

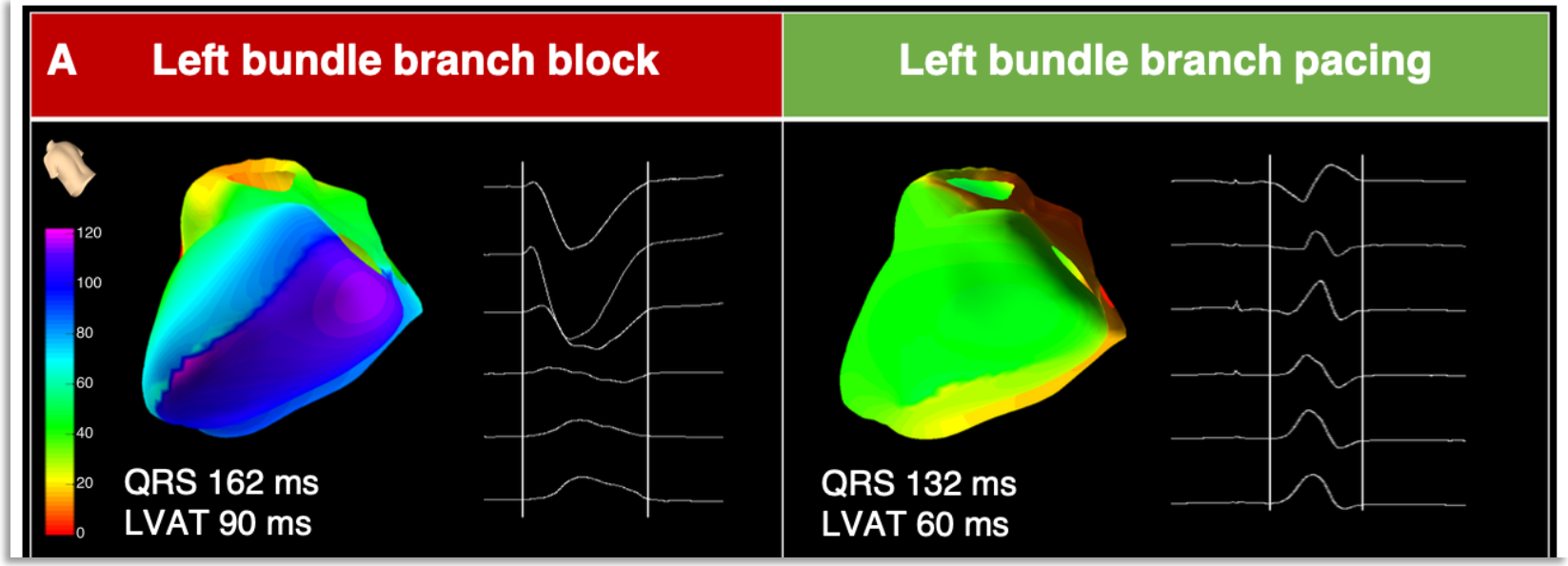
Korekcia dyssynchrónie stimuláciou: CRT-P, CSP











EHRA Consnsus on CSP 2025, Glikson M et al., *Europac*, 2025, 27

Indikácia CRT pri srdcovom zlyhávaní

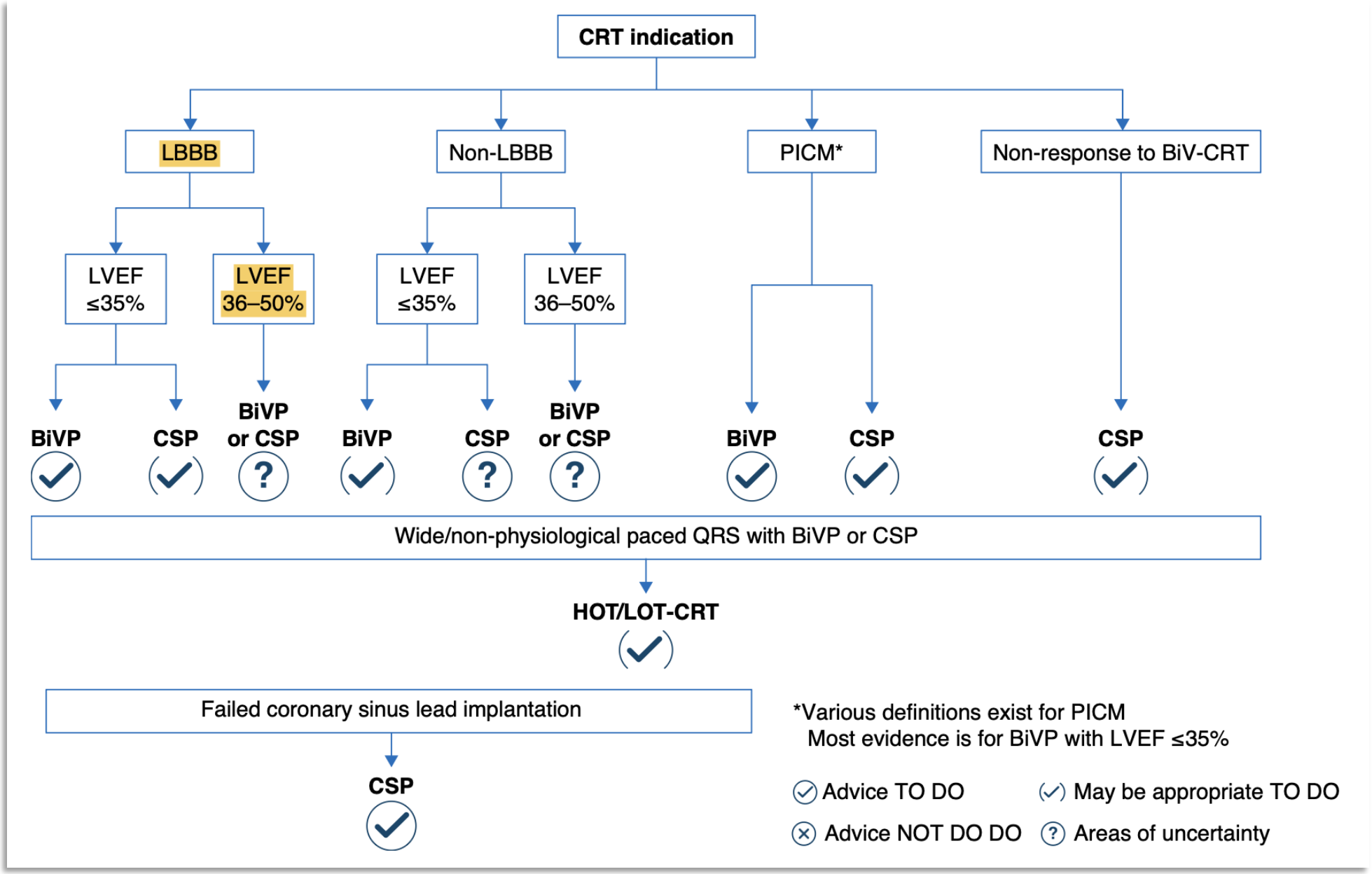
Recommendations	Class	Level
CRT sa odporúča u symptomatických (NYHA II – IVa) pacientov so SZ v SR s EFĽK ≤ 35%, trvaním QRS duration ≥ 150 ms, a QRS morfológie KBĽTE napriek OMT, za účelom zlepšenia symptómov a redukcie morbidity a mortality.		
• SR, KBĽTR, QRS ≥ 150 ms	I	A
• SR, KBĽTR, QRS 130 - 149 ms	IIa	B
• SR, non KBBB, QRS ≥ 150 ms	IIa	B
• SR, non KBBB, QRS 130 - 149 ms	IIb	B

ESC odporúčania 2021 (SZ, Pacing&CRT)

Glikson et al., *European heart journal 2021*, 42 (35): 3427-520.

“Hybridná liečba“ FP (implantácia kardiostimulátora + ablácia AV uzla)

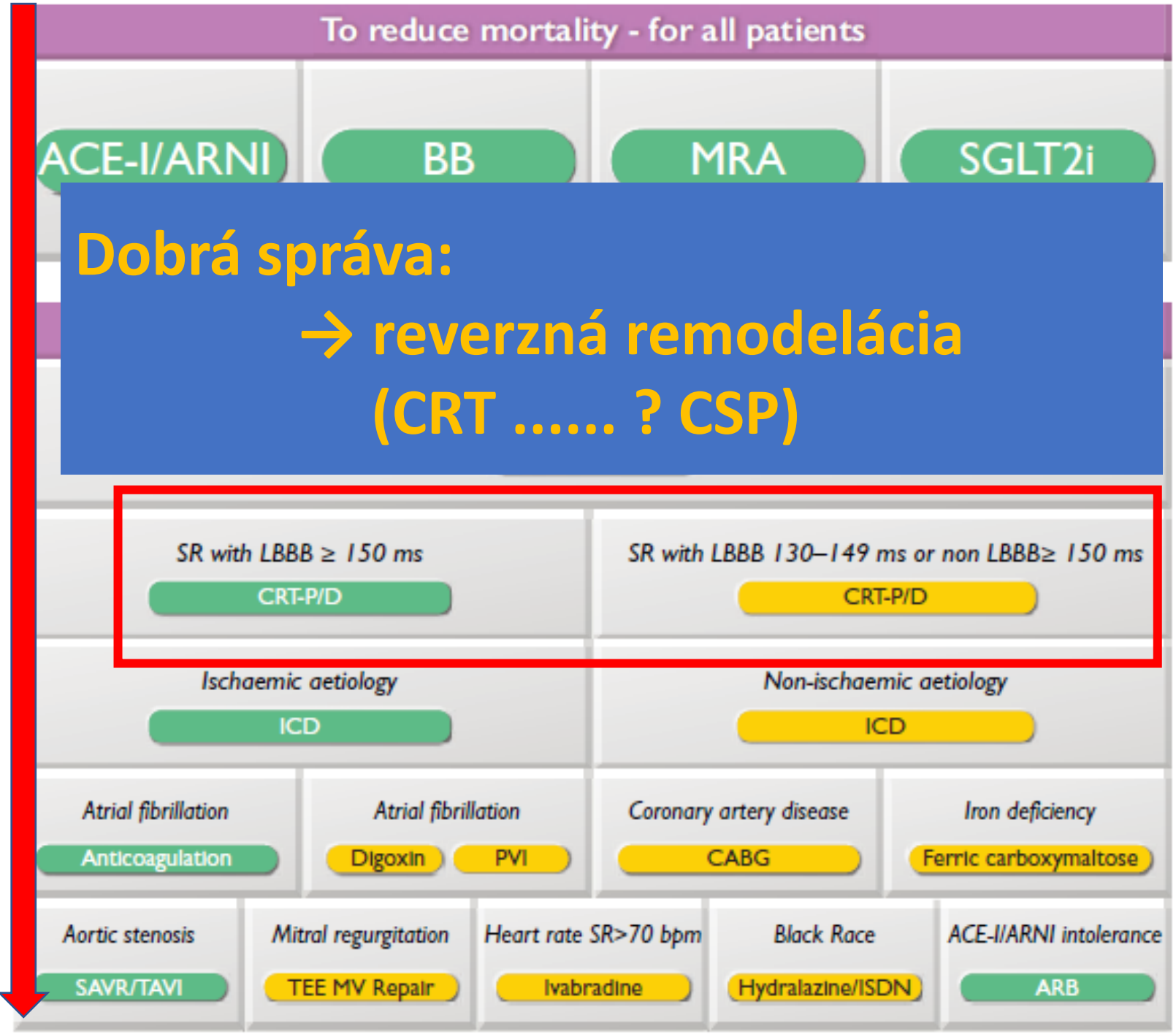
EHRA 2025



Glikson et al.
Europace 2025, 27 (4): 1-29.

Klinický postup pri asymptomatickom KBĽTR

- **vylúčenie štrukturálne ochorenie srdca**
  - → ECHOKG
  - → MRI srdca
  - (→ genetické vyšetrenie)
- **Rodinná anamnéza**
  - → náhla smrť / štrukturálne/ elektrické chorenia srdca v blízkom pokrvnom príbuzenste
- **Aktívne pátranie po symptómoch**
- **Pátranie po iných poruchách prevodu / rytmu**
  - → EKG Holter (poruchy AV, BPTR, KES ...)
- **pravidelné sledovanie a reevaluácia + liečba zistených / neskôr vzniknutých ochorení srdca (... KMP)**



Farmakologická liečba chronického SZ

- **ACEi / ARNI**
  inh. neprilyzínuin + ARB
- **Betablokátory**
  metoprolol
  sukcinát, bisoprolol, carvedilol
  ...
- **Antagonisty mineralokortik. receptorov**
  eplerenon, spironolacton
- **Inhibítory SGLT2**
  empagliflozin, dapagliflozin ...

McDonagh et al.
European heart journal 2021, 42 (36): 3599-726.

Záver: Novozistený KBĽTR

- **KBĽTR nie je celkom benígny nález (osobitne u mladých)**

  → prejav doposiaľ nezisteného / latentného ochorenia srdca

  → zvyšuje riziko rozvoja KMP

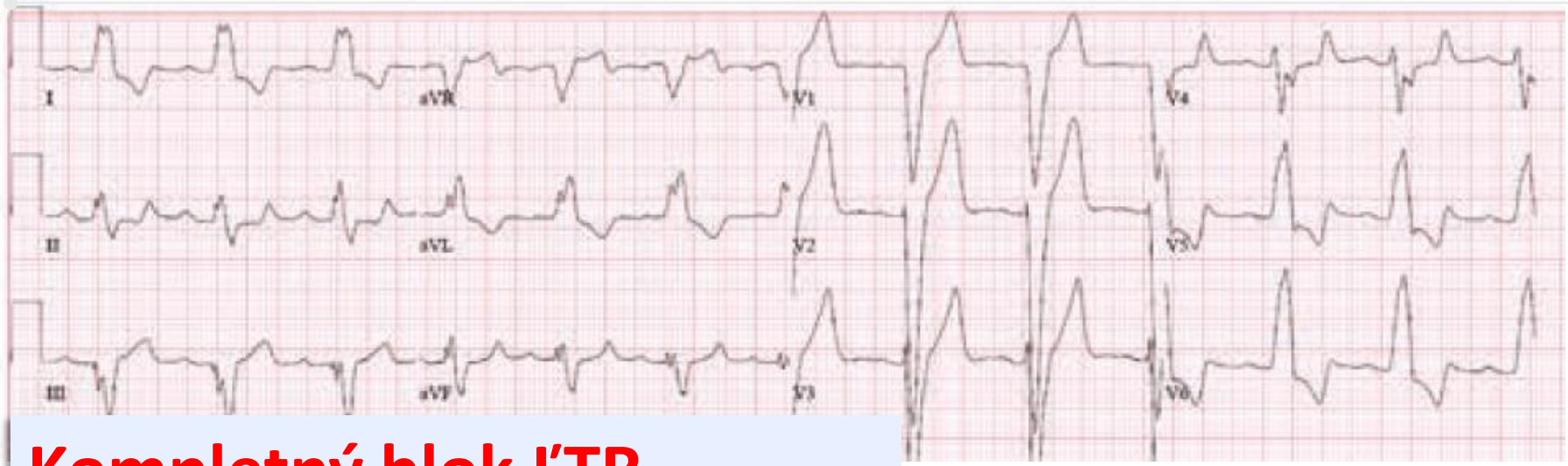
  (preexistujúcej / indukovanej samotným KBĽTR v dôsledku komorovej dyssynchrónie)

- **pátranie po štrukturálnom ochorení srdca (vrátane MRI)**

- **pravidelné sledovanie a reevaluácia pacienta**

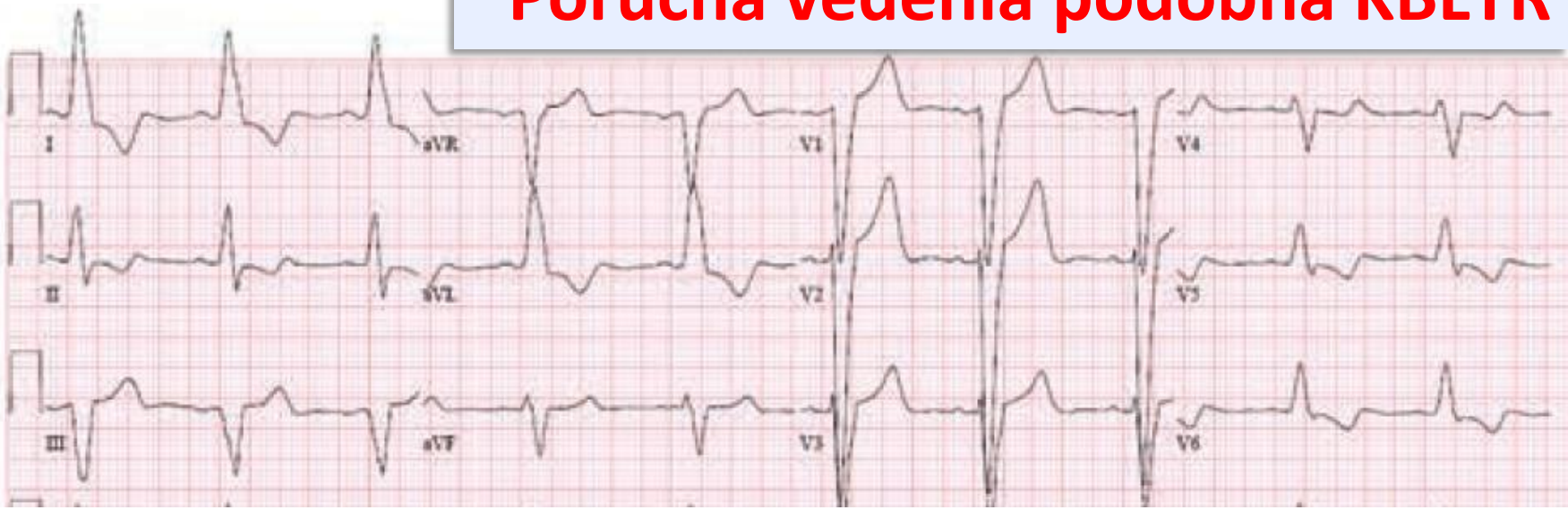
Ďakujem za pozornosť !

EKG pri KBĽTR Typický kompletný BĽTR (Strauss et al.)



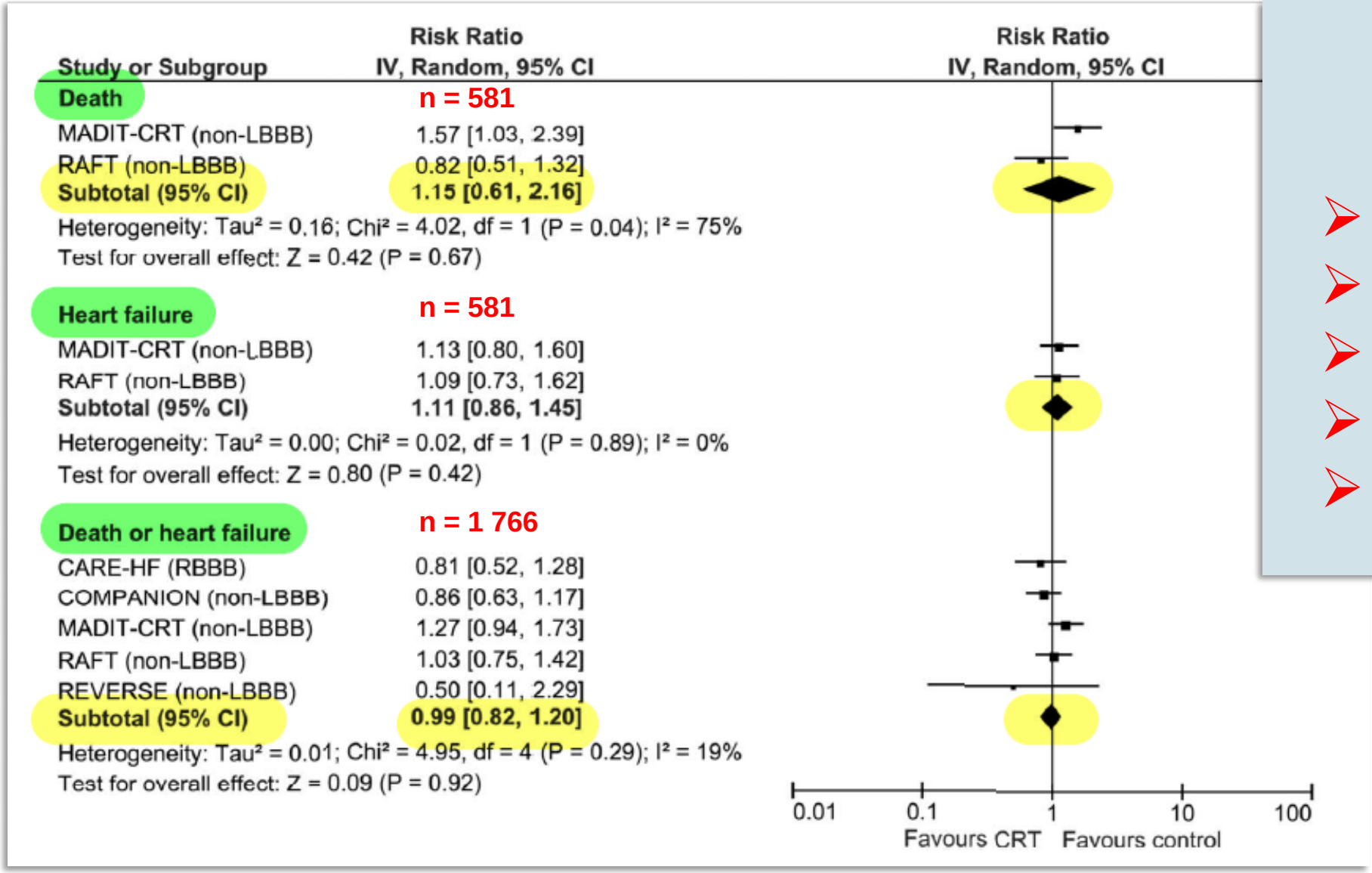
Kompletný blok ĽTR

Porucha vedenia podobná KBĽTR



Tan et al., *Circulation. Arrhythmia and electrophysiology 2020*, 13 (4): e008239.

Efekt CRT pri inom QRS ako KBĽTR - metaanalýza



Zaradené štúdie

- CARE HF
- COMPANION
- MADIT - CRT
- RAFT
- REVERSE

Colin et al., *Heart 2015*, 101 (18): 1456.

EKG kritériá pre diagnózu typického KBĽTR

		De Luna 2006	AHA/ACC/HRS 2009	Strauss 2011
QRS duration (m/f, ms)		≥120/≥120	≥120/≥120	≥140/≥130
QRS notching or slurring		-	Broad notched/slurred R wave in leads I, aVL, V5, and V6	Mid-QRS notching/ slurring in ≥ 2 of leads V1, V2, V5, V6, I, and aVL
QS or rS in leads V1 and V2		+	-	+
Delayed intrinsicoid deflection (>60 ms)		Present in leads V6 and I	Present in leads V5 and V6 absent in leads V1, V2, and V3	-
Usually discordant ST and T wave		+	+[a]	-
QS pattern with a positive T wave in aVR		+	-	-
Q waves in leads I, V5, and V6		-	Absent	May be present in patients with concomitant anterior and/or apical infarct
ECG pattern	V1, V2			
	V5, V6			

Surkova et al., *Europace. 2017*, 19 (8): 1251-71.

EKG kritériá pre diagnózu typického KBĽTR

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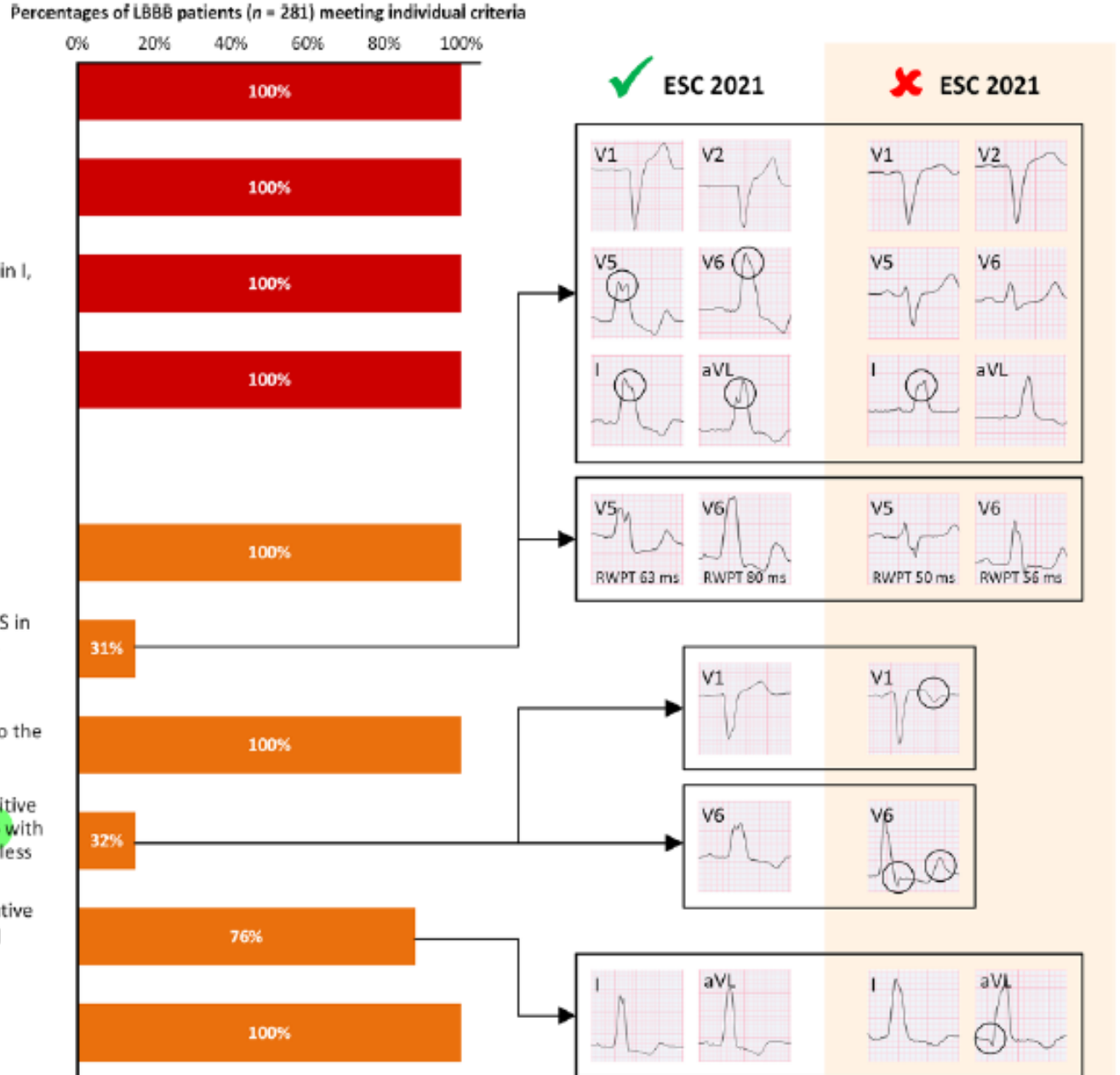
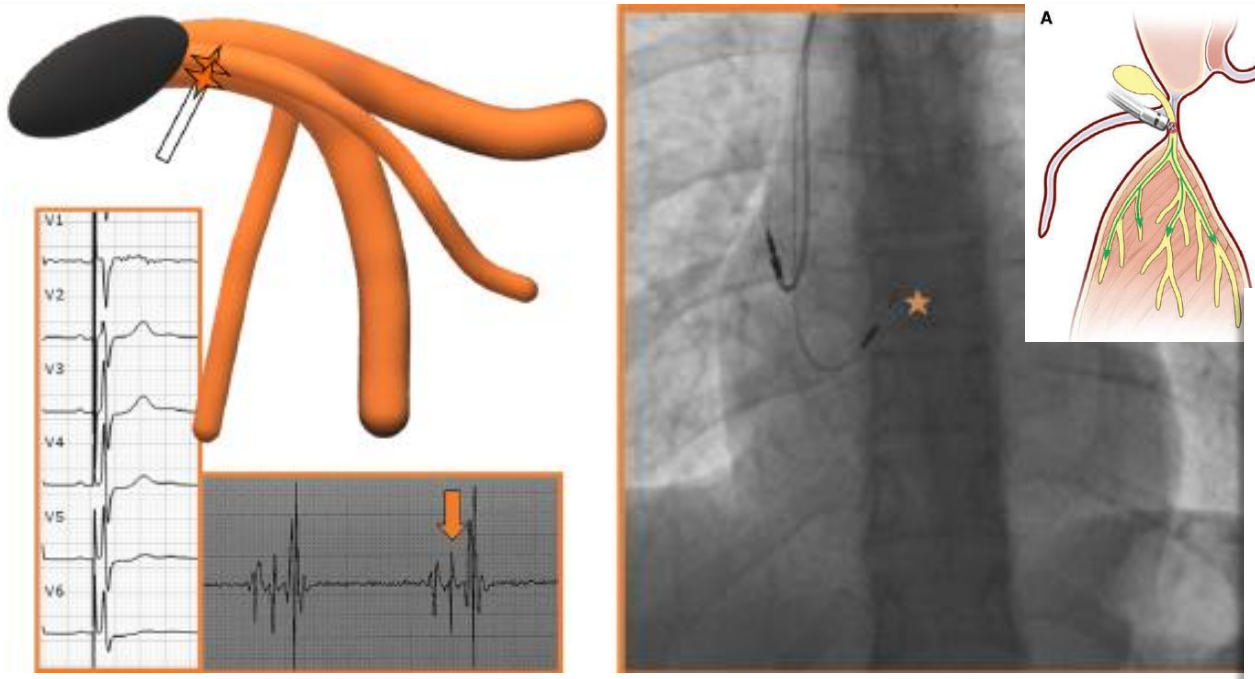


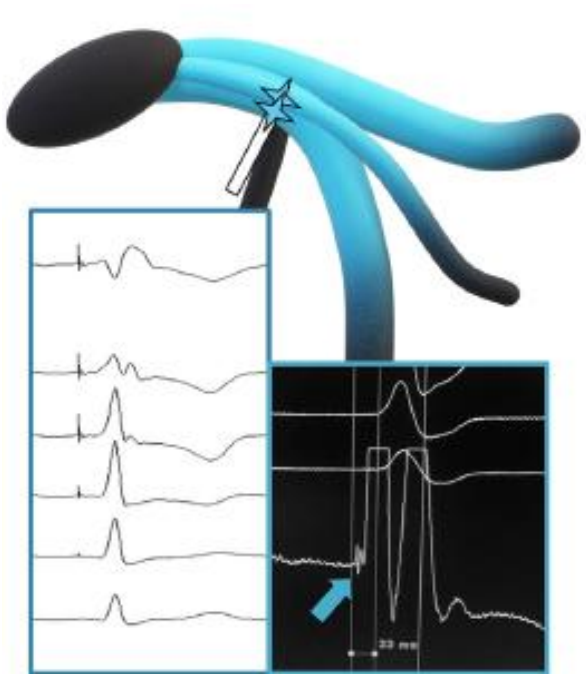
Calle et al
Netherlands heart journal 2022
30 (11): 495-8.

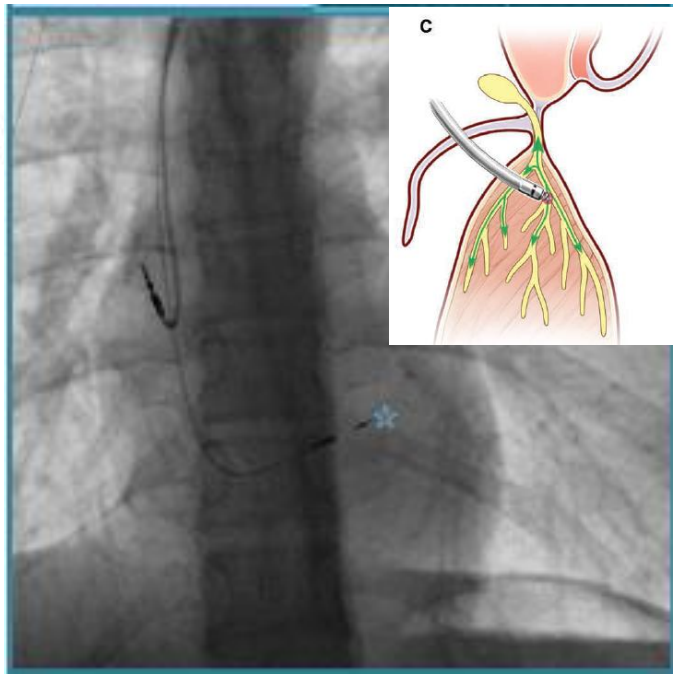
Alternatívy k CRT – stimulácia Hisovho zväzku alebo ĽTR



Stimulácia Hisovho zväzku

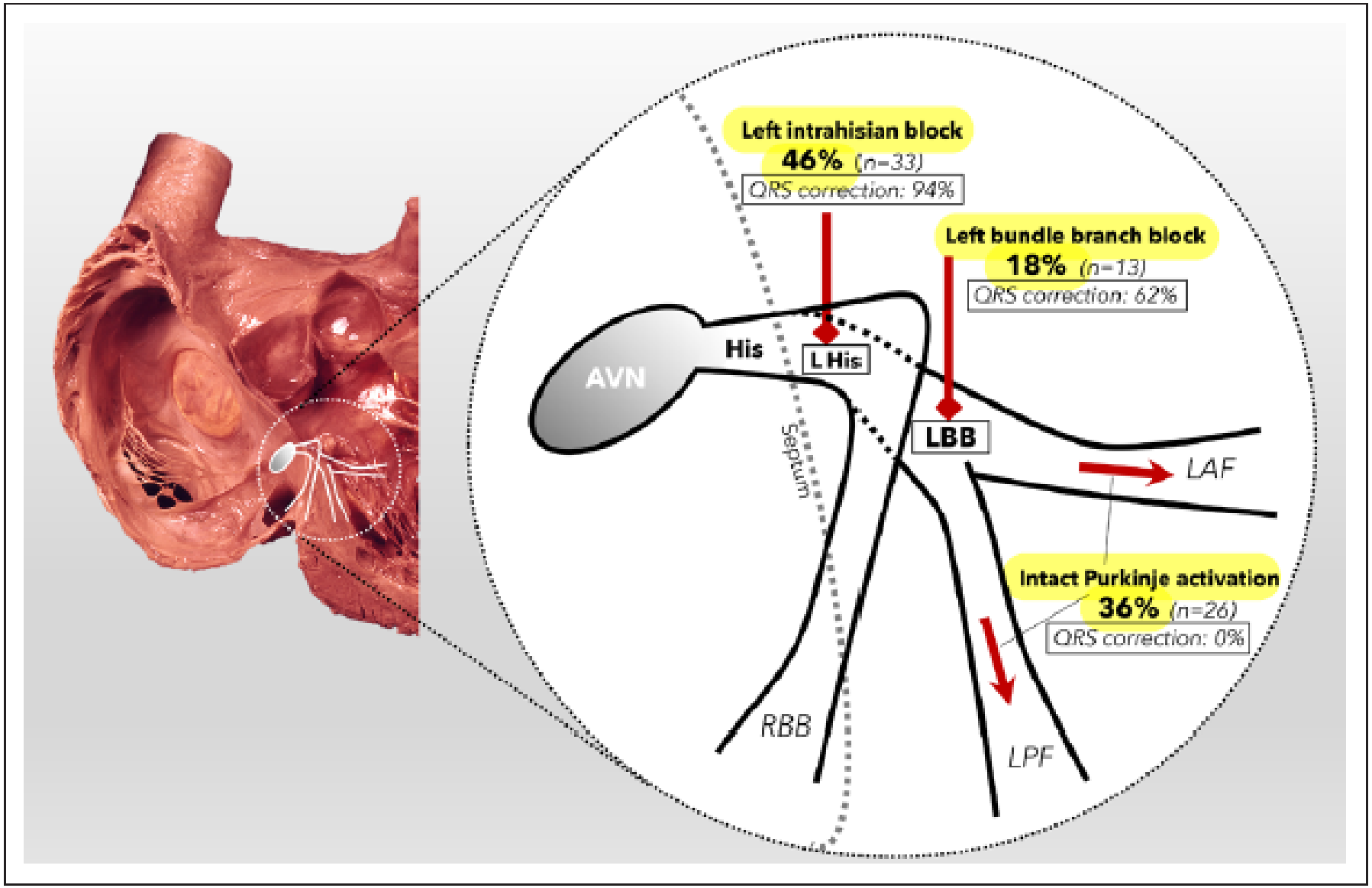
Stimulácia ľavého TR

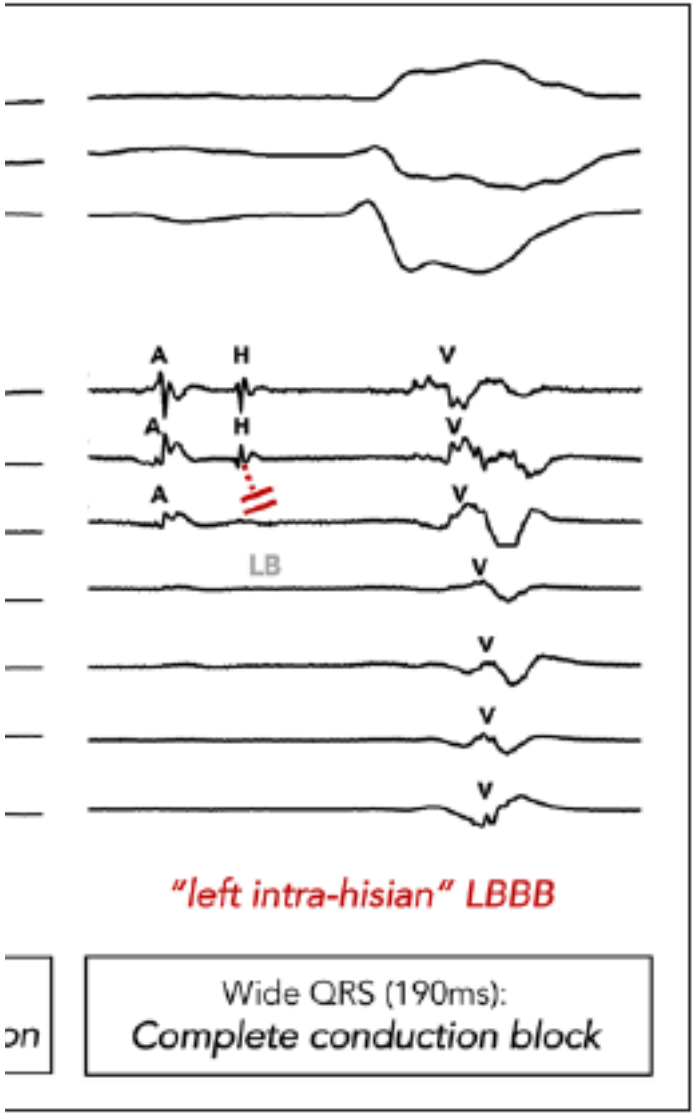




Pujol-López et al. *Card. electrophysiology clinics 2021*, 13 (4): 671-84.
Tan et al., *Circulation. Arrh. and electrophys. 2020*, 13 (4): e008239.

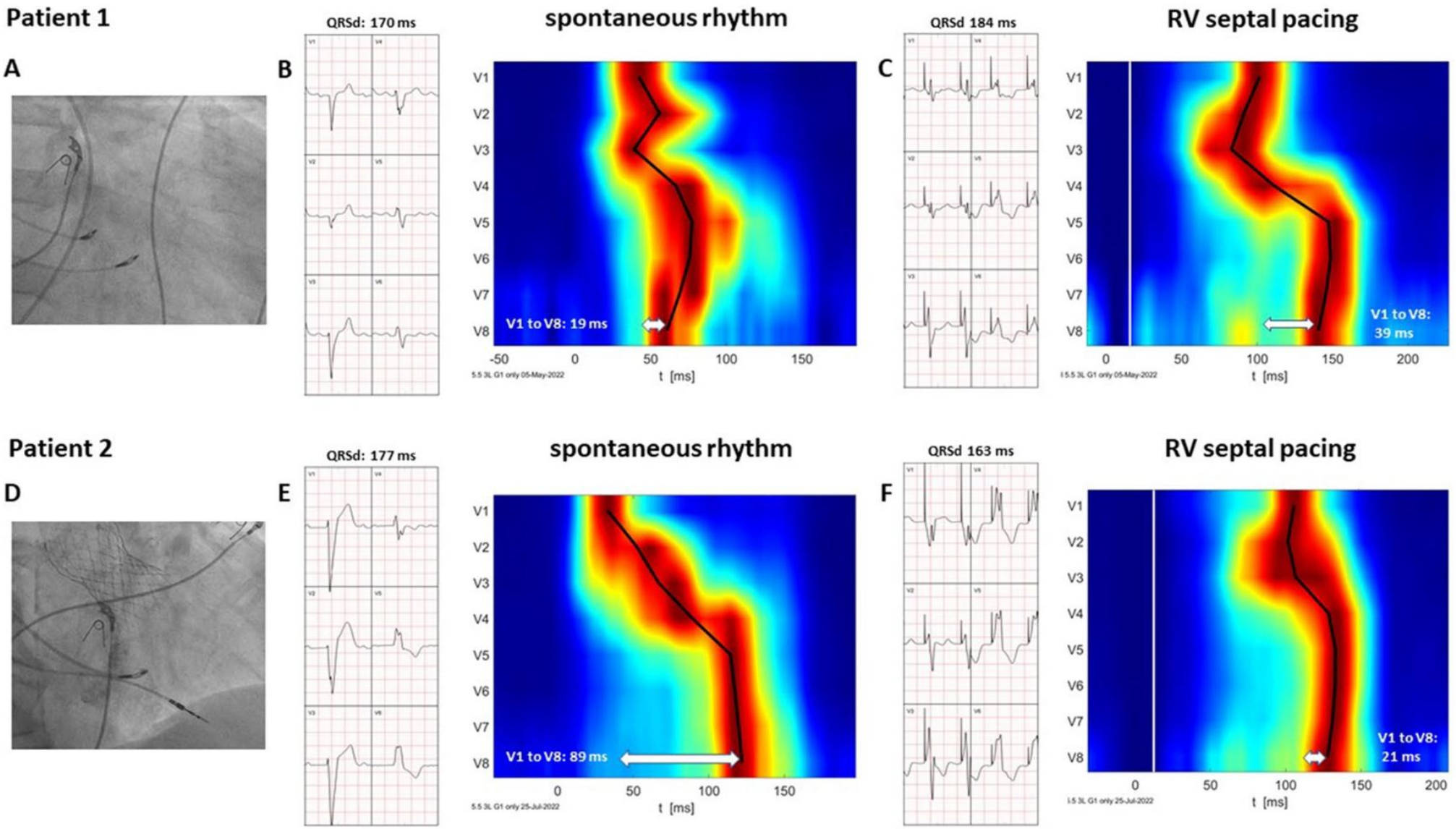
Miesto bloku pri KBĽTR (intrakardiálna aktivácia)





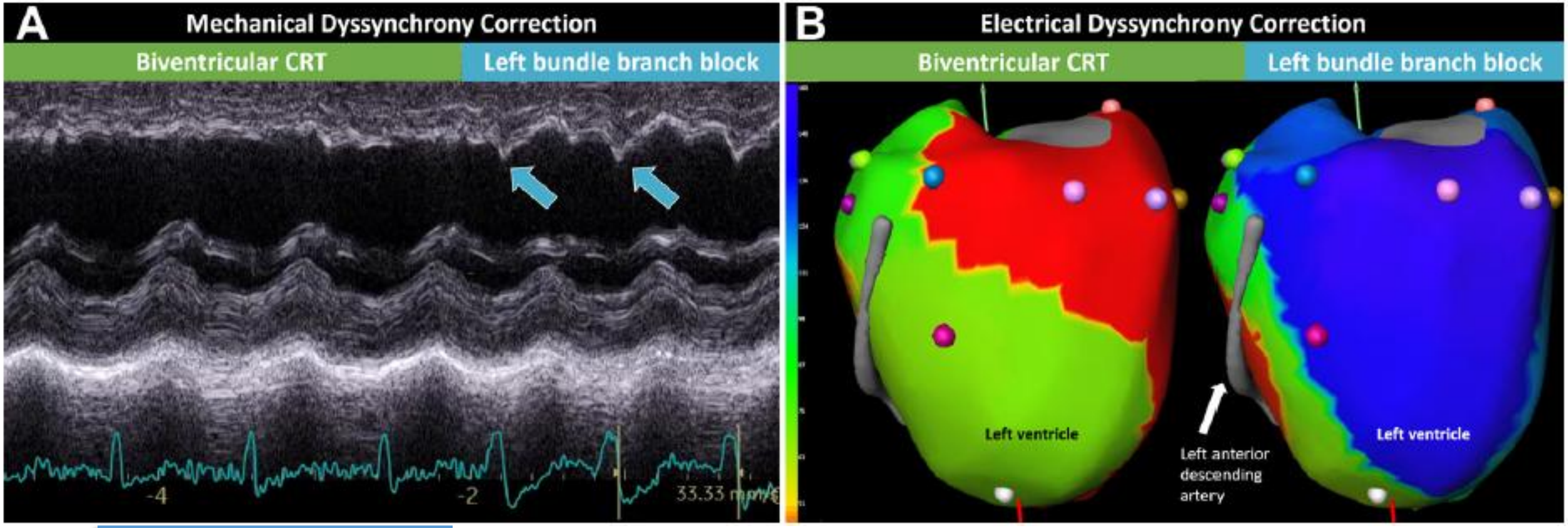
Upadhyay et al., *Circulation 2019*, 139 (16): 1876-88.

Porucha vnútrokomorového vedenia vs. typický KBĽTR



Čurila et al.
JICE 2023

Korekcia asynchrónnej kontrakcie ĽK (KBĽTR) pomocou CRT

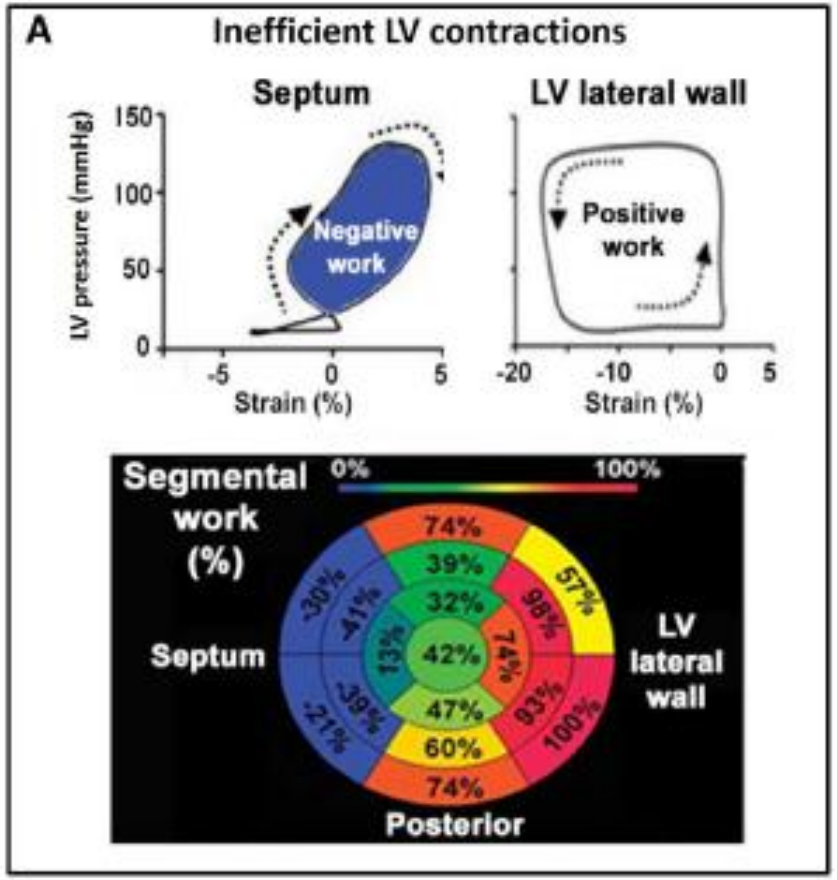


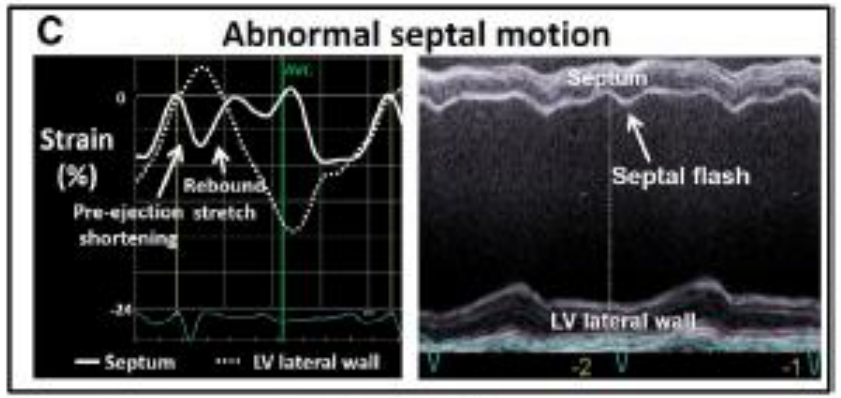
Septal Flash

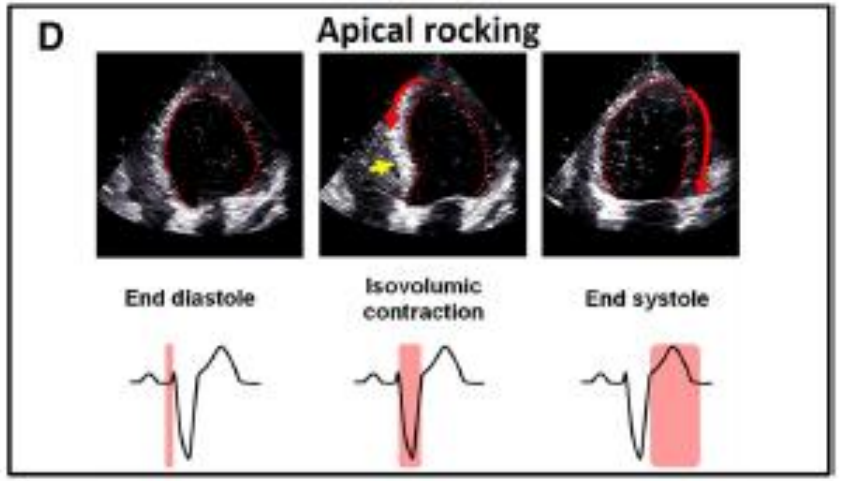
(Septal beak)

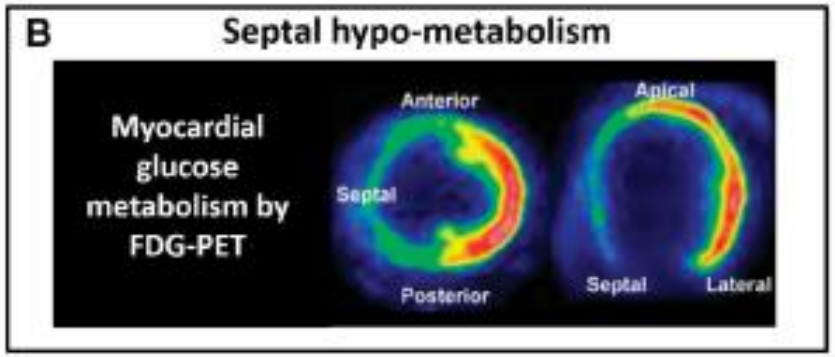
Pujol-López et al., *Cardiac electrophysiology clinics 2021*, 13 (4): 671-84.

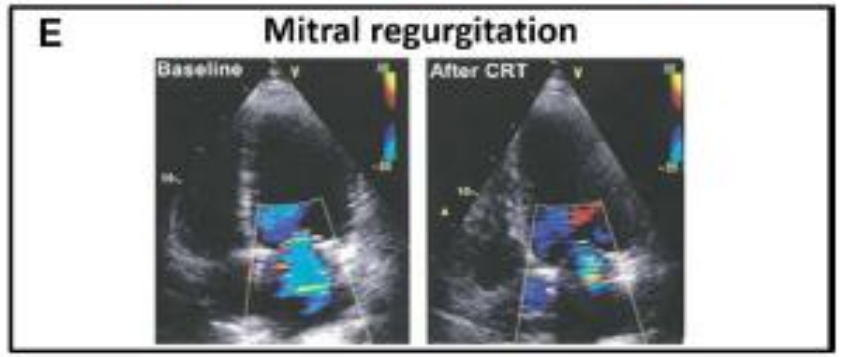
Dyssynchrónia kontrakcie ĽK pri KBĽTR - ECHOKG







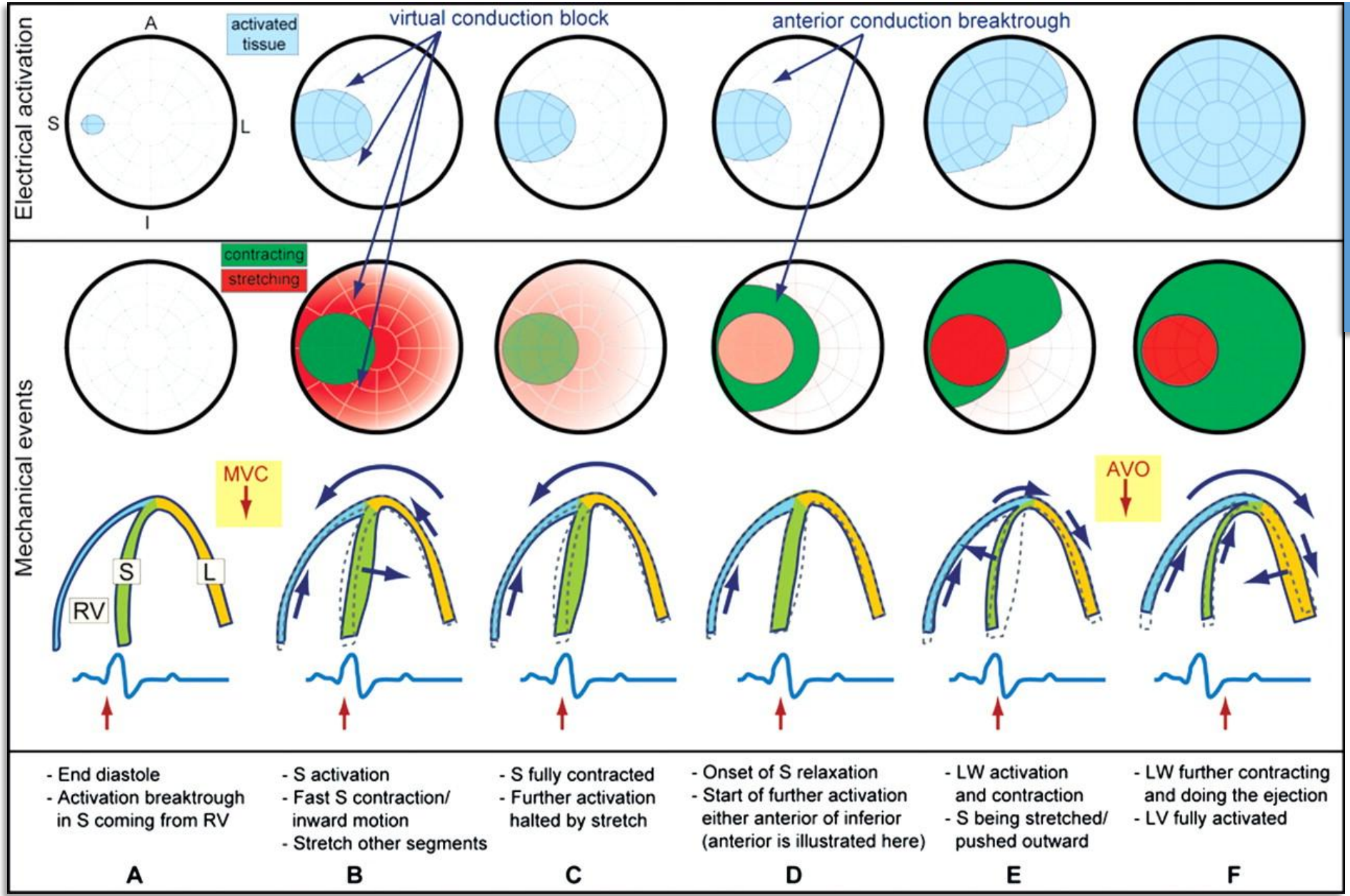




- Septal Flash
(Septal beak)
- Apex Rocking

Smiseth et al., *Trends in cardiovascular medicine 2019*, 29 (6): 335-42.

Dyssynchrónia kontrakcie ĽK pri KBĽTR - ECHOKG



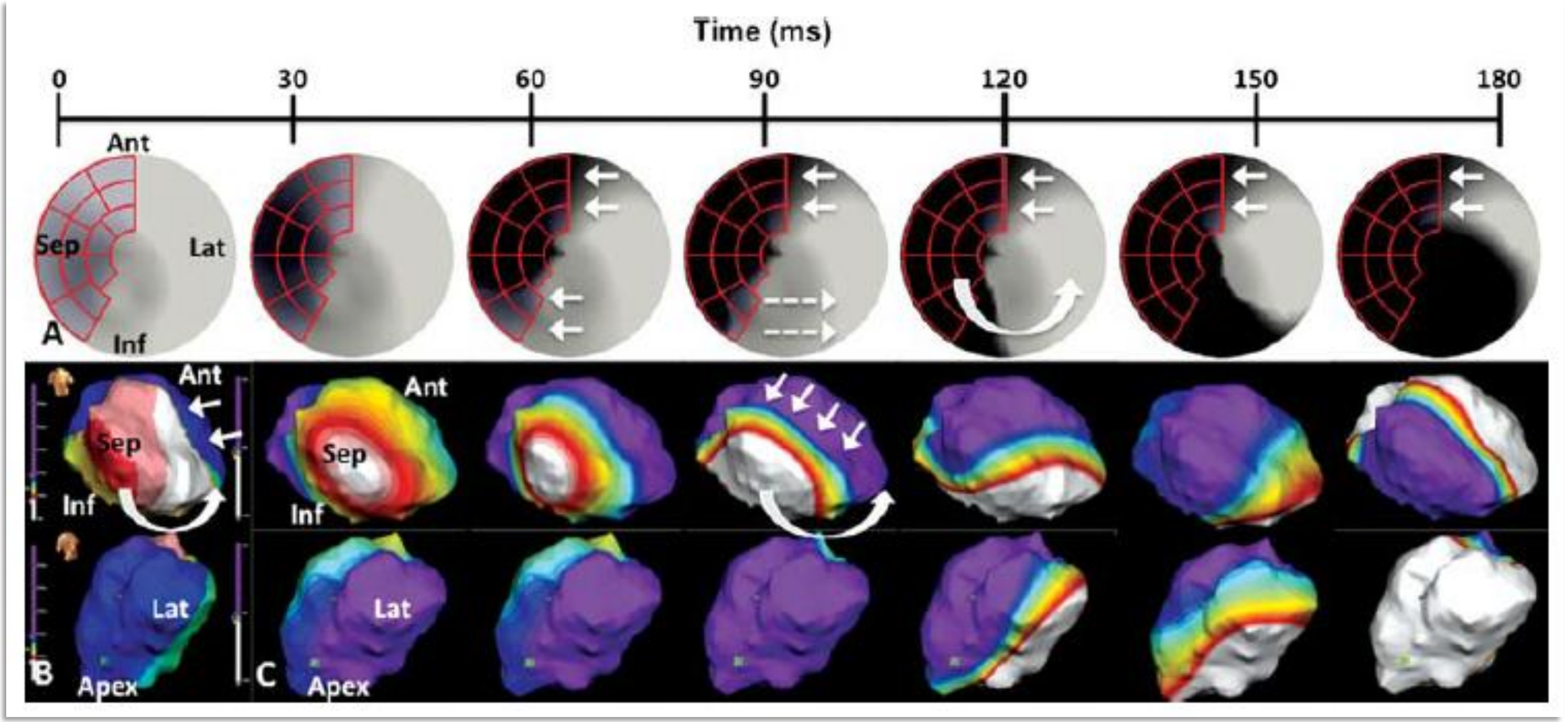
- **S**eptal **F**lash

  (Septal beak)

- **A**pex **R**ocking

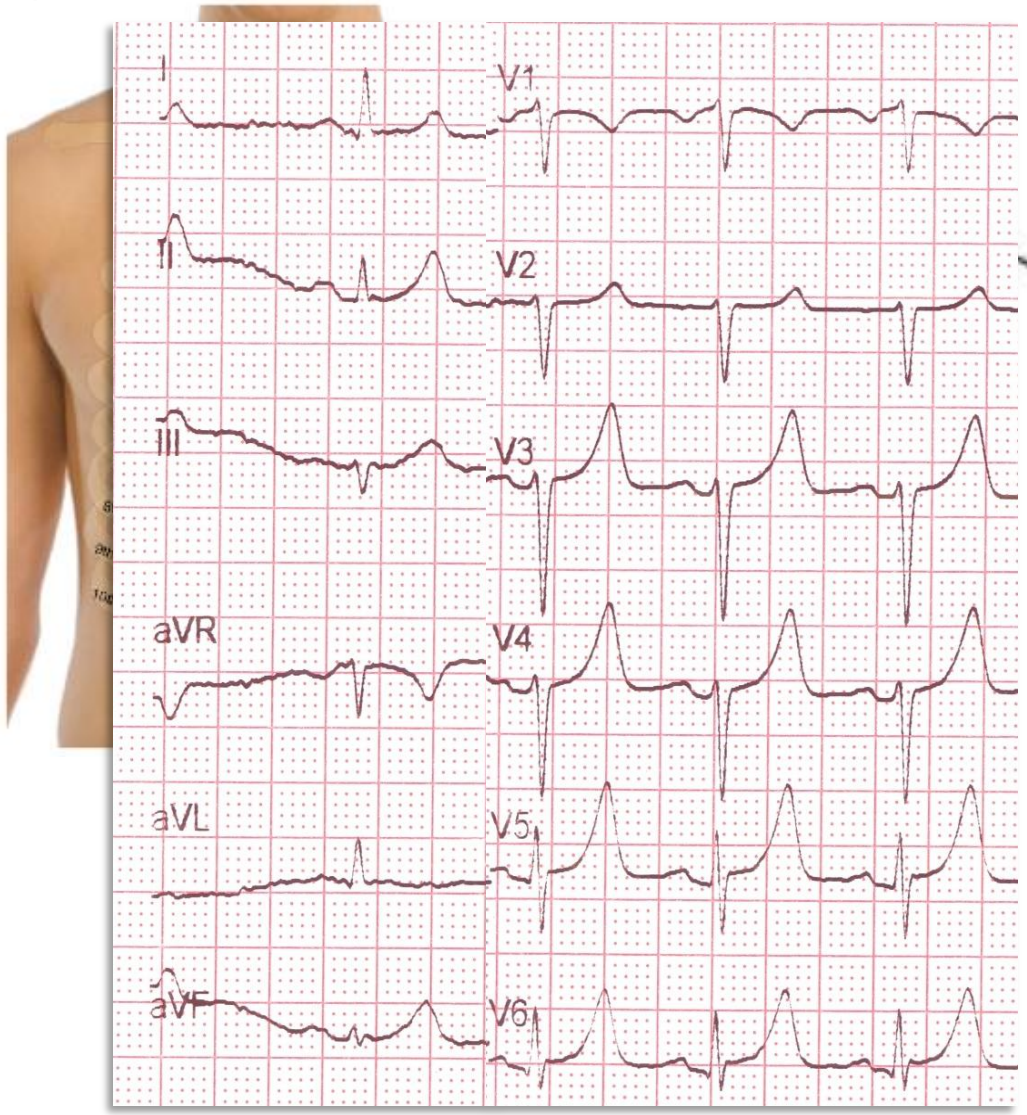
Duckett et al.,
Europace 2012, 14 (1): 99-106.

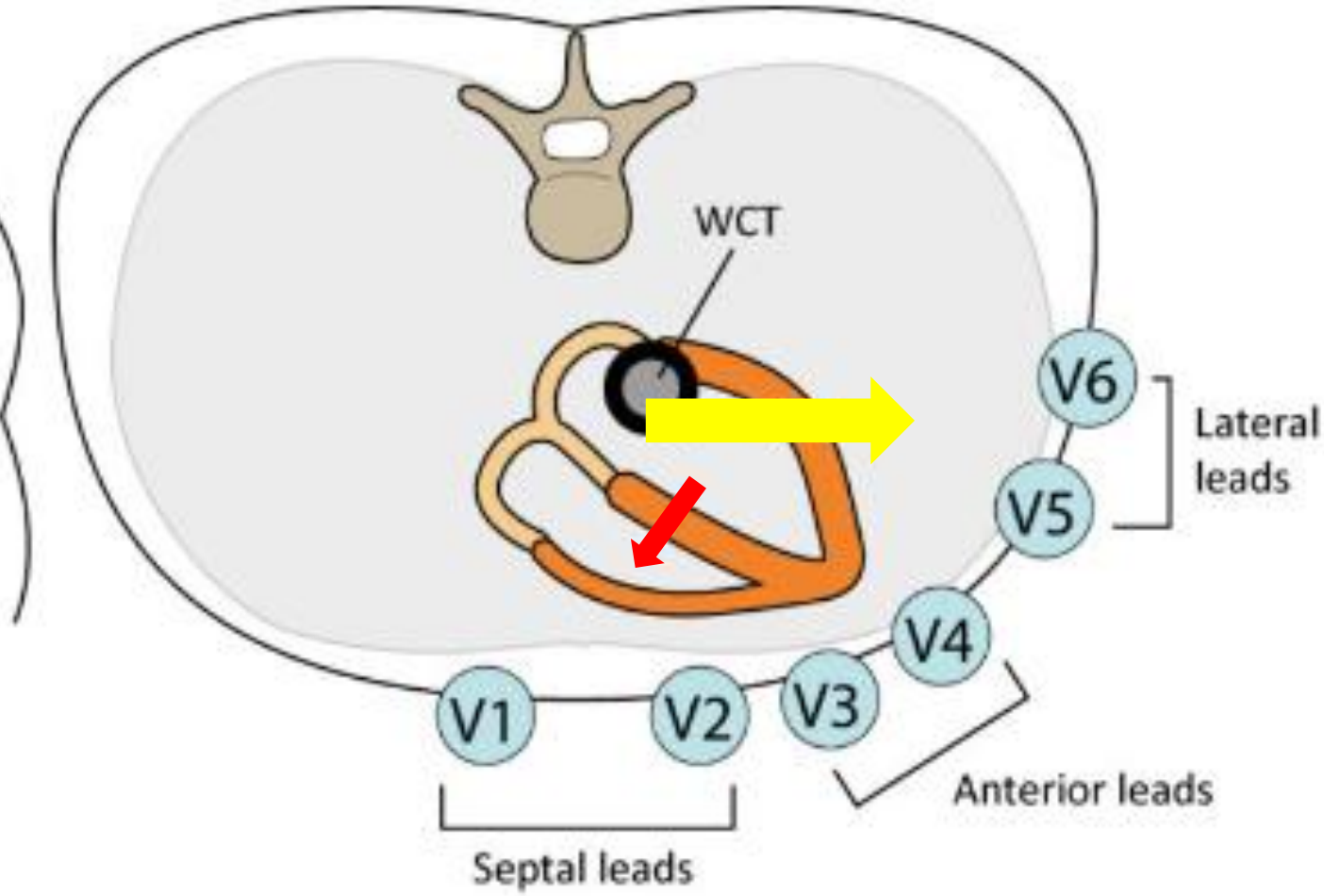
Dyssynchrónia kontrakcie ĽK pri KBĽTR (ECHOKG - Septal Flash)



Duckett et al., *Europace 2012*, 14 (1): 99-106.

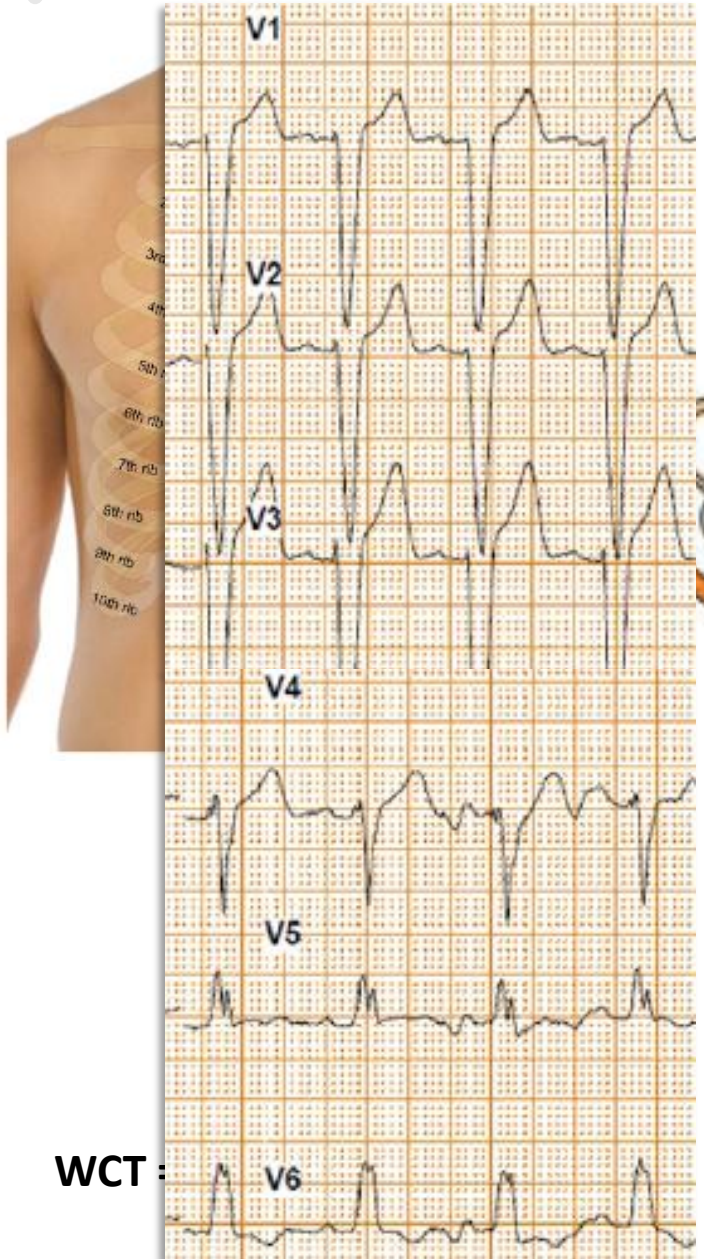
Prekordiálne (hrudné) zvody – normálna aktivácia



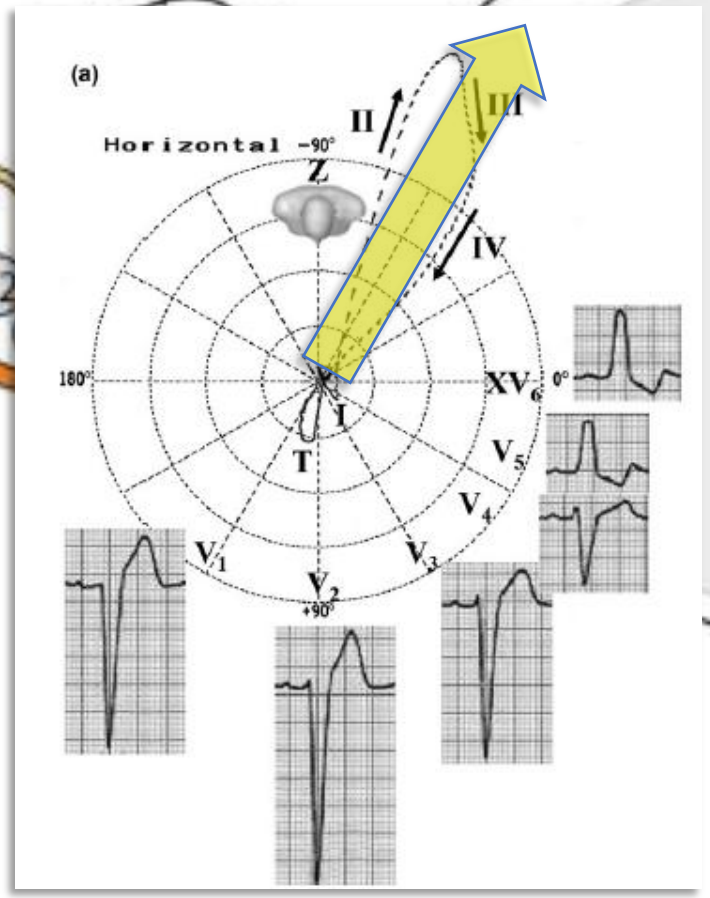


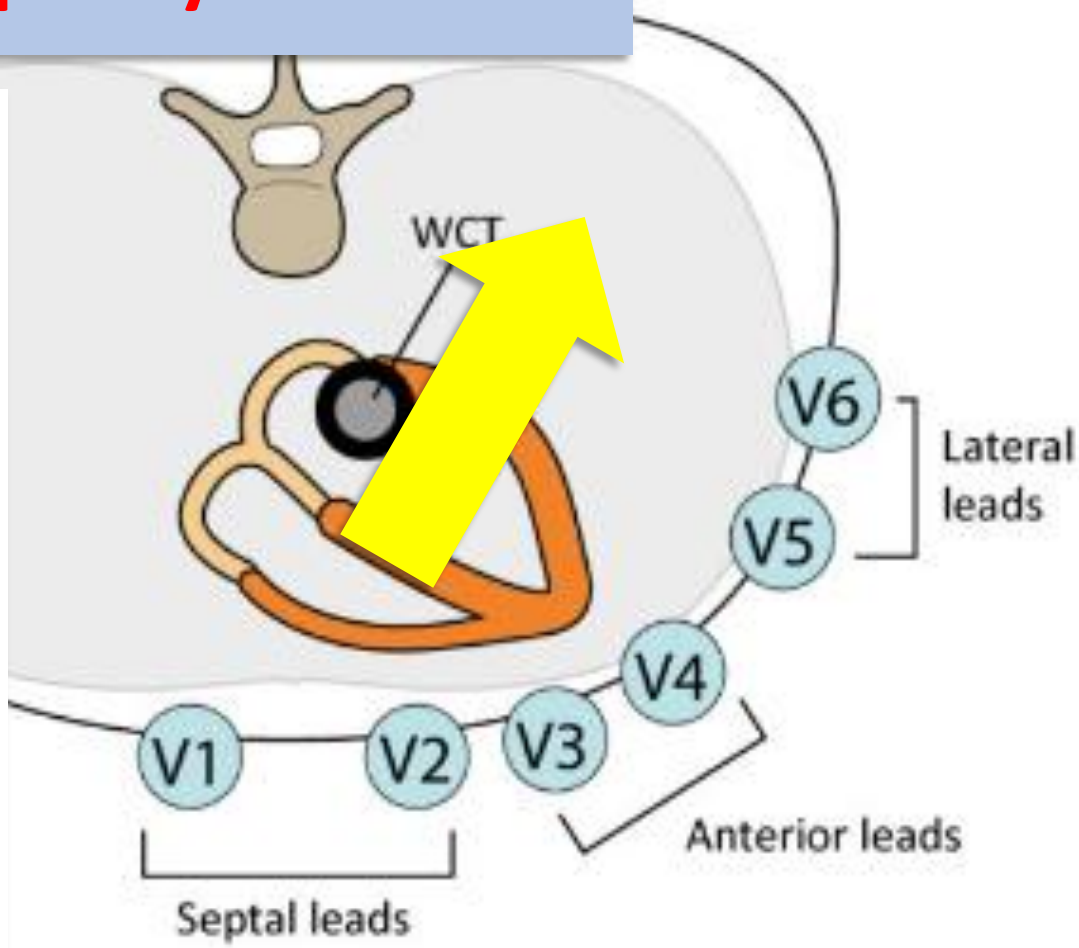
WCT = Wilsonova svorka

Prekordiálne (hrudné) zvody



Kompletný blok ĽTR



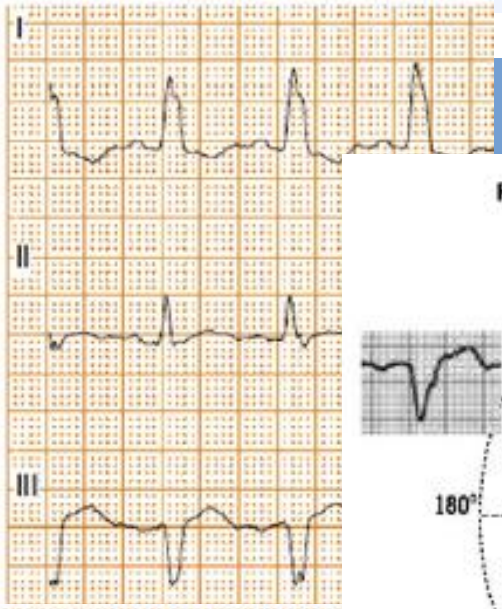


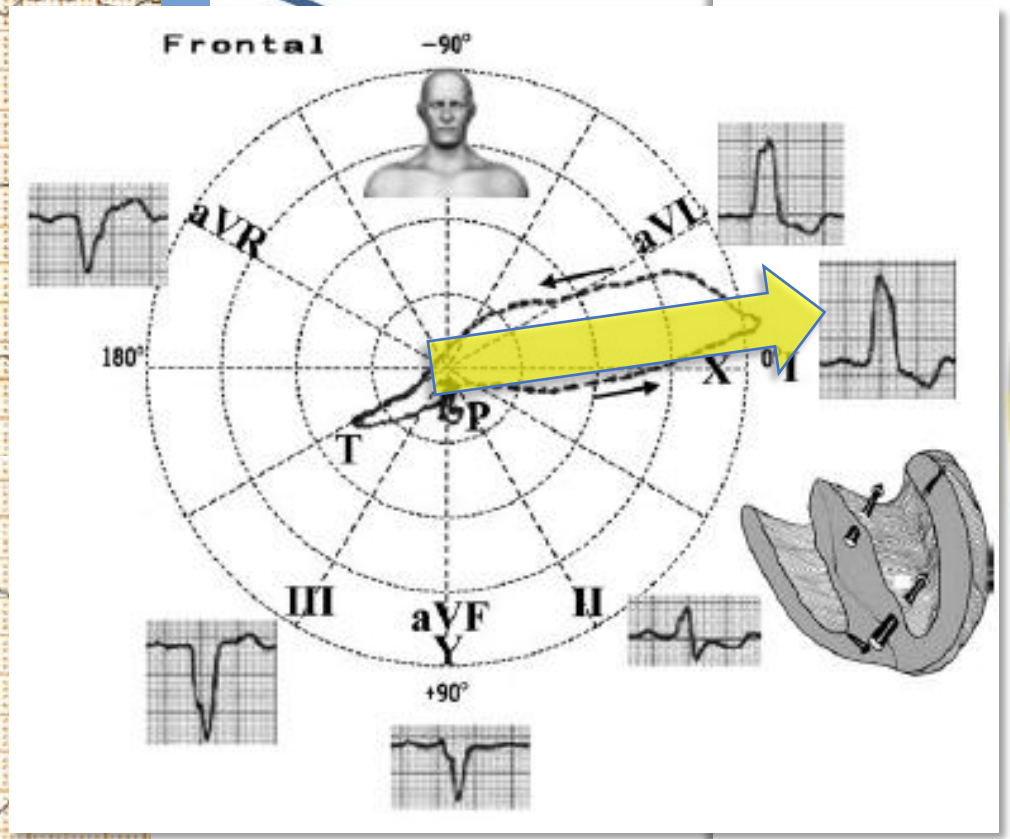
WCT =

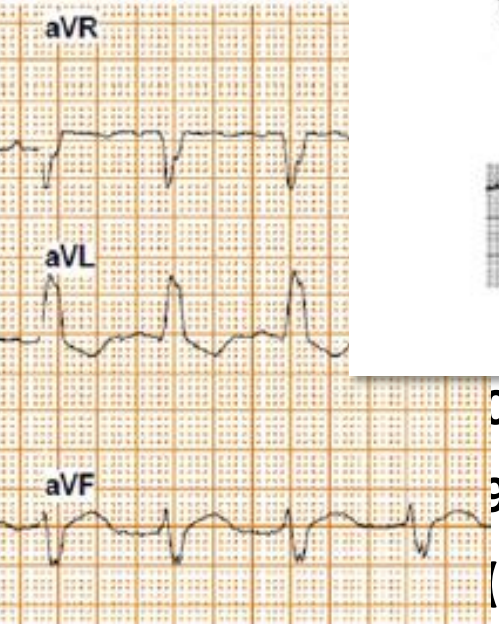
Pérez-Riera et al., *Annals of noninvasive electrocardiology 2019*, 24 (2): e12572.

EKG - štand. zvo

Kompletný blok ĽTR



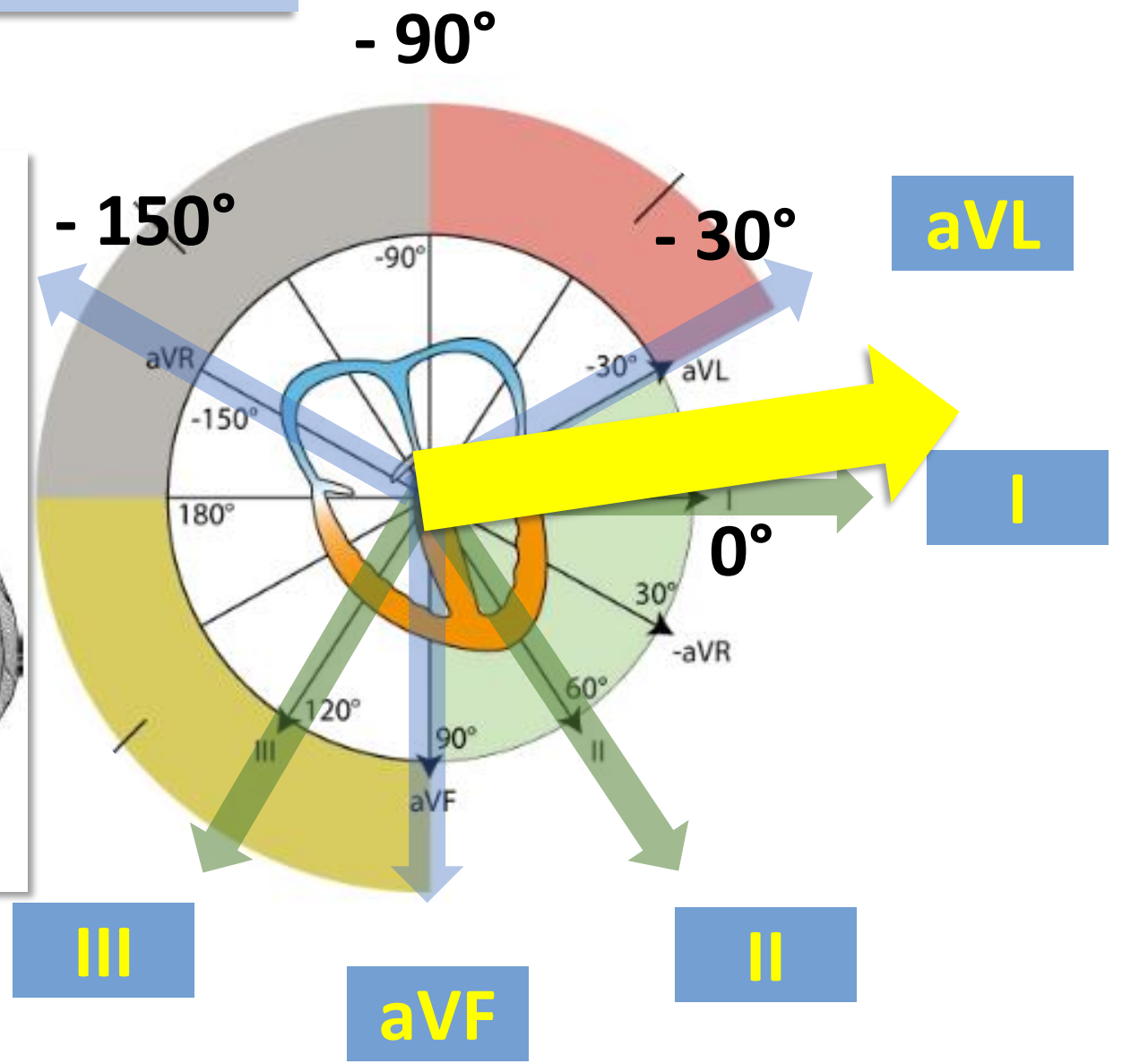




)°až -90°)

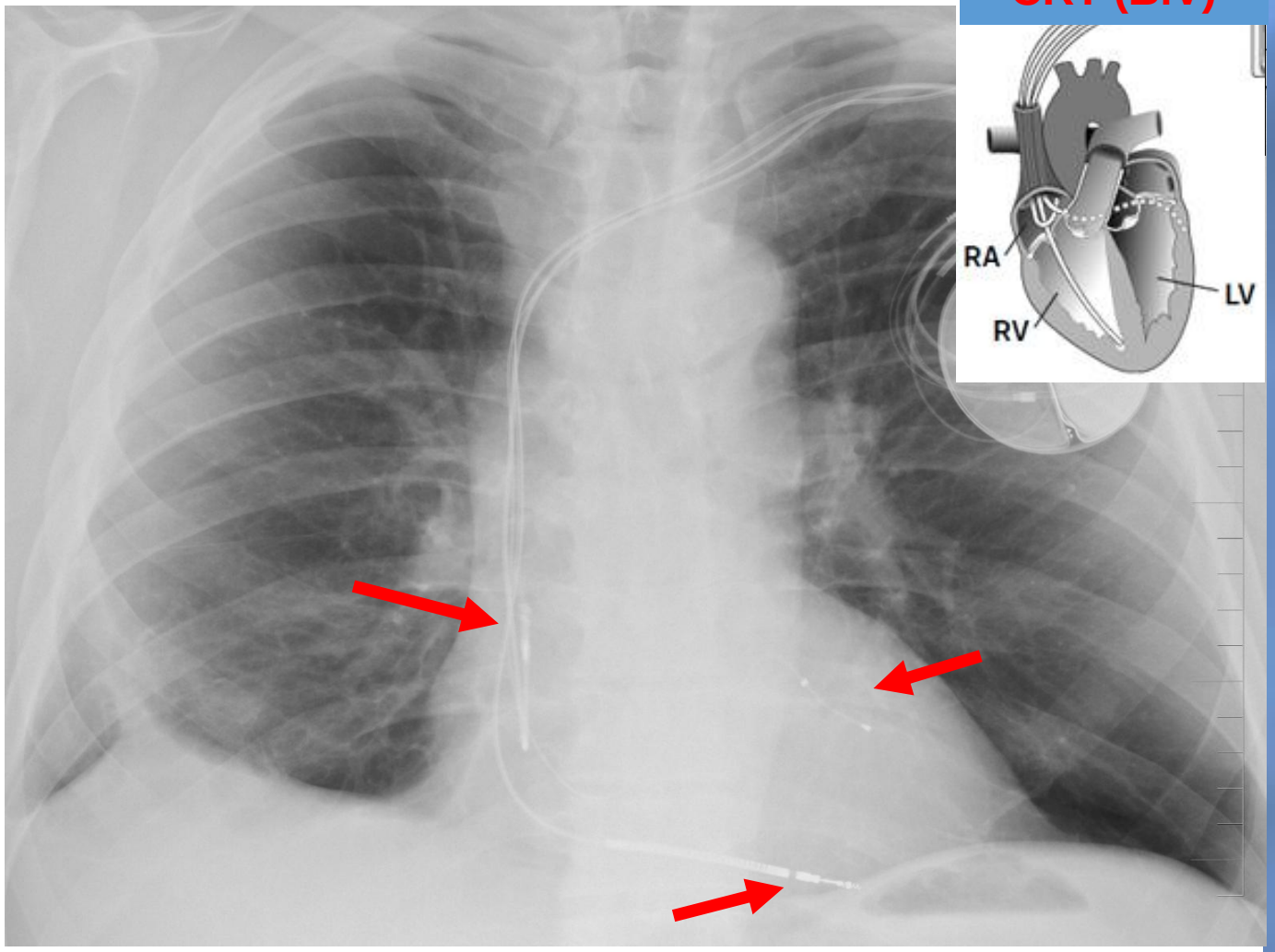
)0°až 180°)

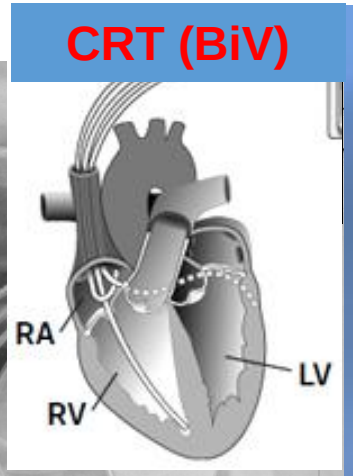
(-90°až 180°)

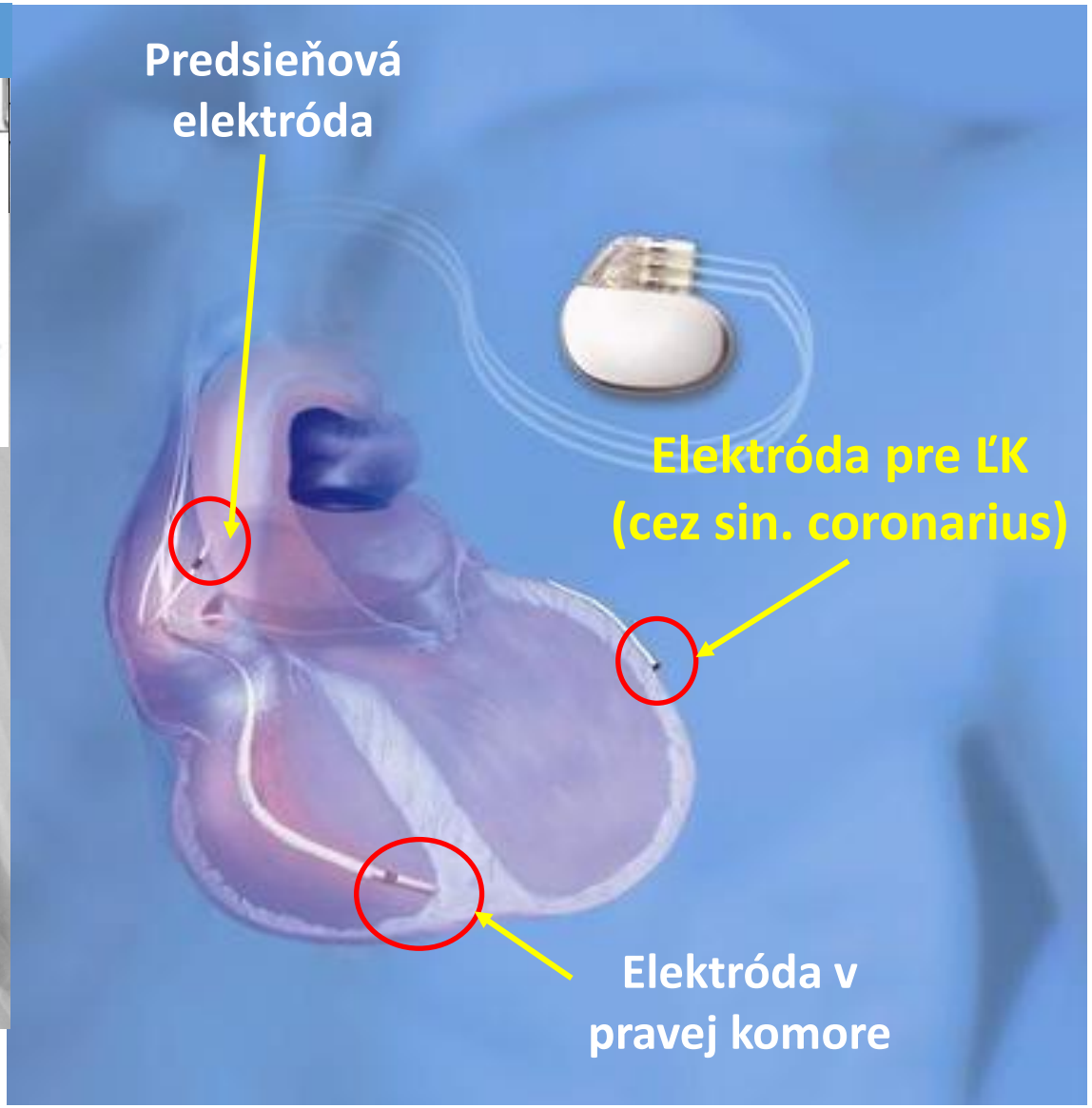


Pérez-Riera et al., *Annals of noninvasive electrocardiology 2019*, 24 (2): e12572.

Kardioresynchronizačná liečba (CRT-P / CRT-D)



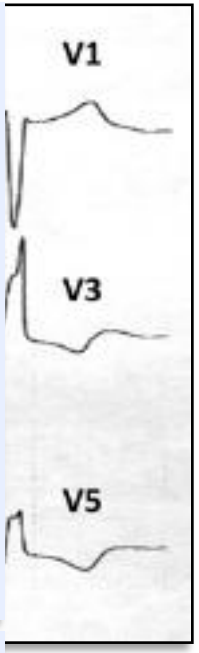




Leon AR et al., *JACC*, 2005, Morgan JM, *Europace* 2009

Efekt kardioresynchronizačnej liečby (CRT)

- ↑ **funkčná kapacita**
- ↑ **kvalita života**
- ↓ **hospitalizácie pre SZ**
- ↓ **celková mortalita:**



➢ **CARE-HF:**

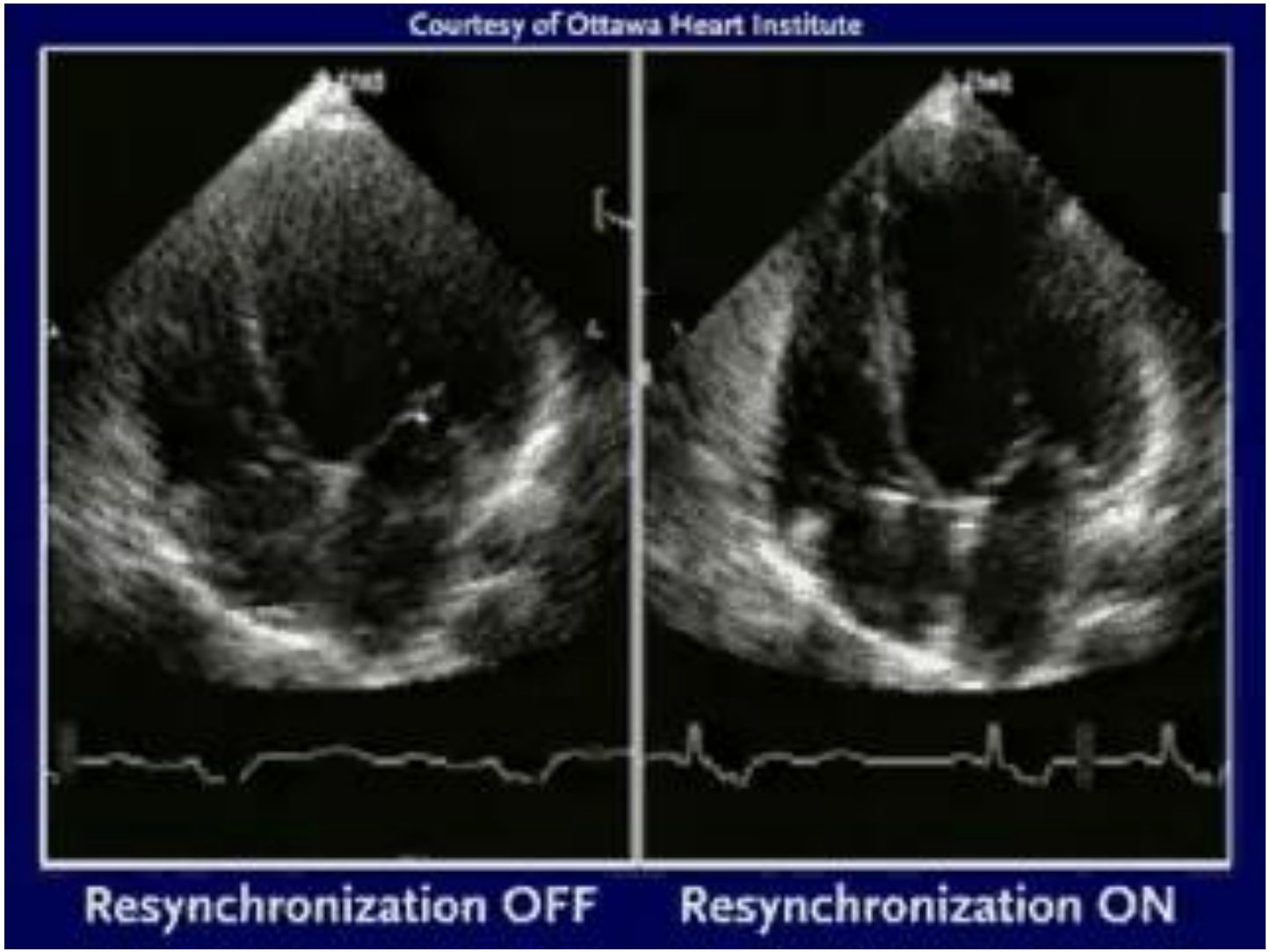
CRT - P: **36%** (RR)

P <0,002, NNT = 9

➢ **COMPANION:**

CRT-D: **- 36%** (RR), *P* = 0,003

CRT- P: **- 24%** (RR), *P* = 0,059



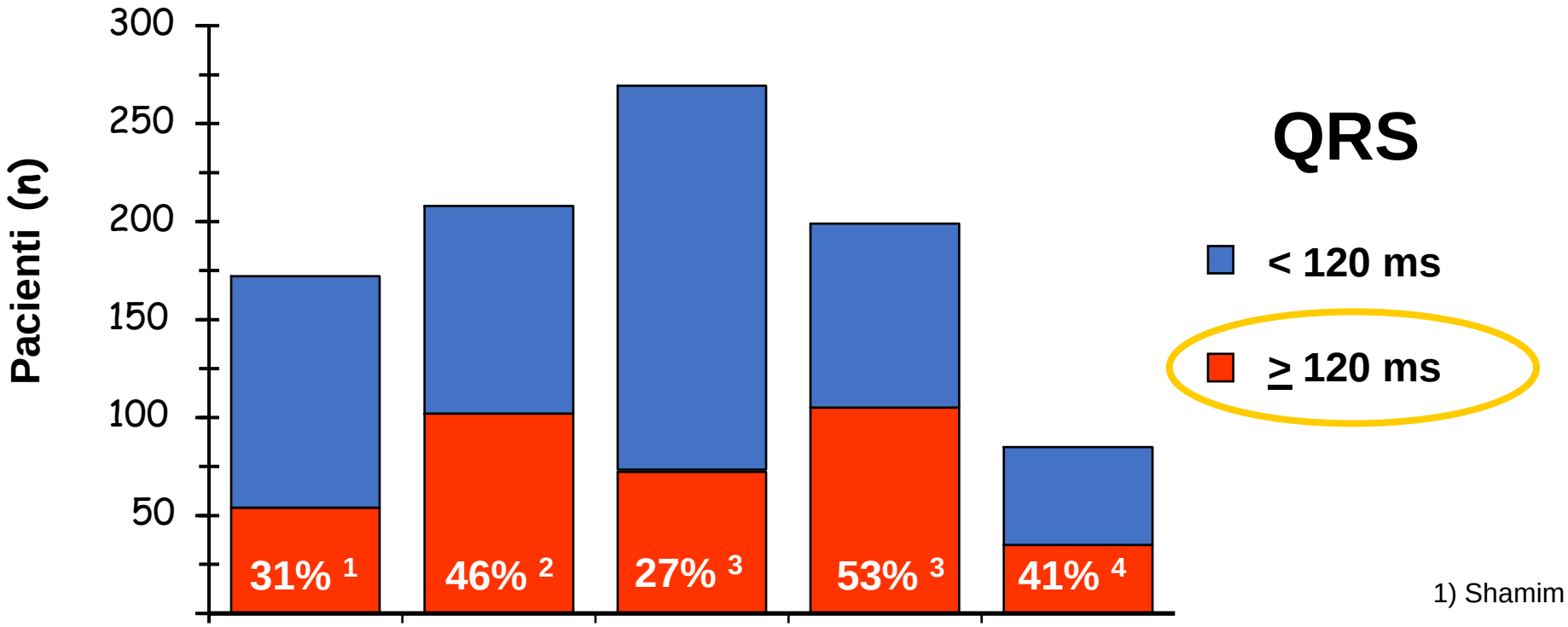
Daubert JC. et al., *Arch Cardiovasc Dis 2012*, 105: 291-99.

2016 ESC Guidelines on Heart Failure, *Eur Heart Jour 2016,* 37: 2129-2200

Spomalenie vedenia vzruchov pri CHSZ

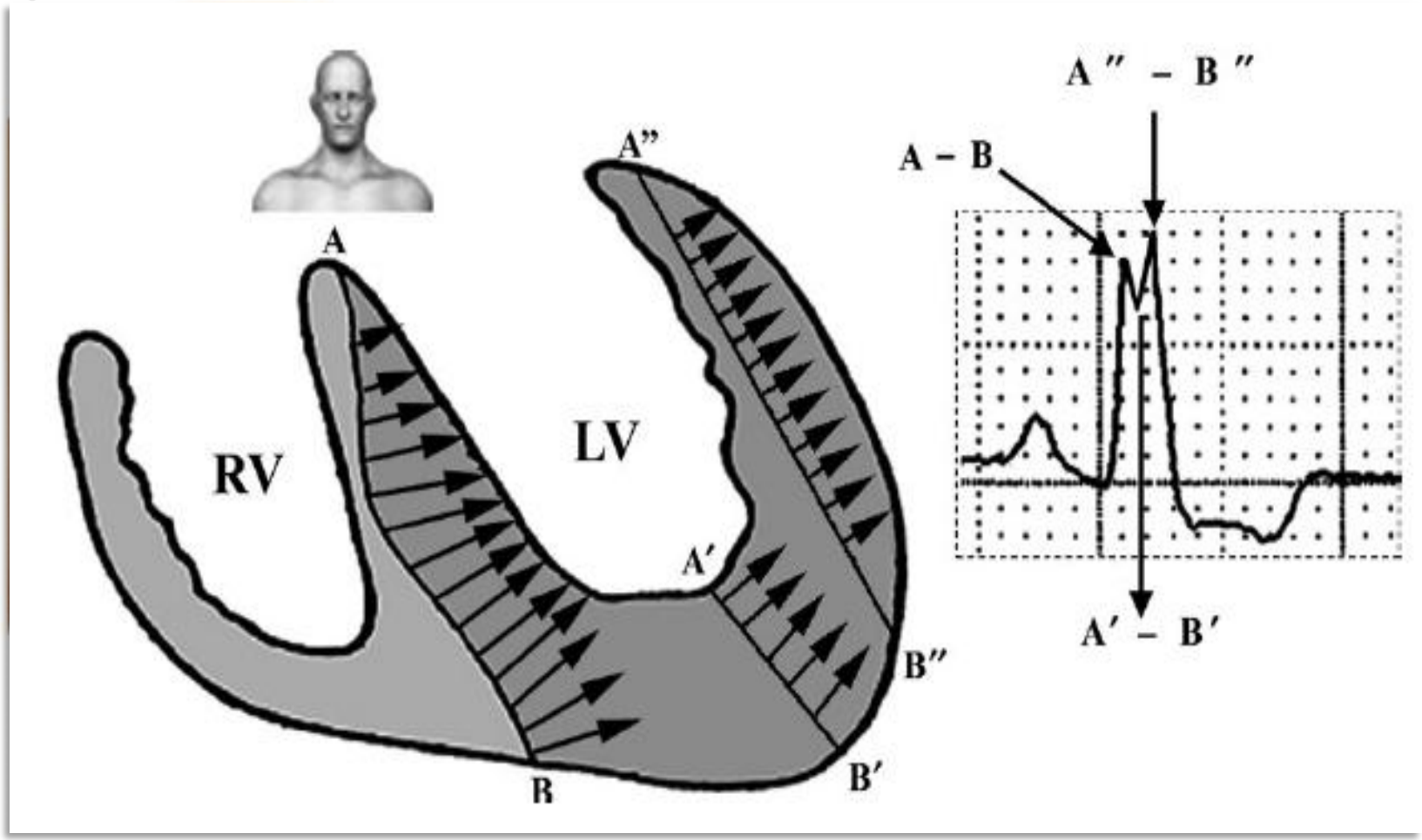
QRS ≥ 120ms: 27- 53%
KBĽTR: 15-27%
AVB I st.: 35%

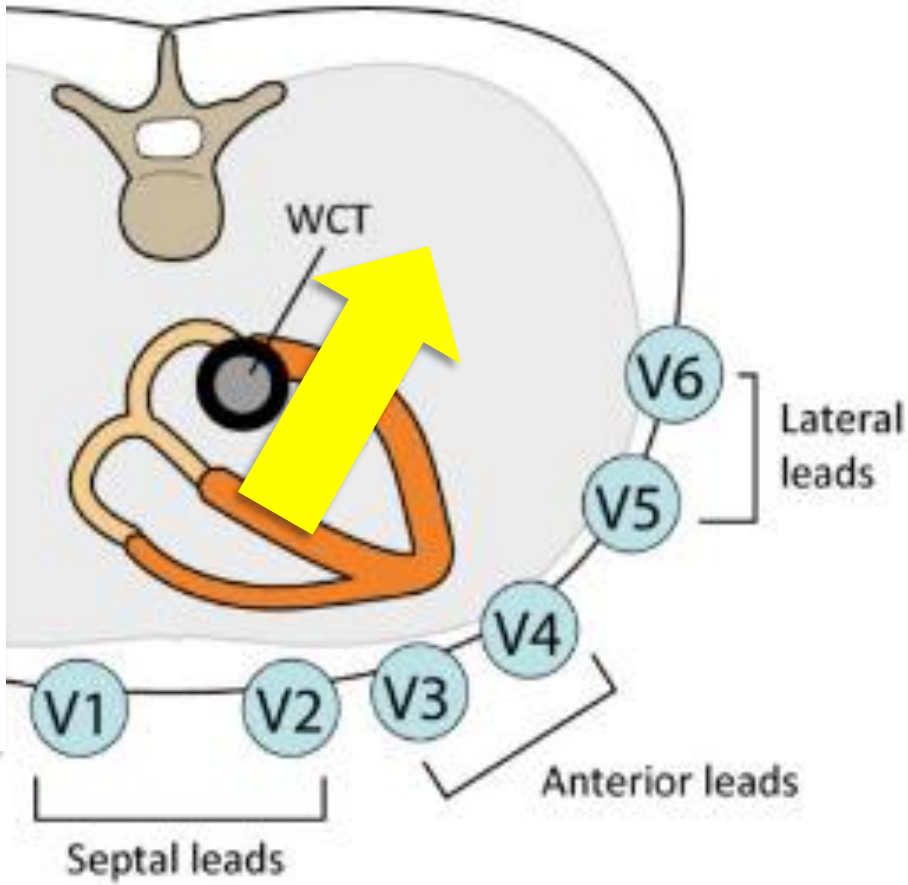
} **chorých s pokročilým SZ**



1) Shamim et al. *Eur Heart J* 1998;19:abstract 926.
2) Lamp, et al. *PACE* 1998;2:II-975
3) Aaronson et al. *Circulation* 1997; 95:2660-2667.
4) Schoeller et al. *Am J Cardiol* 1993;71:720-726

Zárezy v QRS pri typickom KBĽTR



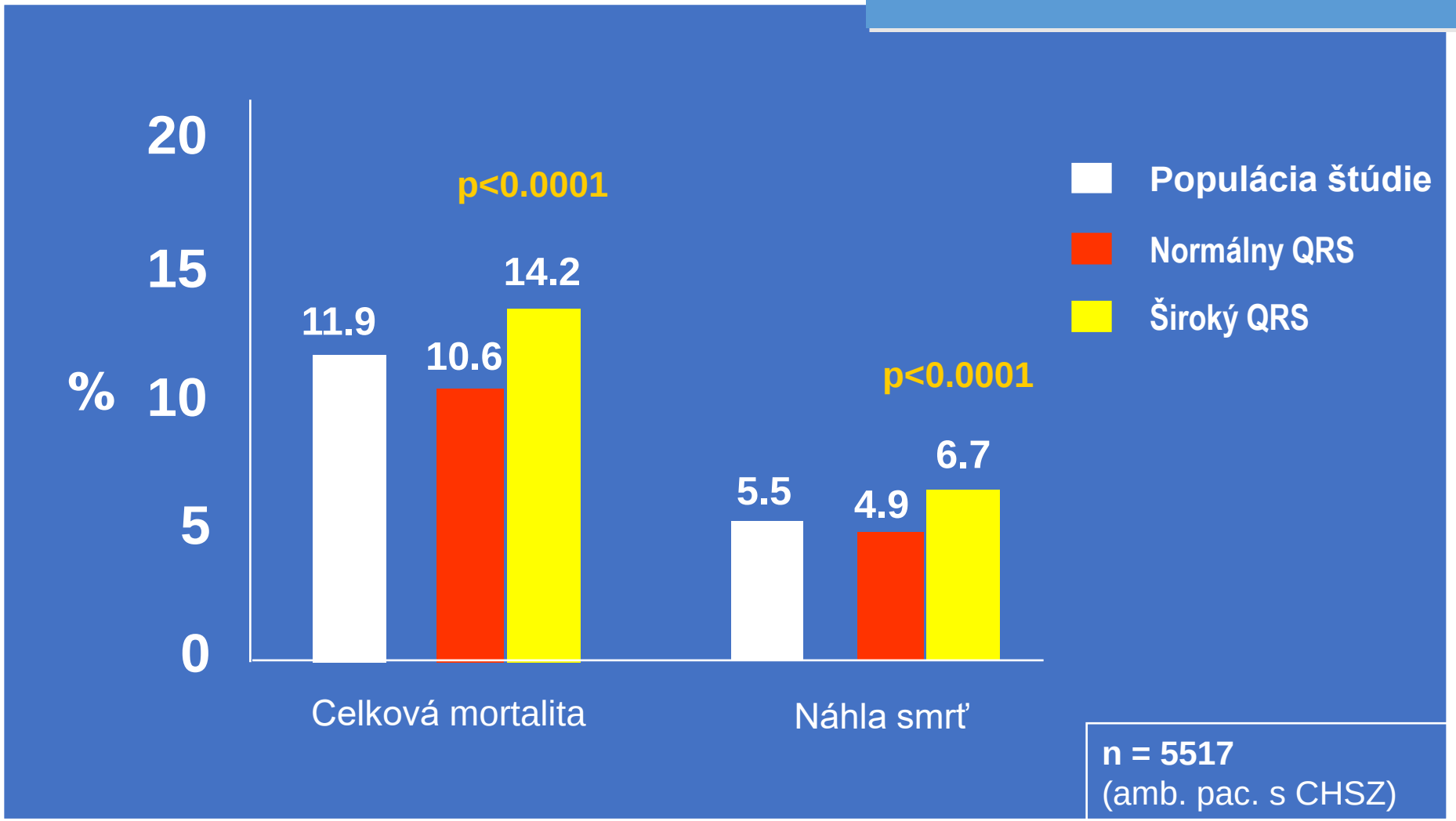


WCT = Wilsonova svorka

Pérez-Riera et al., *Annals of noninvasive electrocardiology 2019*, 24 (2): e12572.

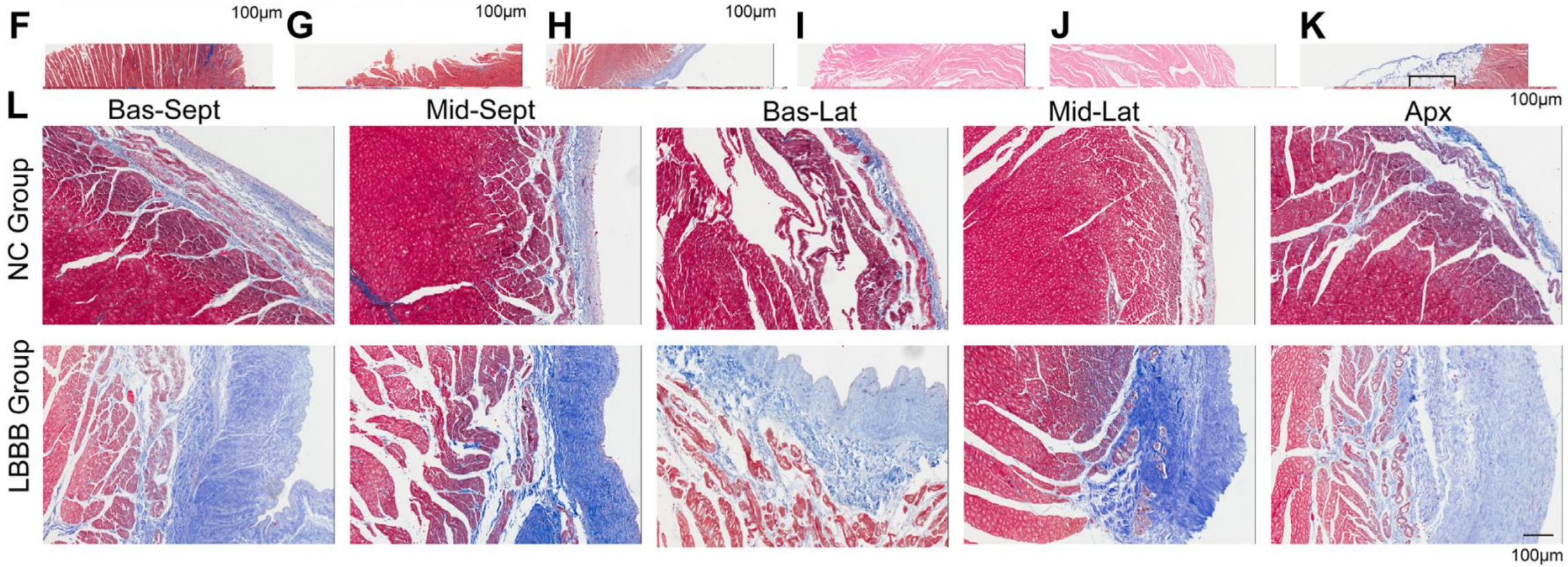
Horšia prognóza pri SZ a poruche vnútrokom. vedenia

KBĽTR a 1-ročná mortalita pri CHSZ



S. Baldasseroni et al., *Am Heart J,* 2002;143:398-405

Prognóza novovzniknutého KBĽTR – zvierací model (psy)

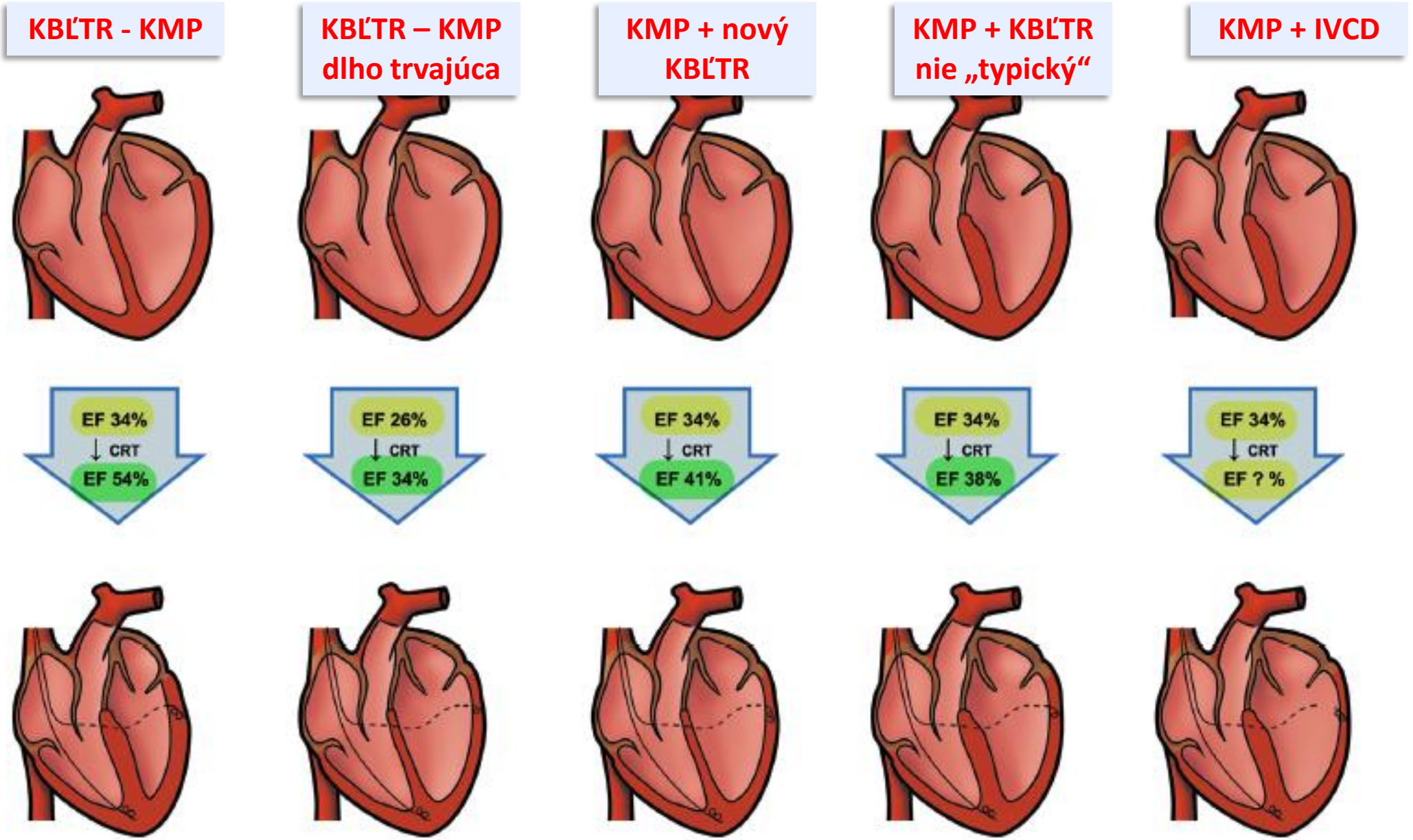


	Baseline	1st month LBBB	3rd month LBBB	6th month LBBB	12th month LBBB
LVEDV, mL	20.78 ± 1.42	20.86 ± 0.88	21.07 ± 1.11	24.86 ± 1.62	26.71 ± 2.12*
LVESV, mL	8.36 ± 0.48	8.93 ± 0.36	9.50 ± 0.59	11.50 ± 0.78**	14.14 ± 1.32**
LVEF, %	59.17 ± 1.45	56.97 ± 1.17	55.17 ± 0.84	53.79 ± 0.51*	47.69 ± 1.44**

*$P < .05$, **$P < .01$ vs baseline parameters.

Wang X. et al., *Heart Rhythm 2024*;21:1370–1379

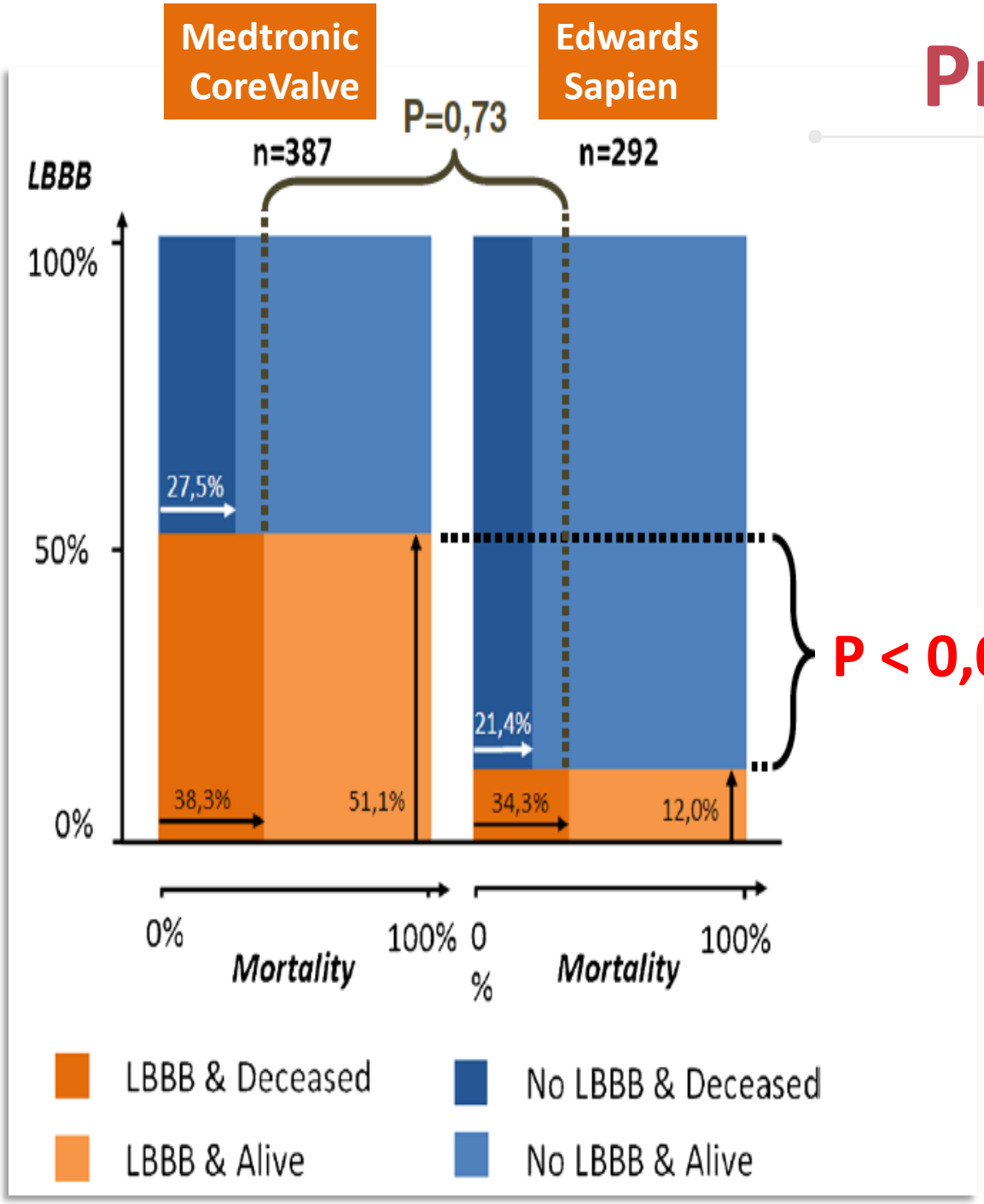
Korekcia BĽTR / dyssynchrónie ĽK a klinické scenáre CHSZ



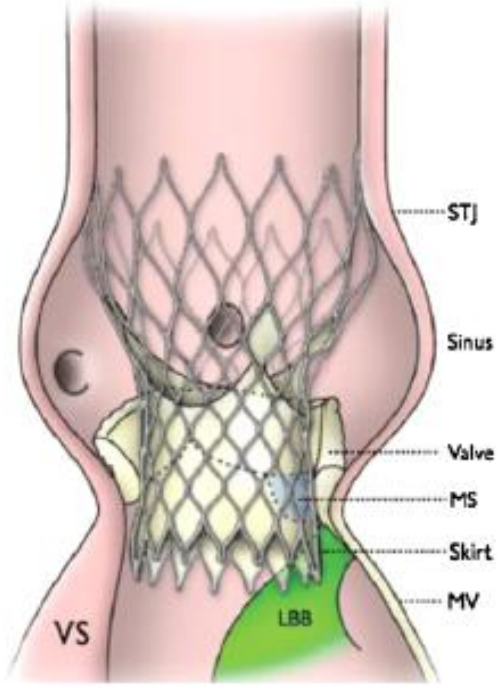
Calle et al., *Trends Card. Medicine 2020*, 30 (2): 115-22.

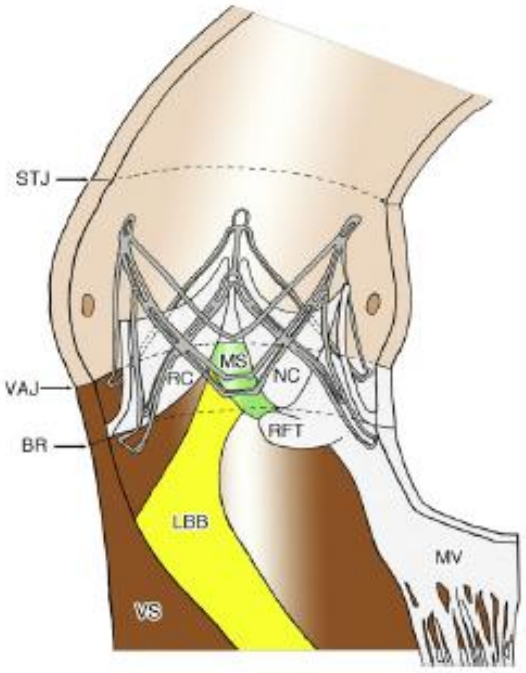
Prognóza KBĽTR po TAVI

Výskyt a mortality KBĽTR po TAVI (porovnanie 2 typov protéz)



P < 0,001



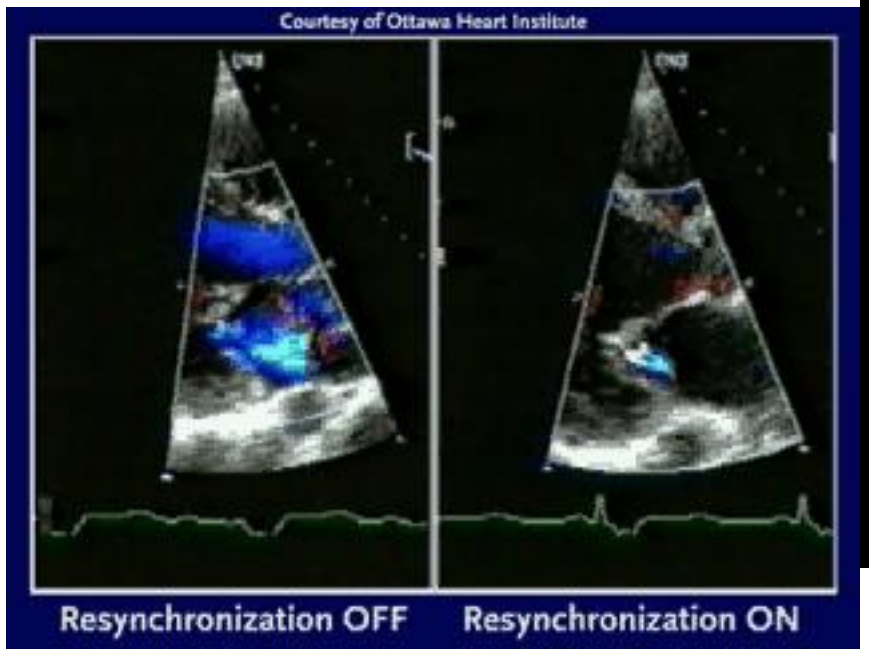


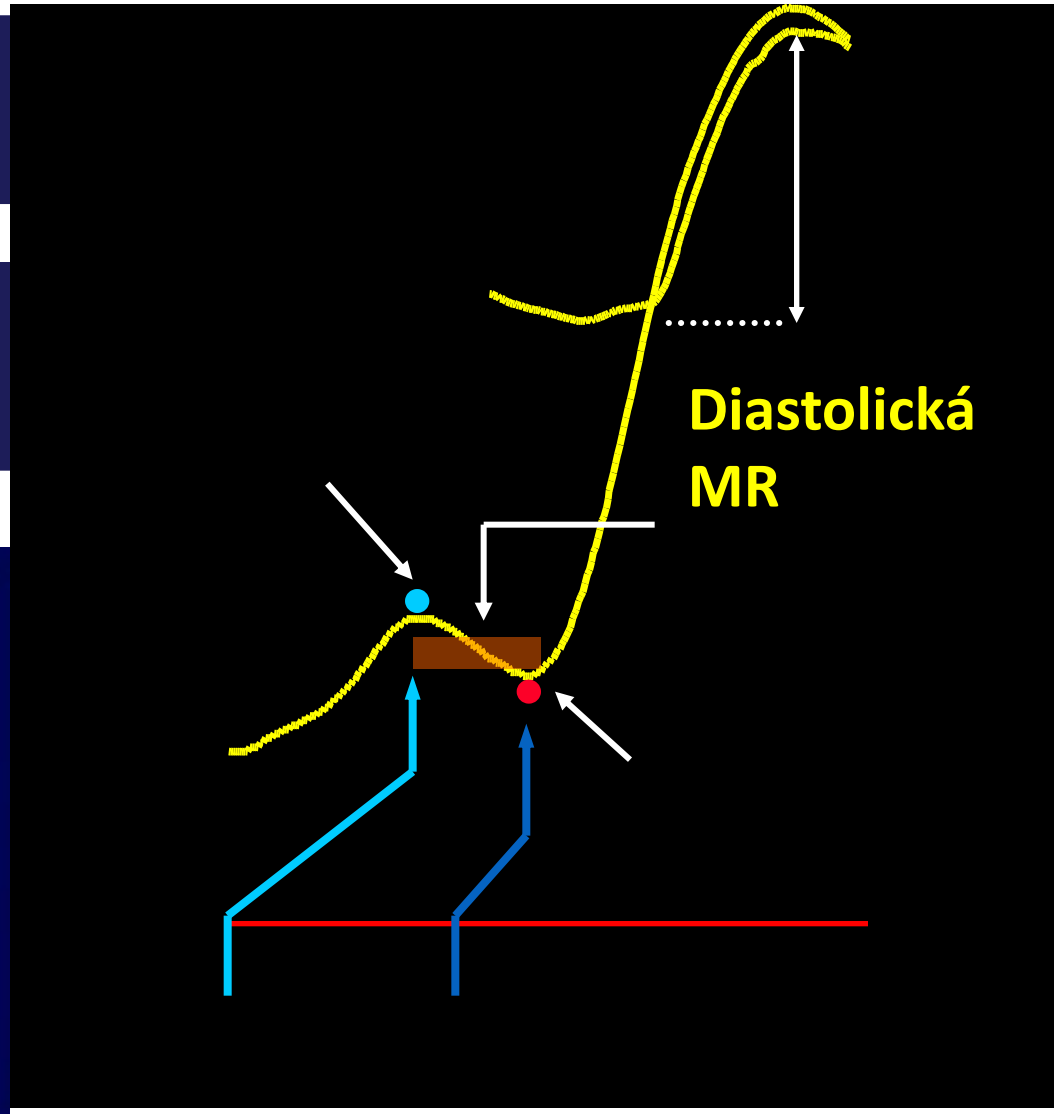
Houthuizen P et al., *Circulation. 2012*; 126:720

Komorová dysynchrónia – AV zložka

Oneskorenie ĽK kontrakcie vo vzťahu k maximálnej kontrakcii A, čím významne poklesne preload.

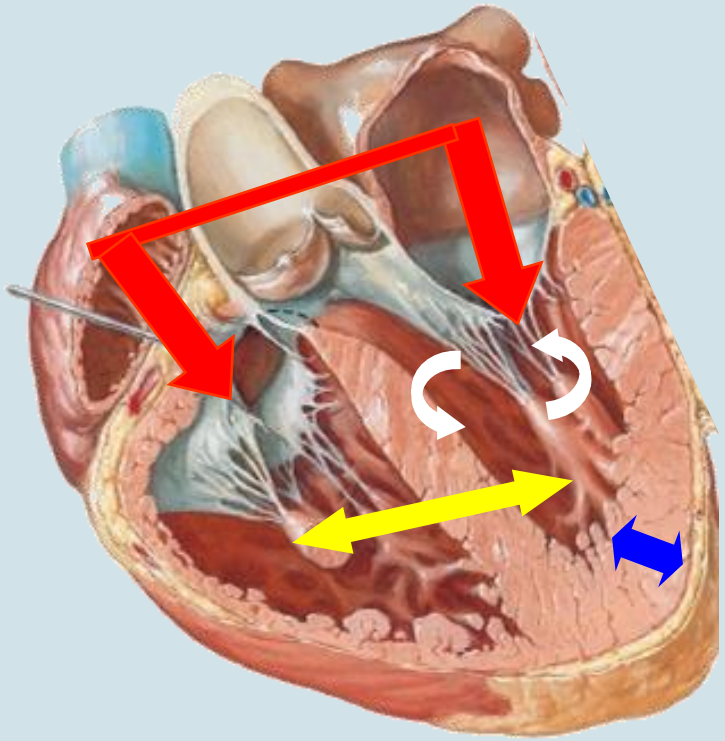
V istom momente tlak v ĽK prevýši tlak v ĽP a dochádza k diastolickej (presystolickej) MR





SZ – Elektrická and mechanická dyssynchrónia

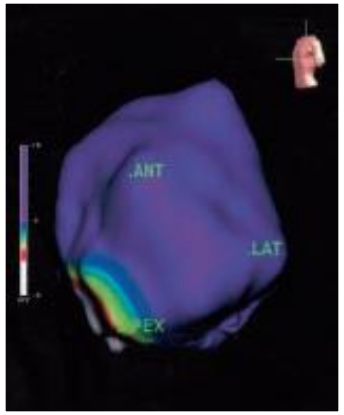
4 – úrovne:

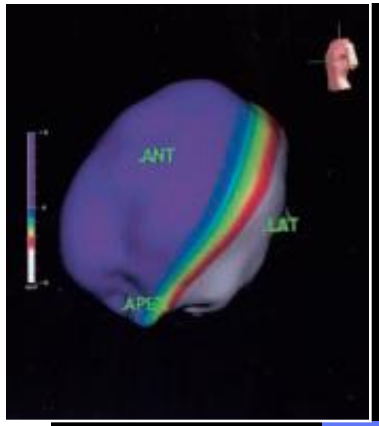


1. atrioventrikulárna (AV)
2. interventrikulárna
3. intraventrikulárna
4. intramurálna

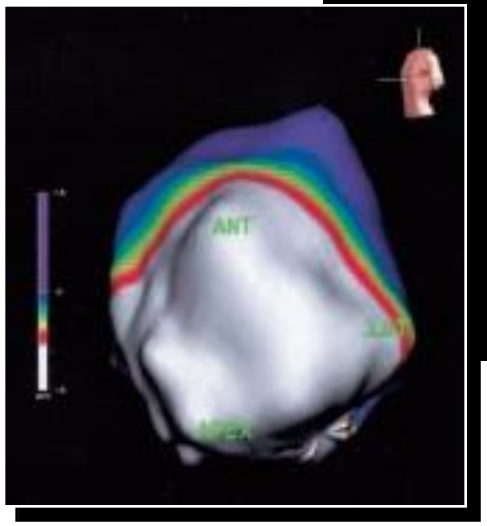
→ menej efektívna kontrakcia

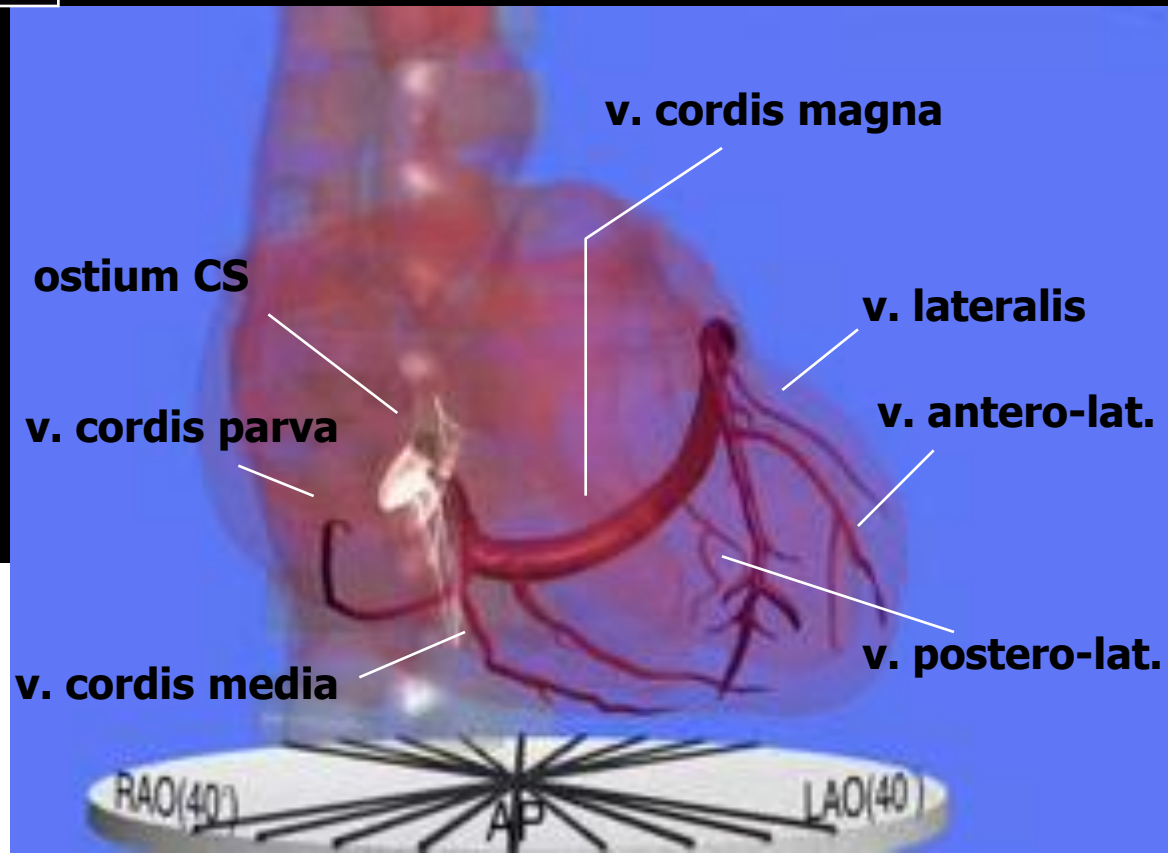
Resynchronizácia – implantácia BiV KS / ICD (CRT-P/D)



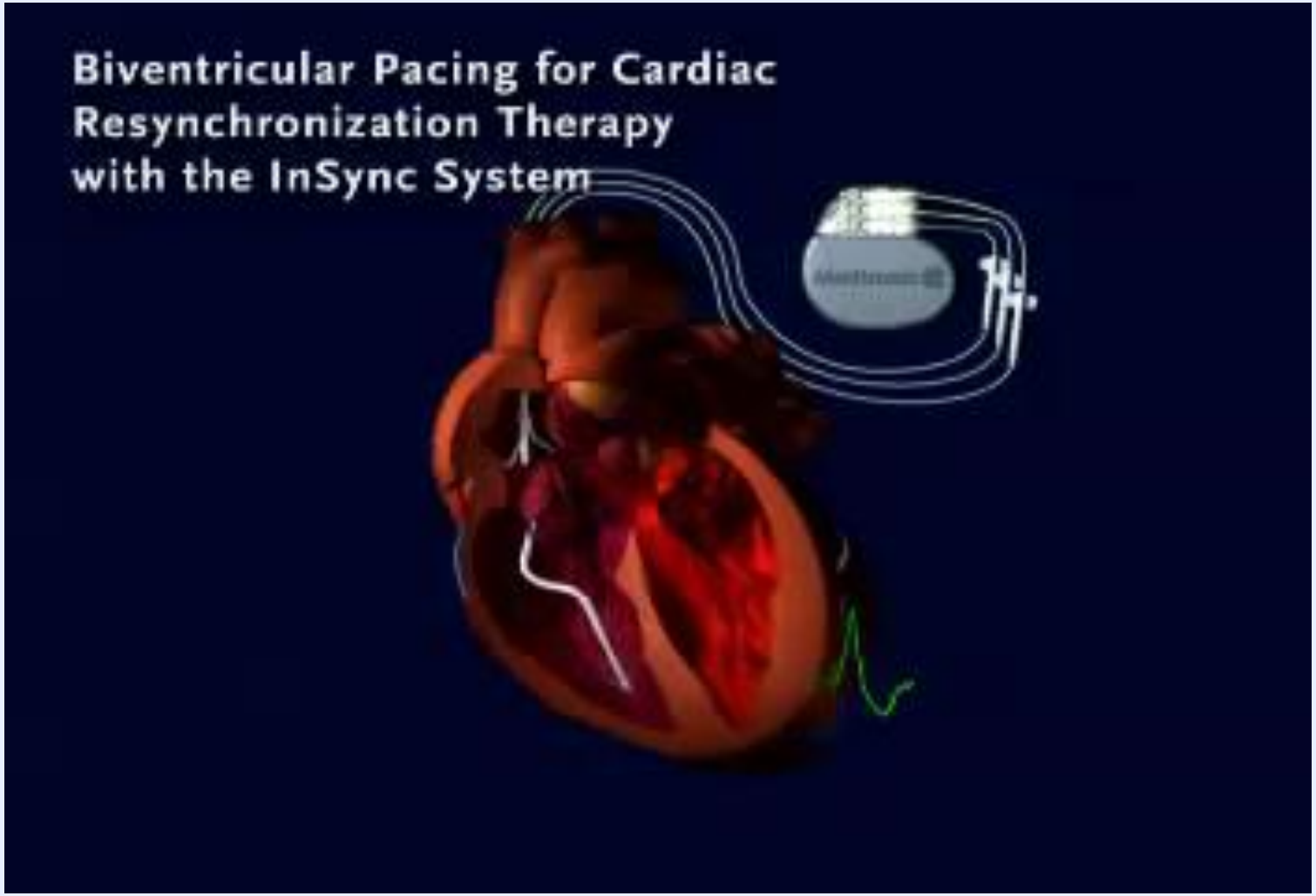


CIEĽ : fúzia depolarizačných frontov podobná šíreniu normálnej depolarzácie





Kardioresynchronizačná liečba SZ (CRT)



Medtronic, Inc.

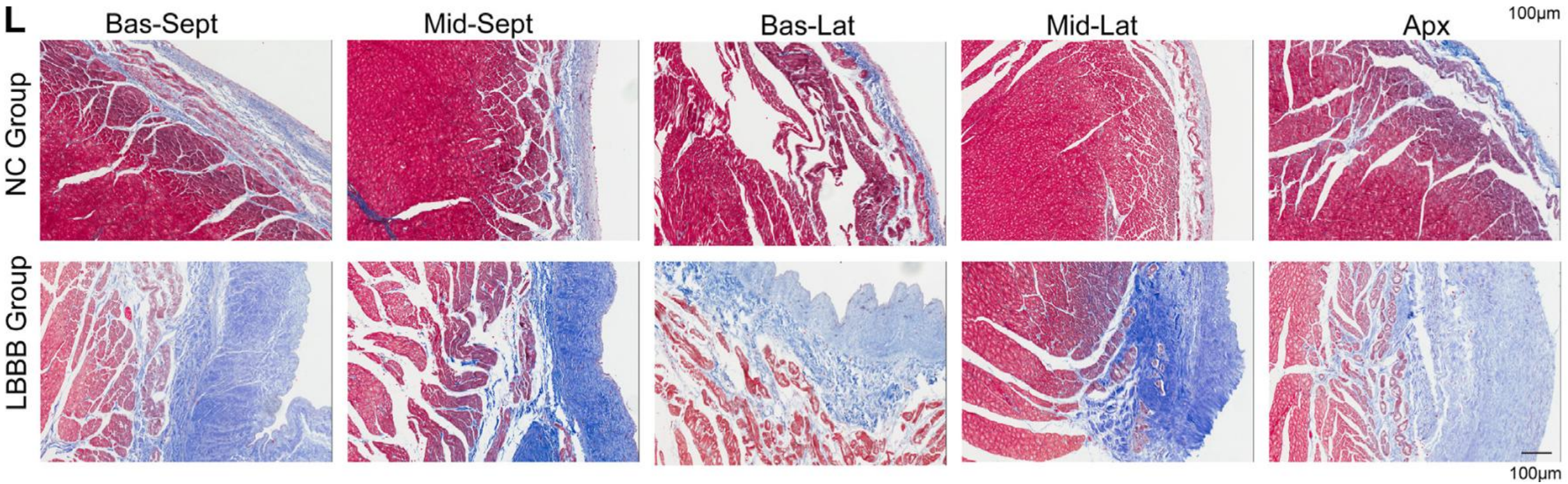
Indikácia CRT pri srdcovom zlyhávaní

Recommendations	Class	Level
CRT is recommended in symptomatic (NYHA II – IVa) patients with HF in SR with LVEF ≤ 35%, QRS duration ≥ 150 ms, and LBBB QRS morphology despite OMT, in order to improve symptoms and reduce morbidity and mortality.		
• **SR, LBBB, QRS ≥ 150 ms**	**I**	**A**
• **SR, LBBB, QRS 130 - 149 ms**	**IIa**	**B**
• **SR, non LBBB, QRS ≥ 150 ms**	**IIa**	**B**
• **SR, non LBBB, QRS 130 - 149 ms**	**IIb**	**B**

ESC guidelines 2021

Glikson et al., *European heart journal 2021*, 42 (35): 3427-520.

Remodelácie ĽK (KMP) pri indukovanom KBĽTR – zvierací model (psy)



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