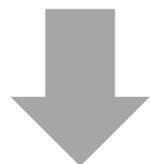


SOUČASNÉ MOŽNOSTI NEINVAZIVNÍHO ZOBRAZENÍ KOMOROVÉ DYSSYNCHRONIE PRO CRT

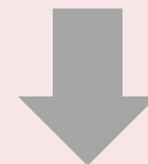
Pavel Jurák

BRADY



**Synchronní
nedesynchronizovat**

CRT



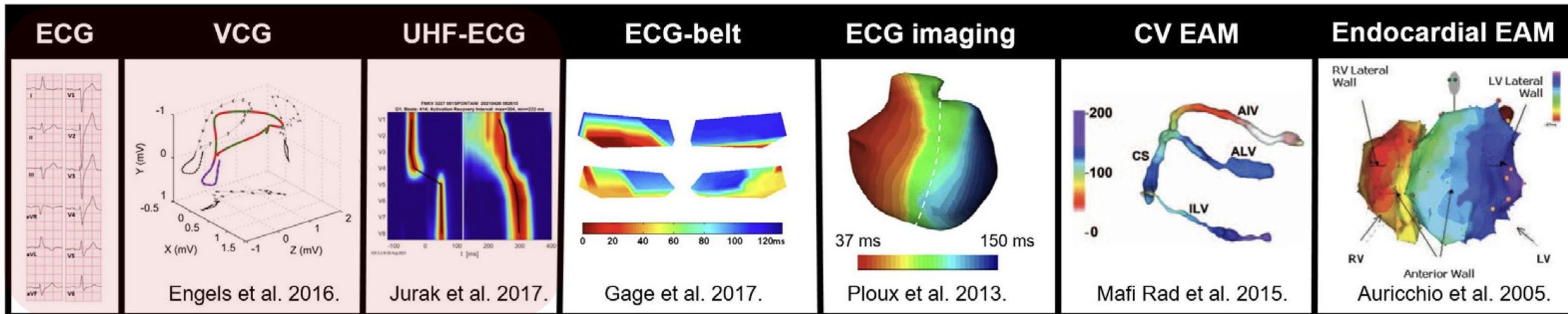
**Synchronizovat
resynchronizovatelné**

- CRT má smysl, pokud existuje komorová dyssynchronie.
- Typ a velikosti poruchy elektrické aktivace určuje techniku CRT.

Jak měřit a zobrazit komorovou dyssynchronii ?

- Šířka QRS
- QRS morfologie - Strauss
- QRS area X-Y-Z
- UHF-ECG

EKG



Non-invasive

Invasive



Senzitivita 75-95%

Specifická 35-55%

SK dobře identifikují pacienty, kteří skutečně budou profitovat z CRT, ale mohou některé vhodné pacienty vynechat.

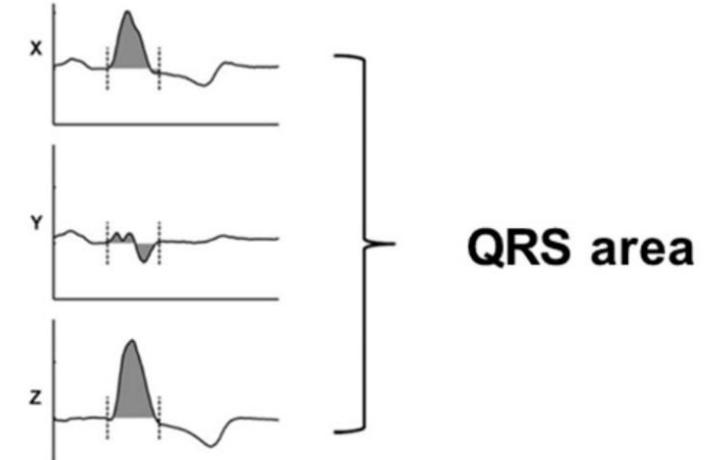
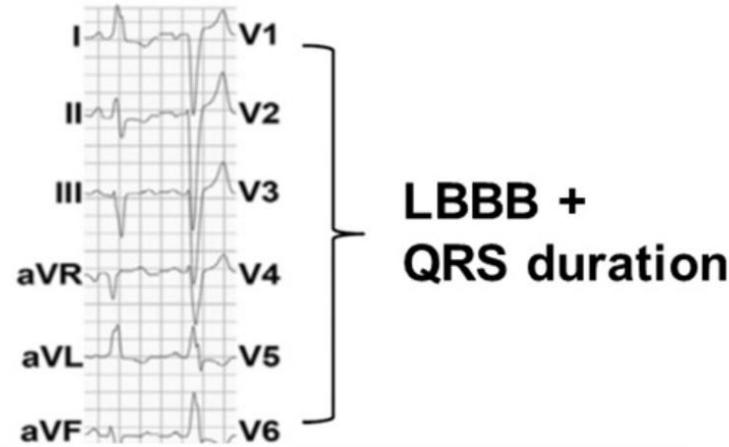
Strausova kritéria pro LBBB

- **Délka QRS komplexu:**
 - ≥ 140 ms u mužů
 - ≥ 130 ms u žen
- **Morfologie v pravostranných svodech:**
 - QS nebo rS vzorec v svodech V1 a V2
- **Změny ve střední části QRS:**
 - Zářezy (notching) nebo rozmazání (slurring) ve dvou sousedních svodech z následující skupiny: V1, V2, V5, V6, I, a aVL.

**Viz přednáška Karol Čurila – Pondělí, 11:30-13:00, CRT a CSP
U KANDIDÁTŮ NA SRDEČNÍ RESYNCHRONIZAČNÍ TERAPII ULTRA-VYSOKO-FREKVENČNÍ EKG PŘEKONÁVÁ STRAUSSOVA KRITÉRIA PRO ODLIŠENÍ BLOKÁDY LEVÉHO RAMÉNKA TAWAROVA OD NITROKOMOROVÉ PORUCHY VEDENÍ**

QRS area

QRS area má silnou souvislost s klinickou a echokardiografickou odezvou na CRT



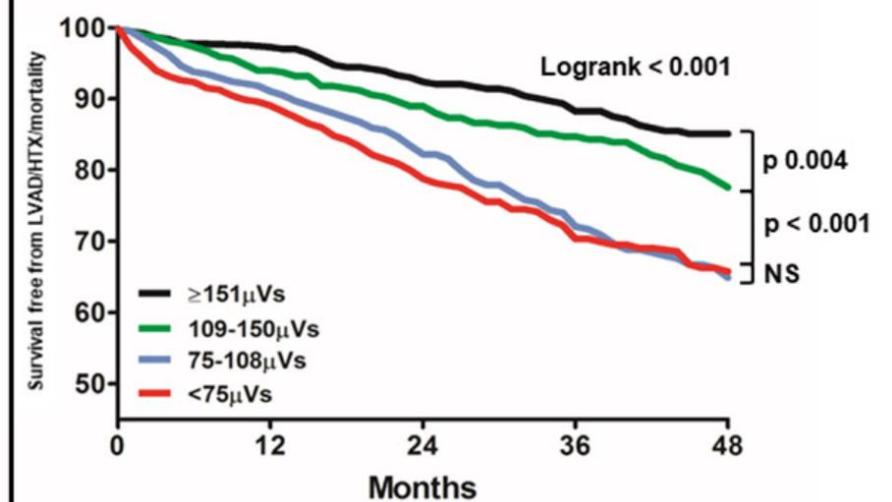
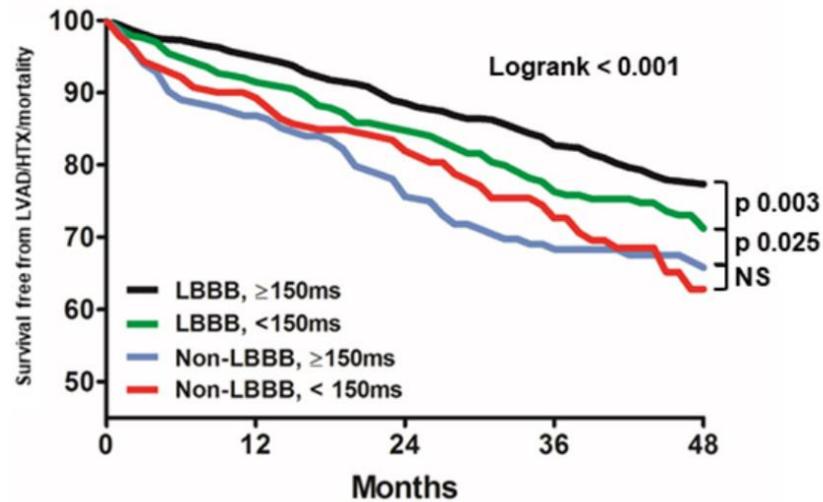
LBBB QRS area > 70 μ Vs

Senzitivita 87 %

Specifická 92 %

MA Ghossein et al., 2022

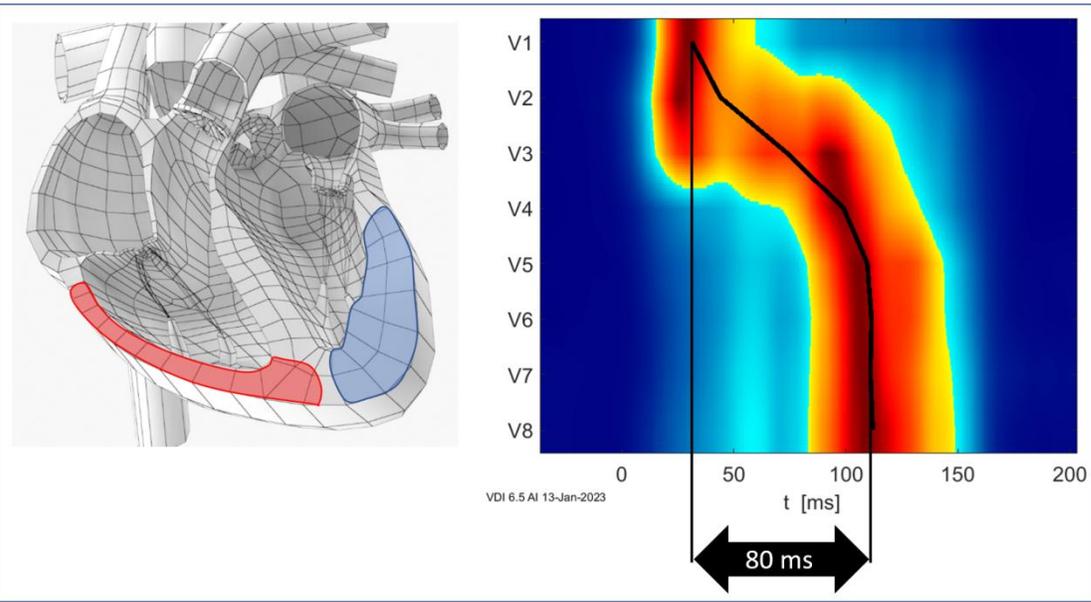
[Vectorcardiographic QRS area as a predictor of response to cardiac resynchronization therapy - PMC](#)



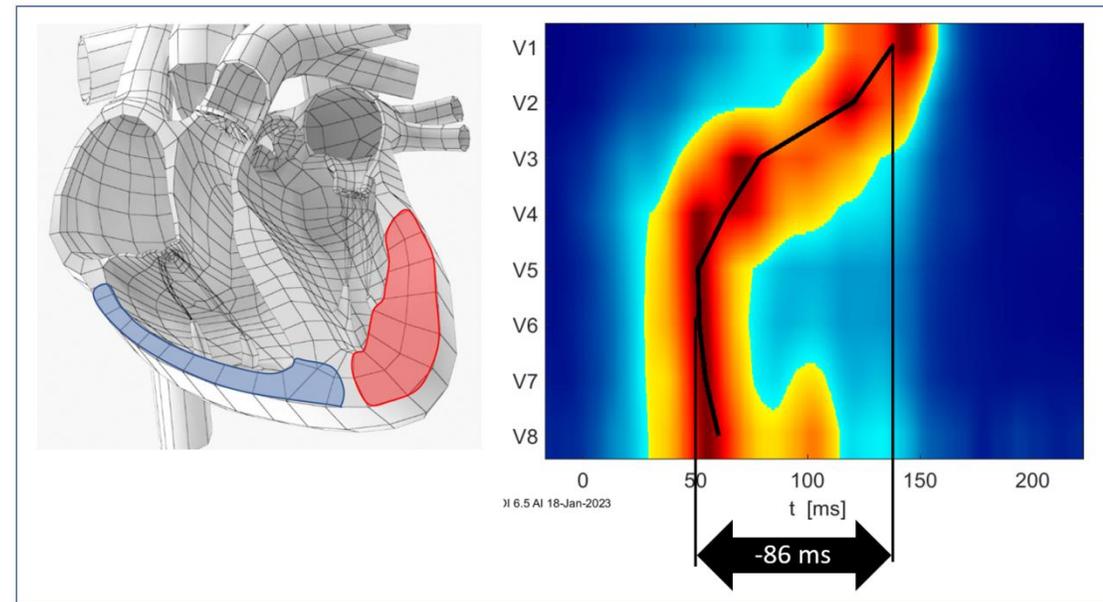
A. Stipdonk et al., 2018

[QRS Area Is a Strong Determinant of Outcome in Cardiac Resynchronization Therapy | Circulation: Arrhythmia and Electrophysiology](#)

UHF-EKG – aktivační mapa

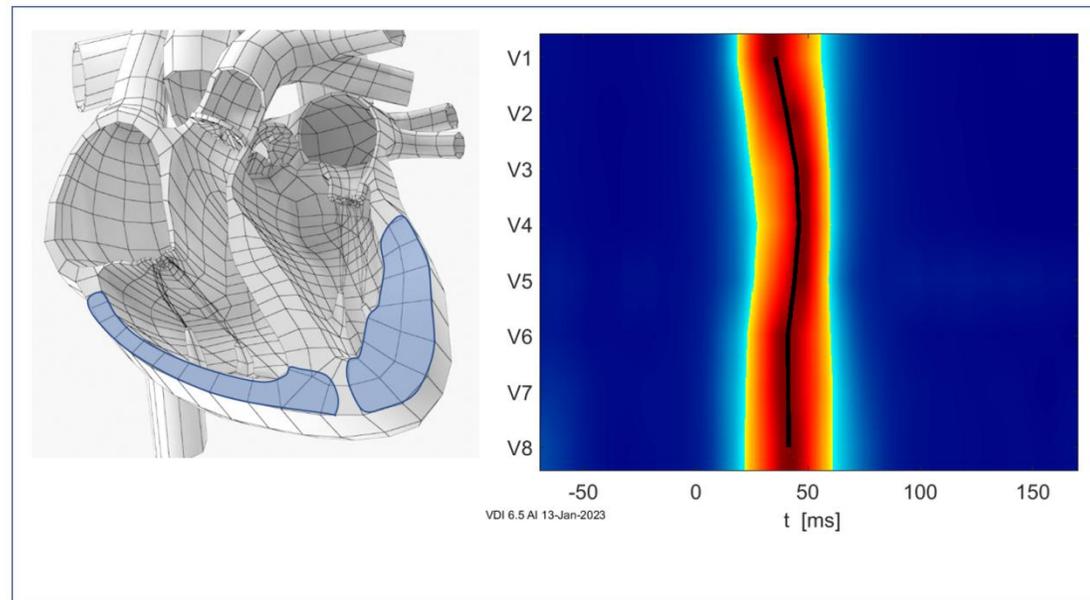


NORMAL



RIGHT
RV delayed

LEFT
LV delayed

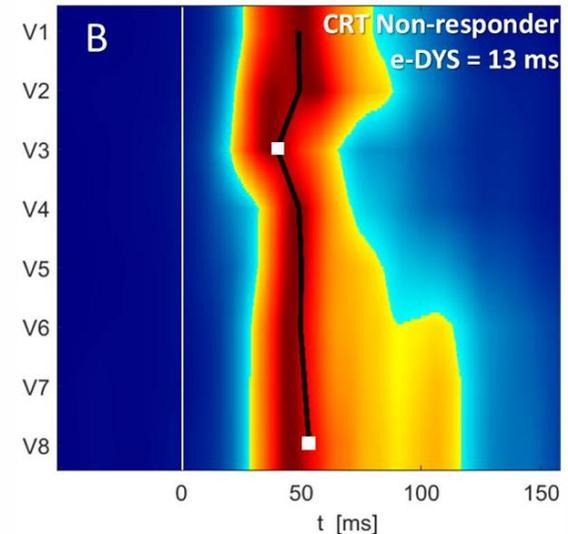
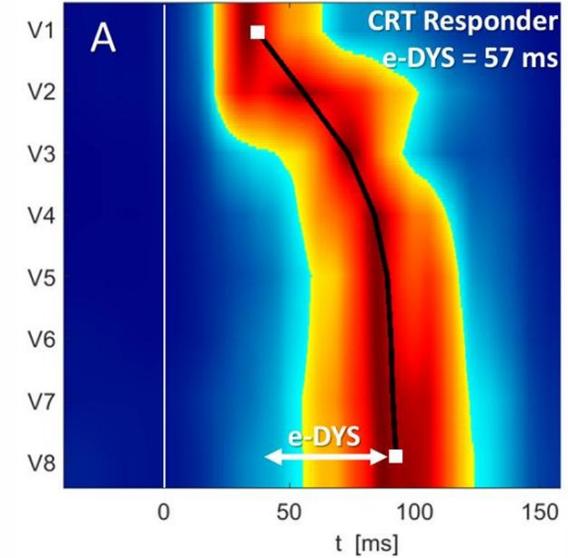
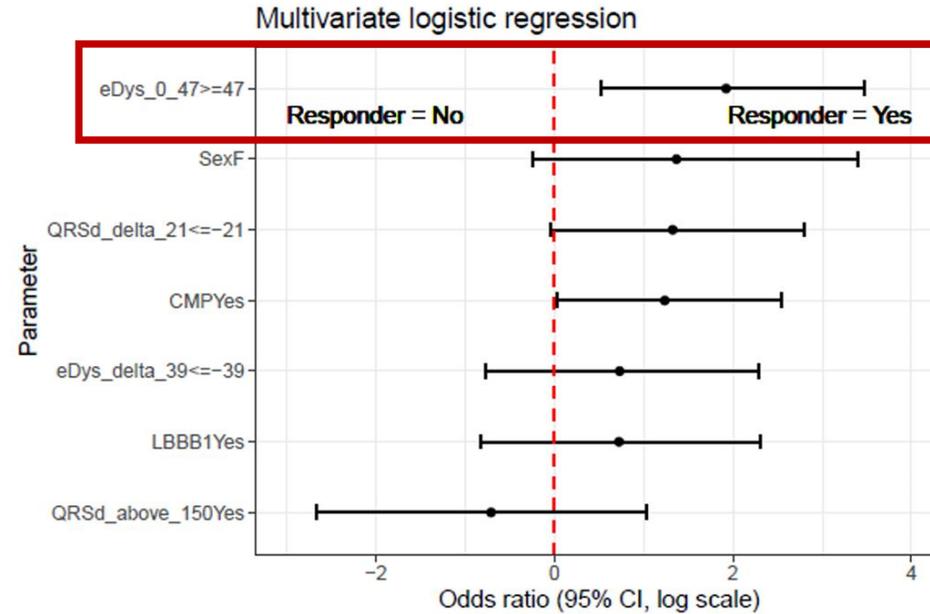


UHF-ECG CRT response prediction

Elektrická dyssynchronie predikuje
responsi CRT.

Sensitivita 78%,
Specificita 79%

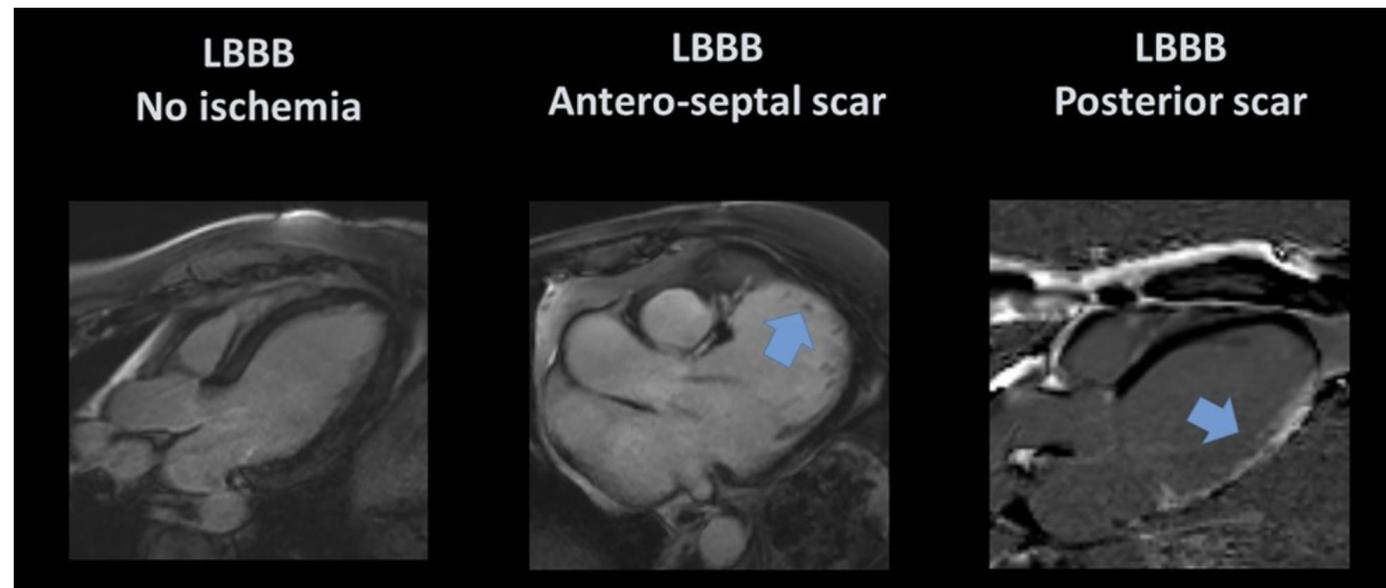
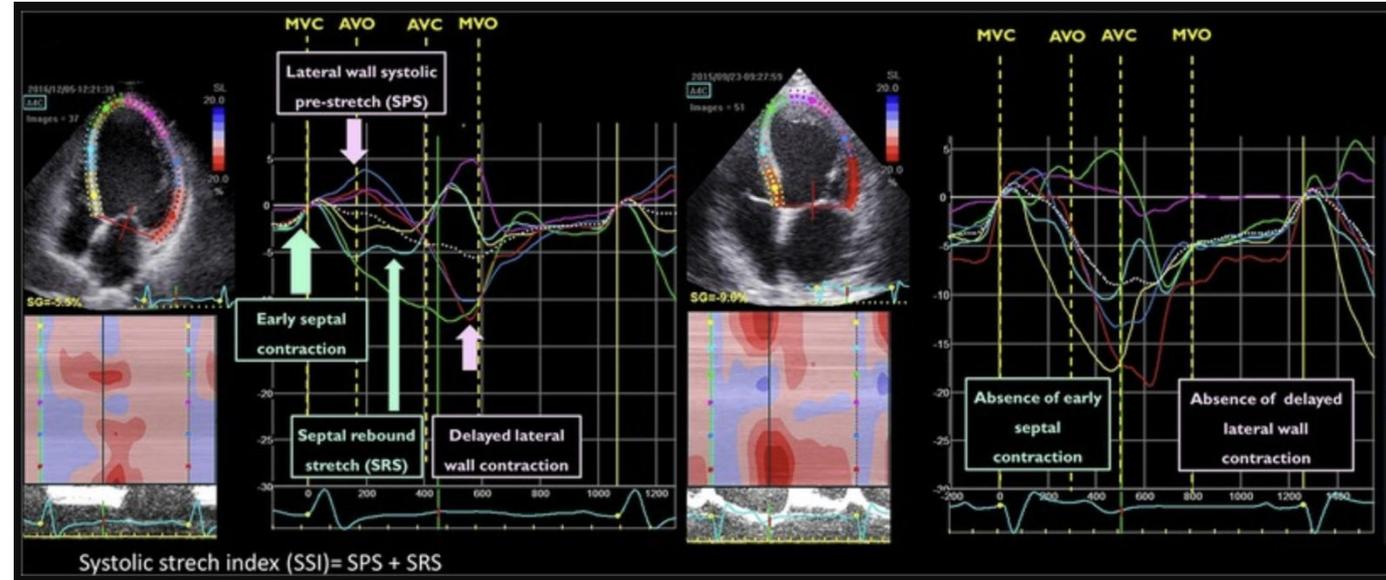
Multivarietní analýza:
Pouze elektrická dyssynchronie je
nezávislým prediktorem CRT
response (p=0.008).



Jak měřit a zobrazit dyssynchronii ?

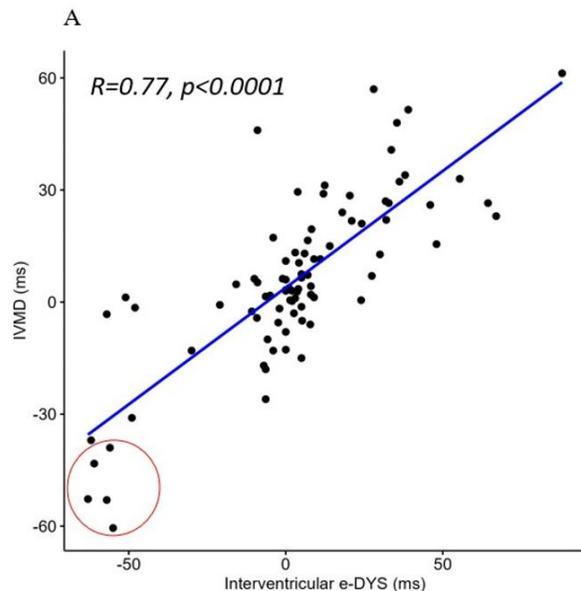
Mechanika

- Echokardiografie
LVEF, LVEDV, LVESV, ... +/-5%, 3D
echo +/-3%, speckle tracking -
radial a longitudinal strain
- CMR – identifikace zpoždění
(krok nad 10 ms), jizvy

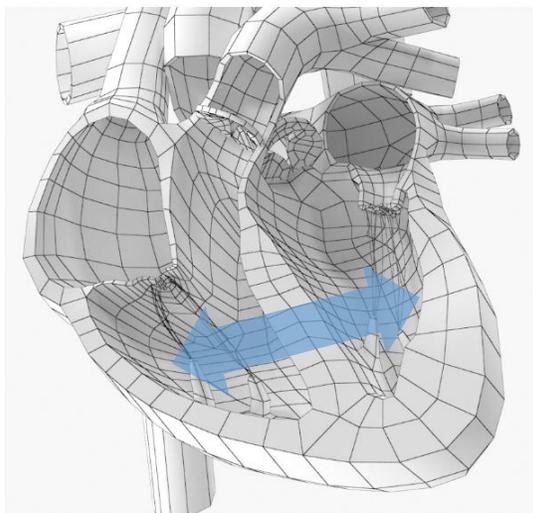


UHF-ECG koreluje s mechanickou dyssynchronií

Electrical and mechanical interventricular dyssynchrony coupling in bradycardia patients; a UHF-ECG validation trial

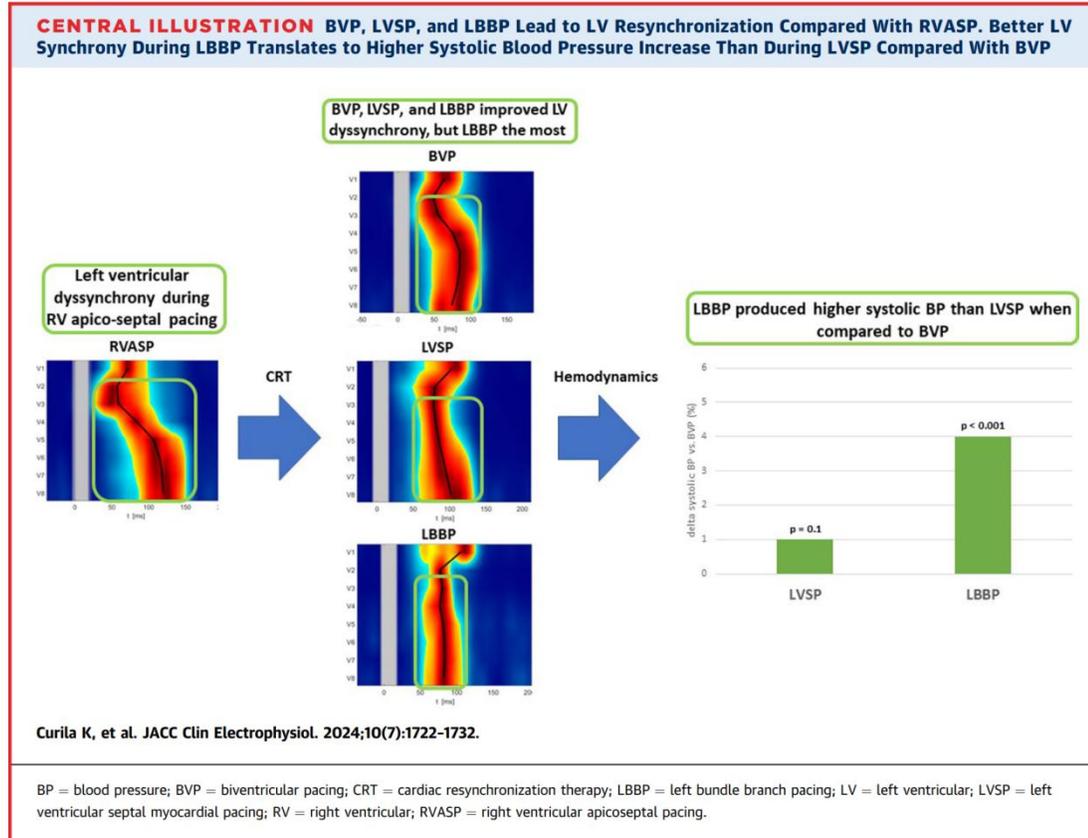


RV-LV INTERVENTRICULAR



Interventrikulární mechanické zpoždění (IVMD) bylo měřeno jako časový rozdíl mezi počátkem komplexu QRS (nebo vrcholem první amplitudy QRS, pokud byl počátek nejasný) a počátkem toku přes výtokovou část levé komory (LVOT) a výtokovou část pravé komory (RVOT).

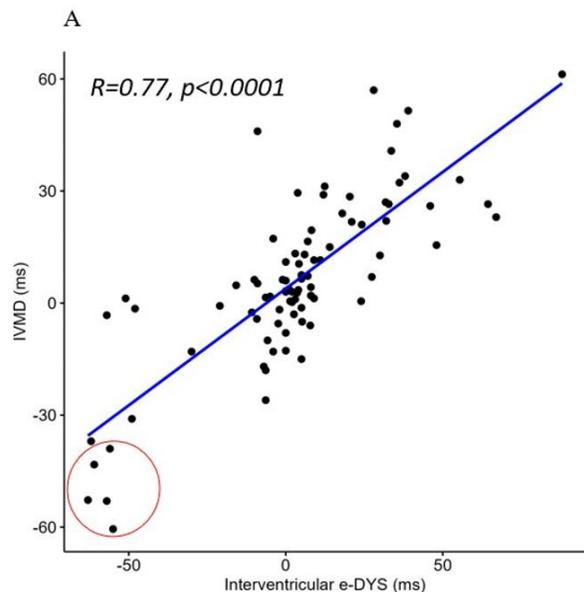
LVSP and LBBP Result in Similar or Improved LV Synchrony and Hemodynamics Compared to BVP



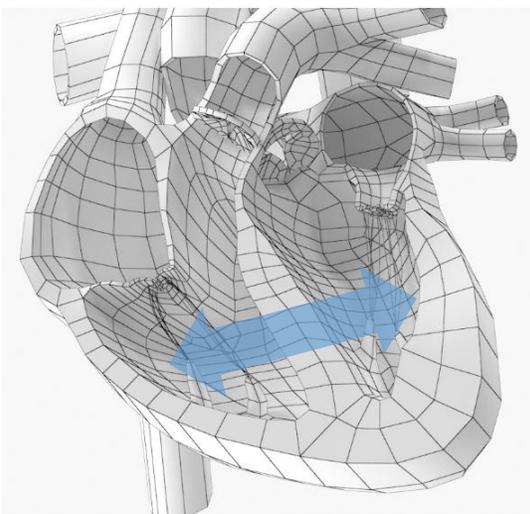
UHF-ECG koreluje s mechanickou dyssynchronií

Po, 12:10, Codex+Scriptum ELECTROMECHANICAL RIGHT VENTRICULAR DYSSYNCHRONY AND CARDIAC RESYNCHRONIZATION THERAPY IN CONGENITAL HEART DISEASE M. Vrbík, J. Janoušek (Praha)

Electrical and mechanical interventricular dyssynchrony coupling in bradycardia patients; a UHF-ECG validation trial

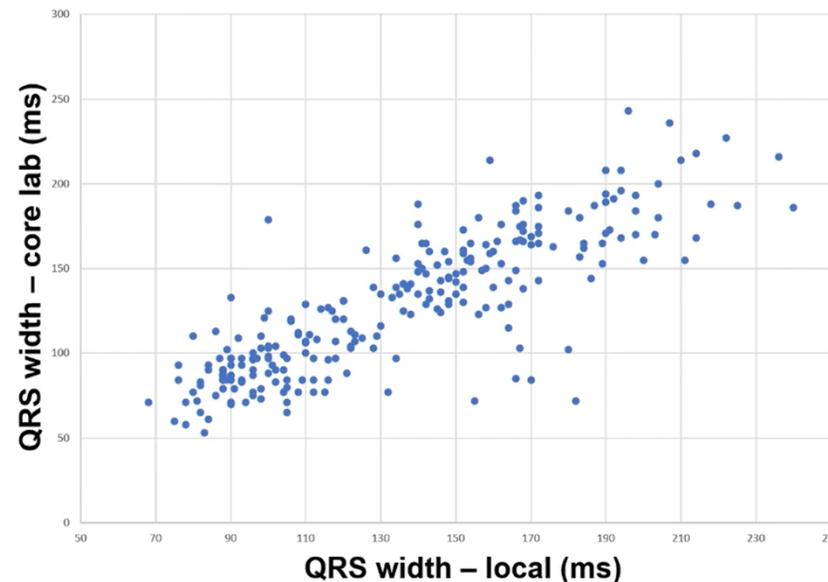


RV-LV INTERVENTRICULAR



Interventrikulární mechanické zpoždění (IVMD) bylo měřeno jako časový rozdíl mezi počátkem komplexu QRS (nebo vrcholem první amplitudy QRS, pokud byl počátek nejasný) a počátkem toku přes výtokovou část levé komory (LVOT) a výtokovou část pravé komory (RVOT).

Baseline QRS width assessment



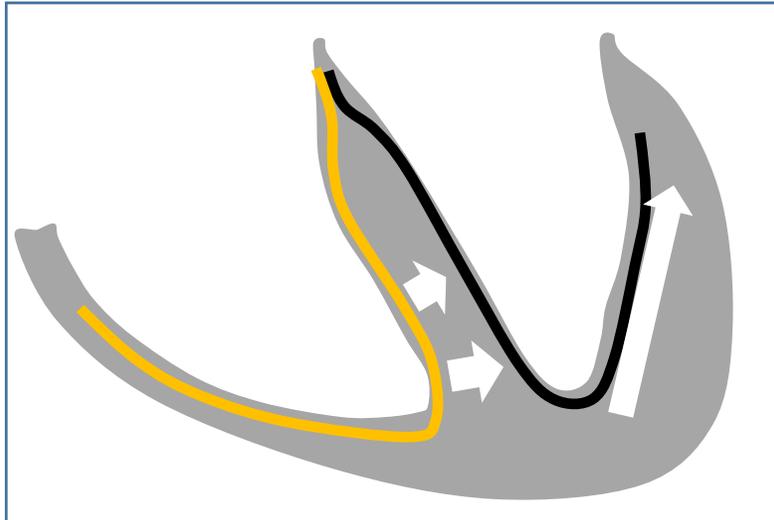
(95% CI 0.70-0.80)
Good reliability

Baseline Morphology

- Narrow 38%
- LBBB 20%
- RBBB 19%
- IVCD 7%
- Paced 16%

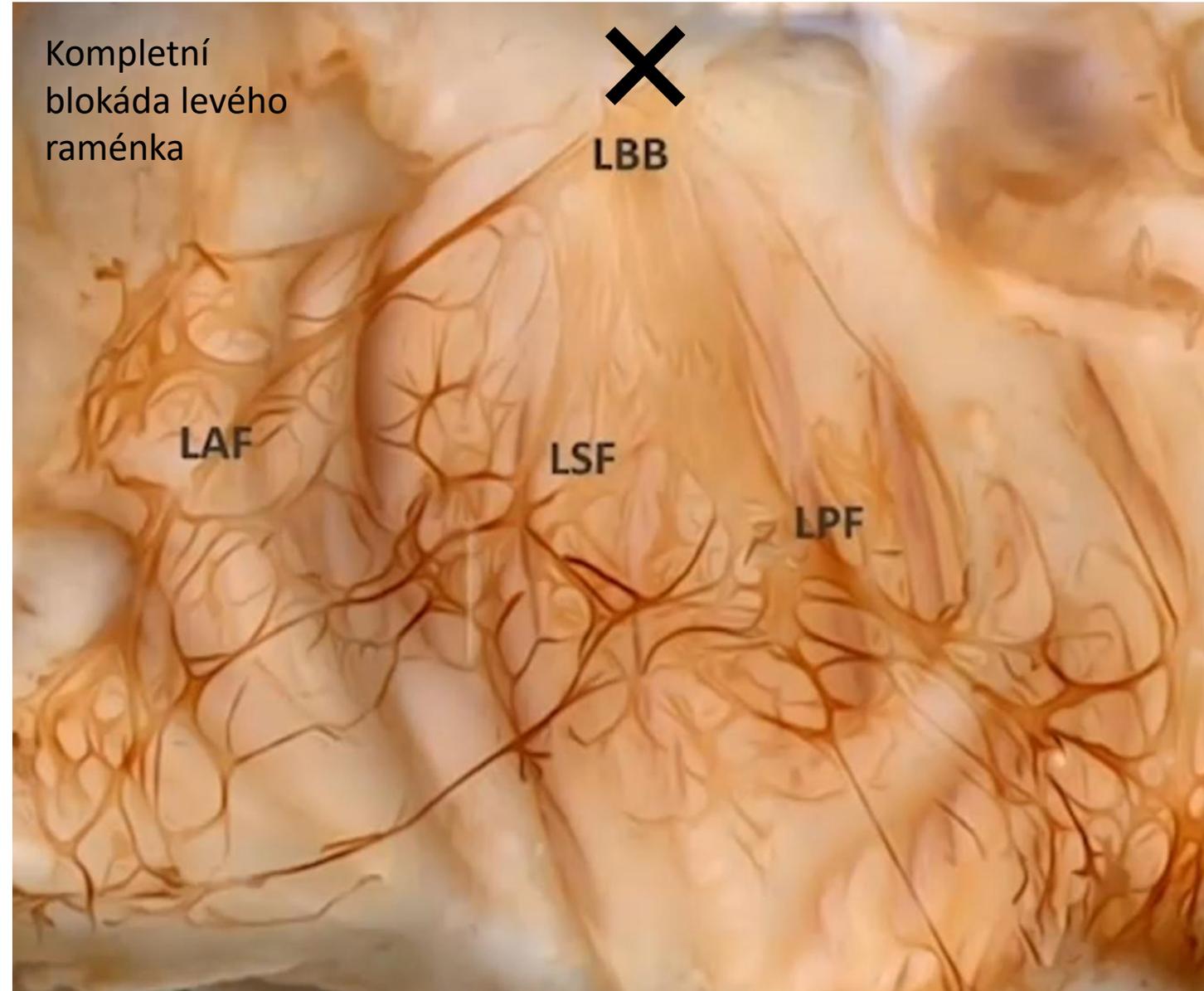
$K = 0.62$
(95%CI 0.58-0.67)
Substantial agreement

Typy poruch elektrické aktivace - LBBB

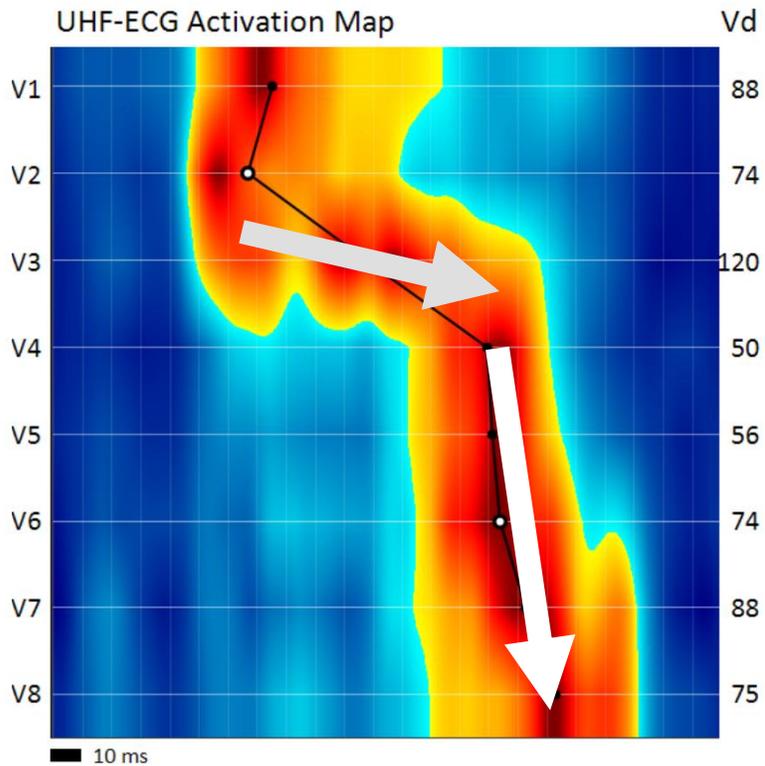


Kompletní
blokáda levého
raménka

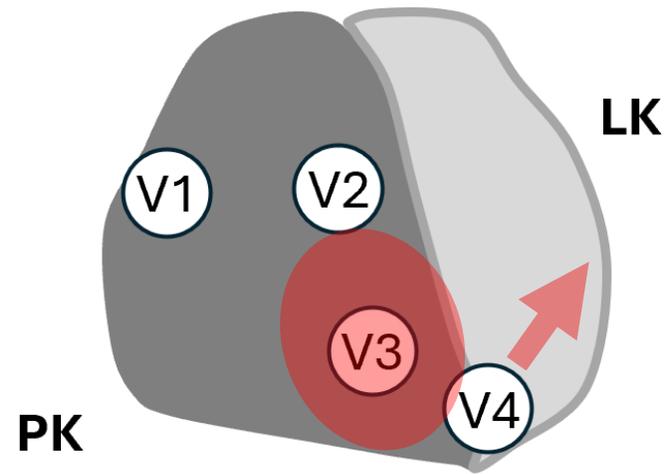
✗
LBB



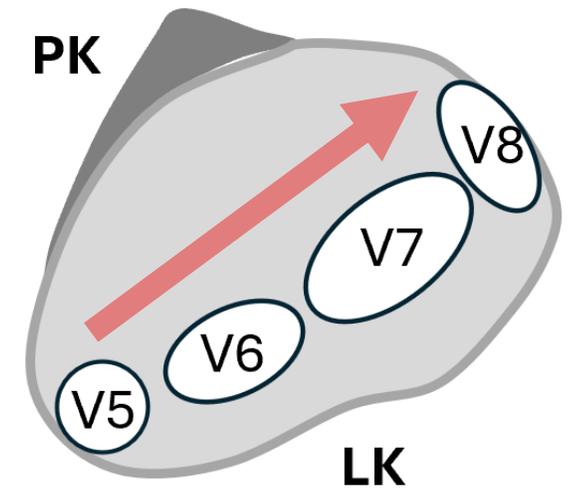
Typy poruch elektrické aktivace - LBBB



VED16 87 ms

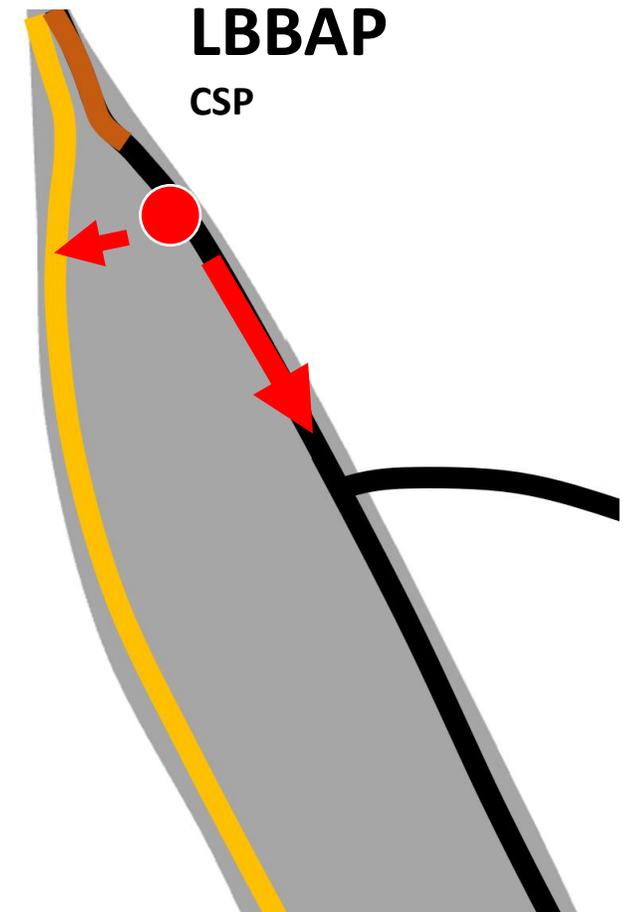
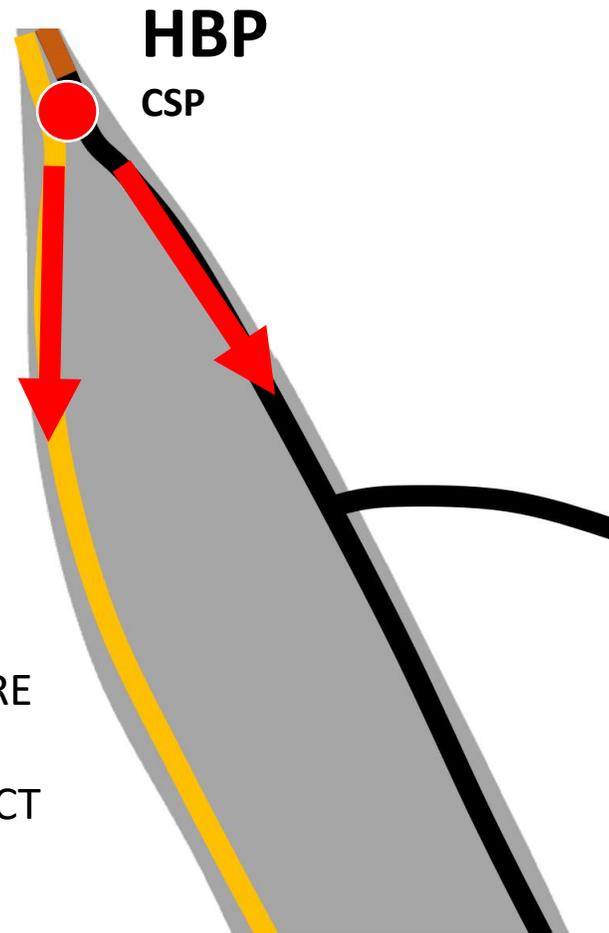
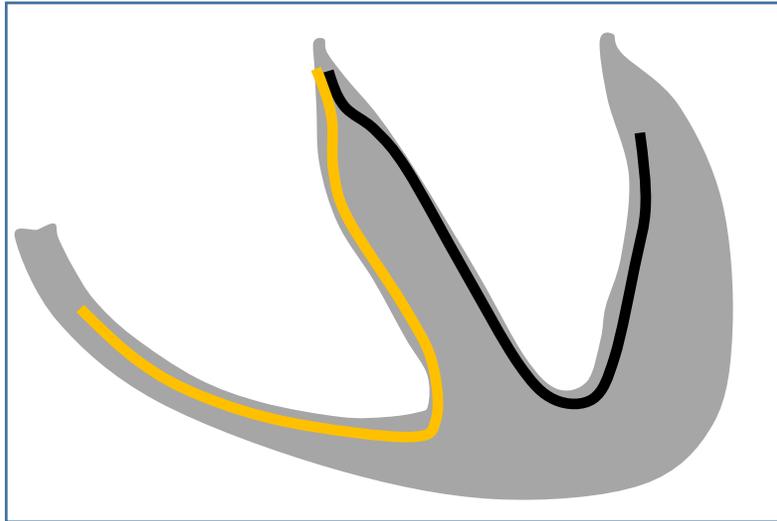


Oblast
zpoždění



Rychlá aktivace
volné stěny LK

Typy poruch elektrické aktivace - LBBB



PO 11:50. Codex+Scriptum LEFT SEPTAL CAPTURE NEAR THE LBB PROVIDES THE SAME LV SYNCHRONY AND LV WORK EFFICIENCY AS DIRECT LBB CAPTURE L. Povišer, et al.

Typy poruch elektrické aktivace - LBBB

QRSd 174 ms
Vd 75 ms

QRSd 213 ms
Vd 75 ms

QRSd 142 ms
Vd 66 ms

QRSd 141 ms
Vd 53 ms

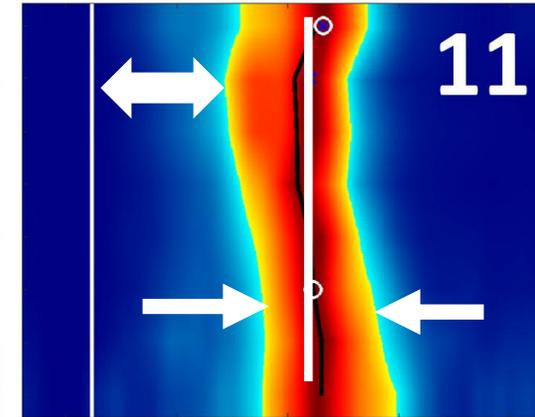
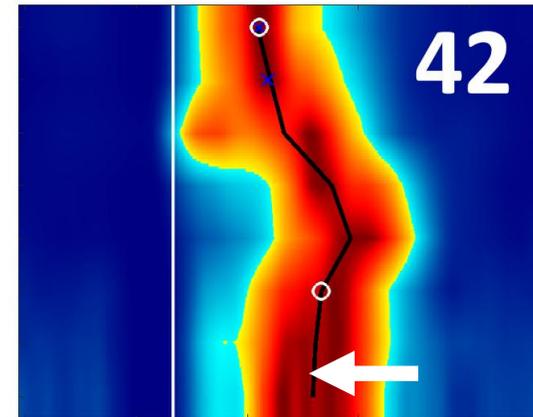
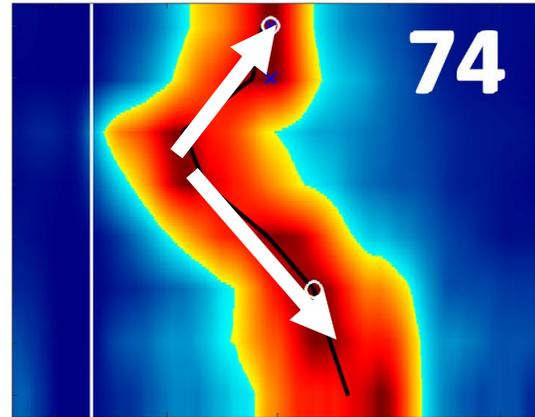
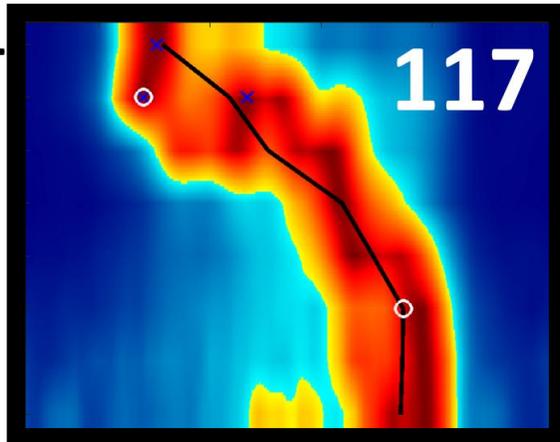
LBBB

RV Apex

BiV VVO

nsLBBP

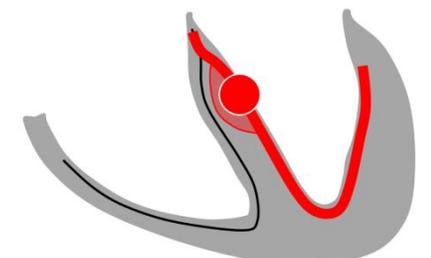
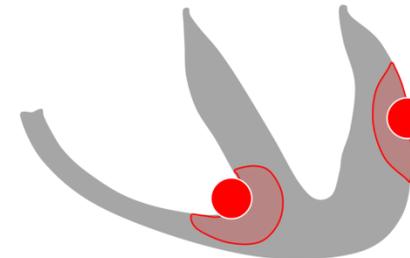
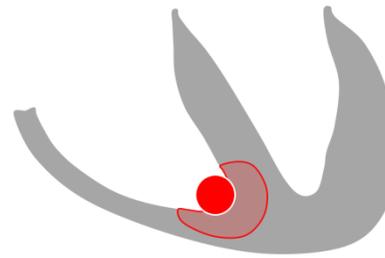
RV + SEPT



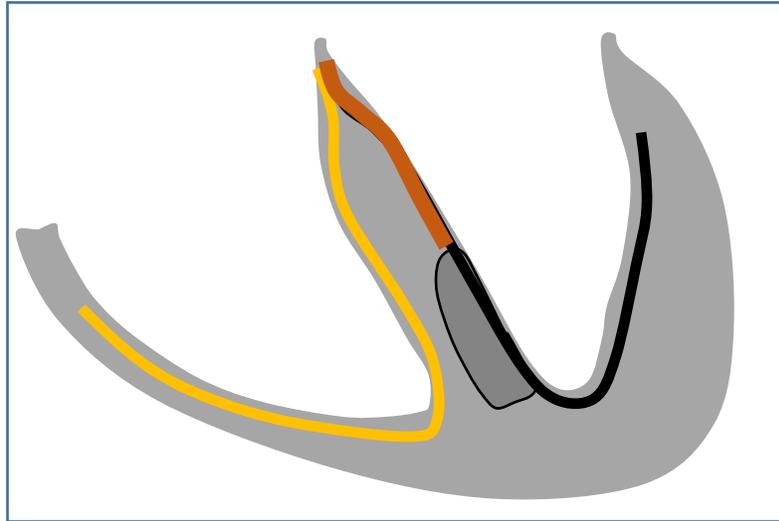
APEX

LV FW

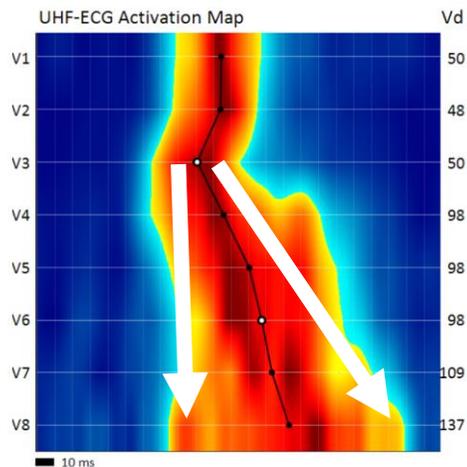
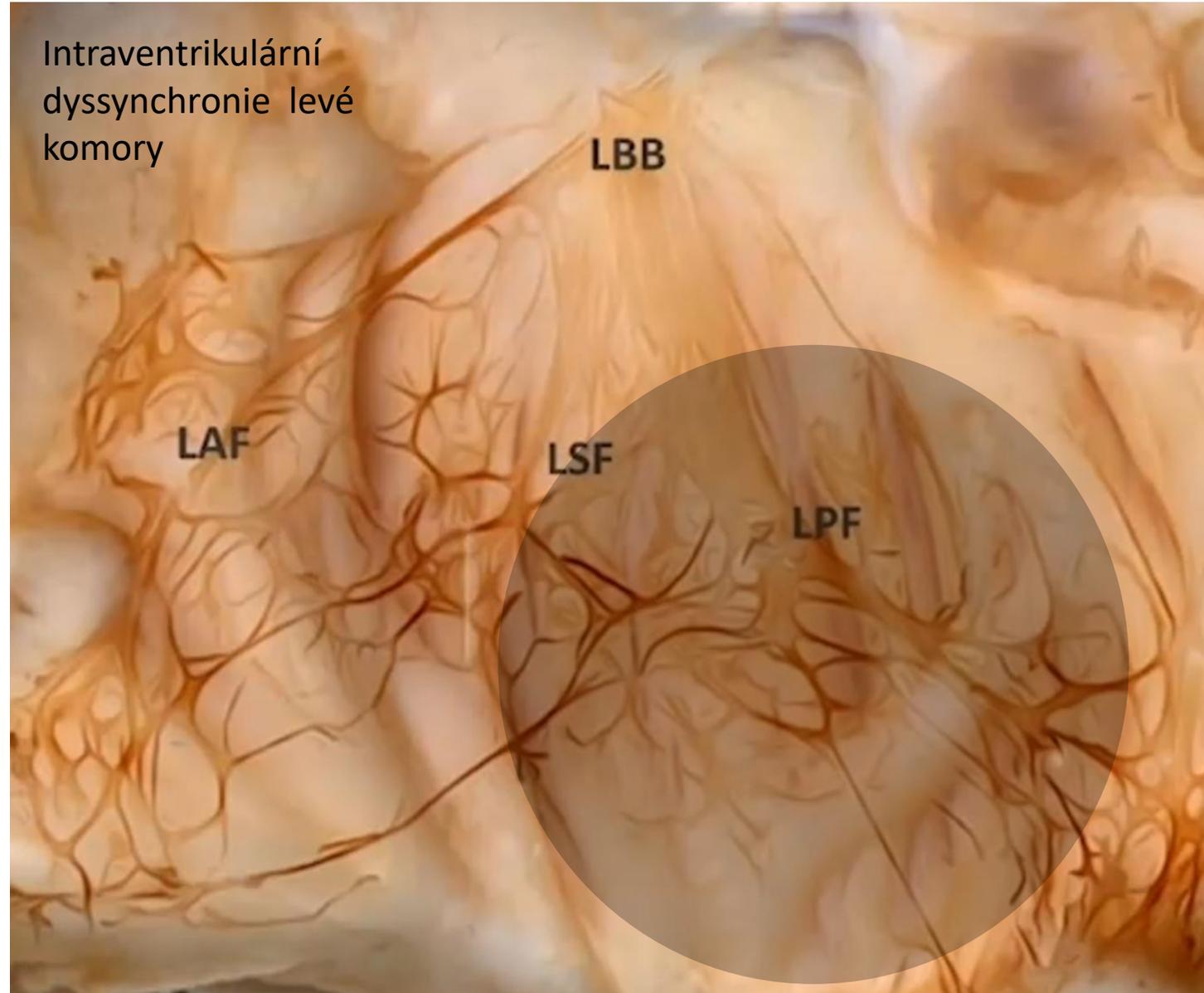
baseline



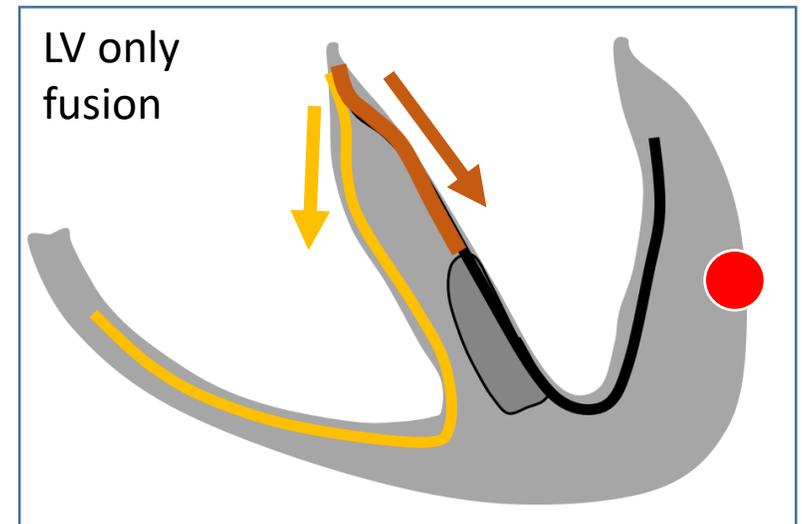
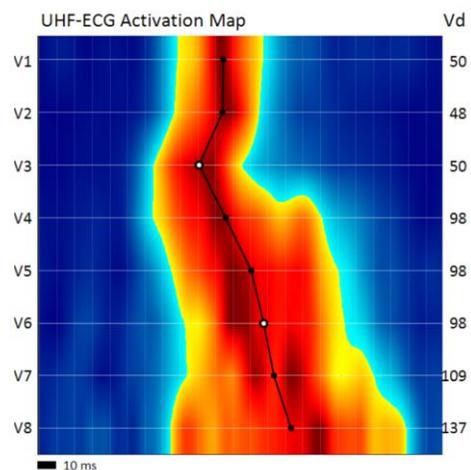
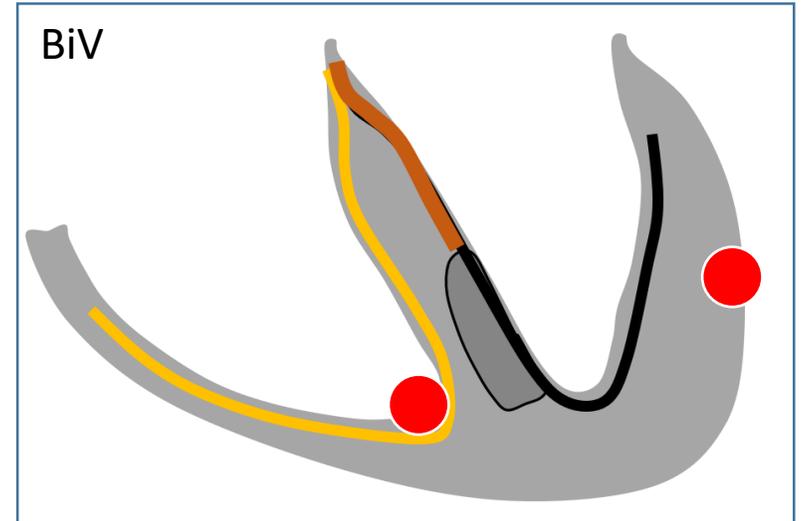
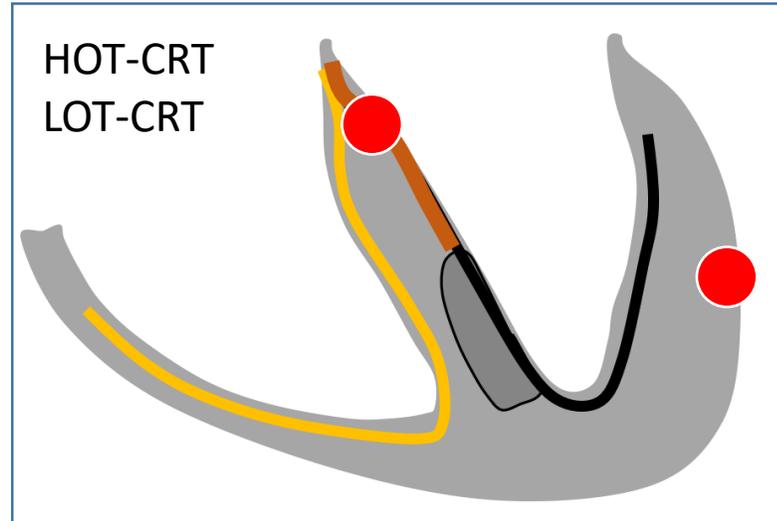
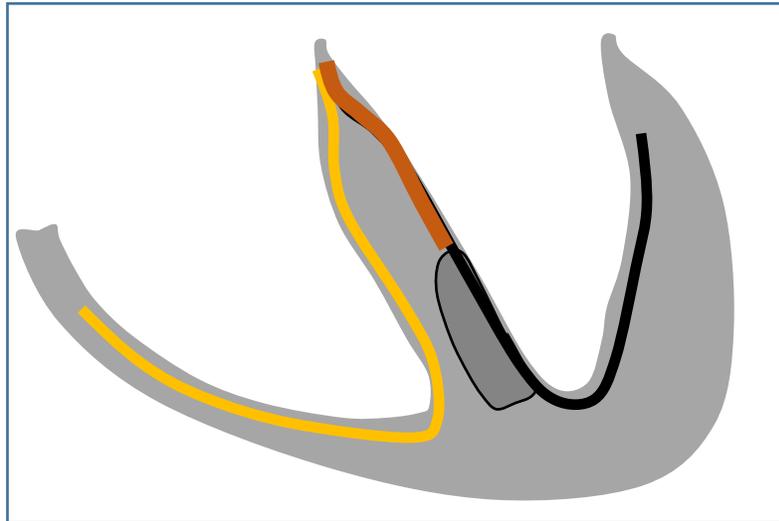
Typy poruch elektrické aktivace - IVCD



Intraventrikulární
dyssynchronie levé
komory



Typy poruch elektrické aktivace - IVCD



Typy poruch elektrické aktivace - IVCD

QRSd 166 ms, Vd 61

177/159, 72

141, 68

150/133, 58

125/106, 51

IVCD

LVSP

BiV

LOT CRT

LOT CRT ANODAL

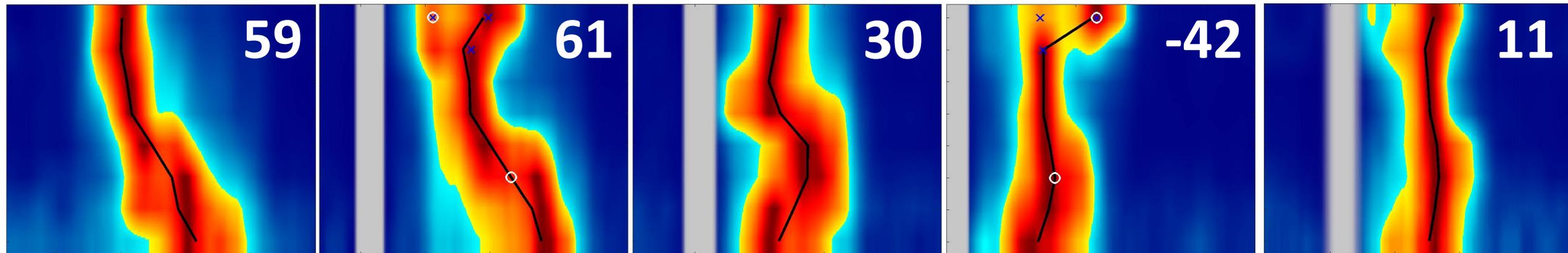
59

61

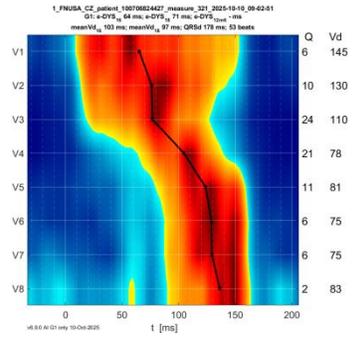
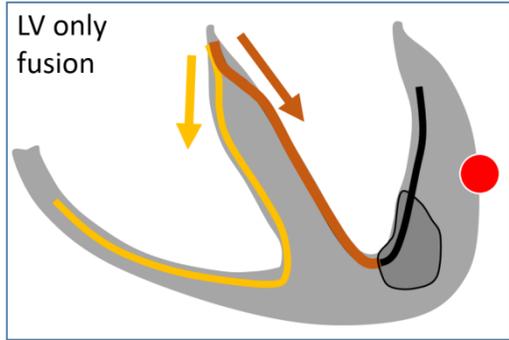
30

-42

11



UHF-ECG guided fusion



LV only,
AV 50

LV only,
AV 110

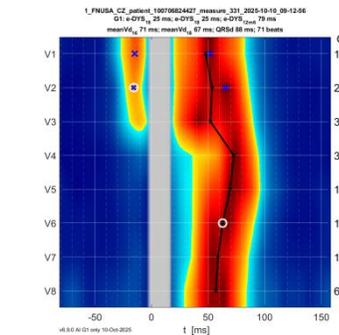
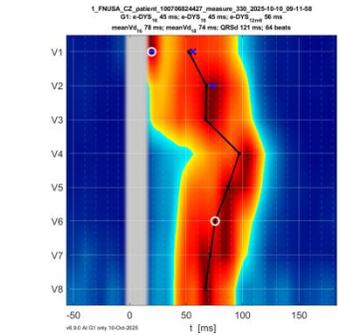
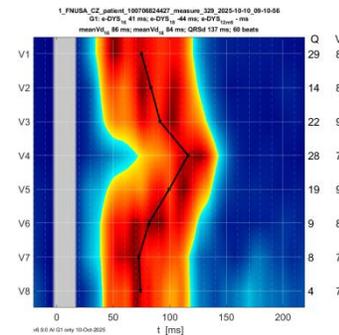
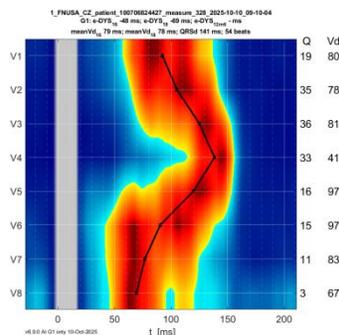
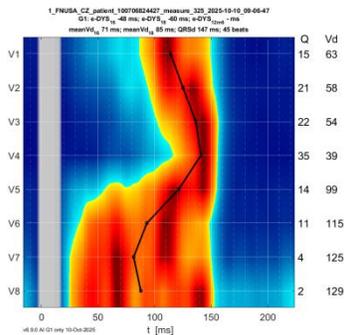
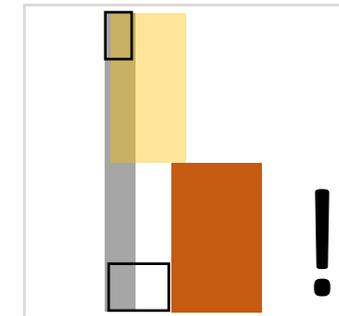
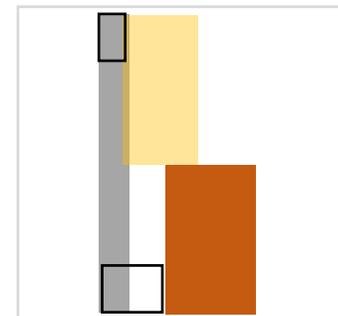
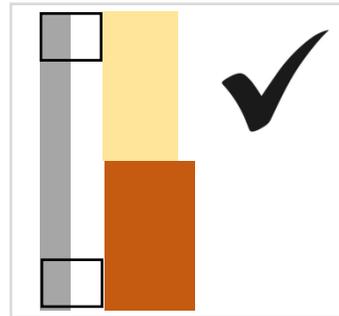
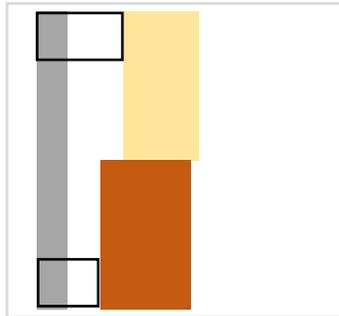
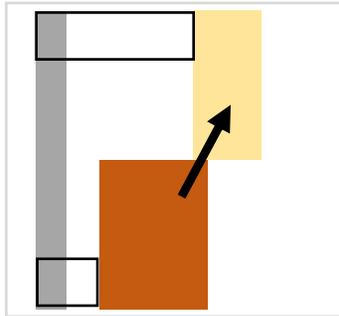
LV only,
AV 140

LV only,
long AV 170

LV only,
long AV 200

RVD

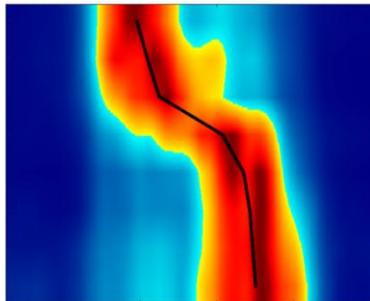
LVD



UHF-ECG guided BiV

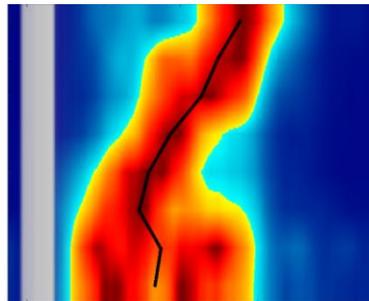
PO 12:20 Codex+Scriptum PŘÍNOS VYSOKOFREKVENČNÍHO EKG VE STANOVENÍ OPTIMÁLNÍ POLOHY LEVOKOMOROVÉ ELEKTRODY CRT PŘÍSTROJŮ, J. Lipoldová et al.

Baseline



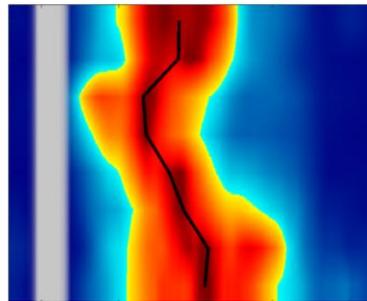
VED 77 ms
VD 70 ms

LV only



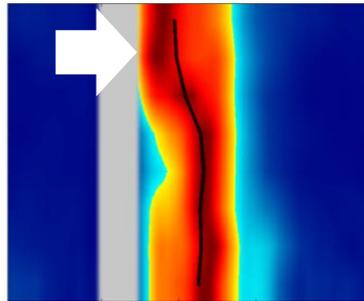
VED -66 ms
VD 76 ms

RV only



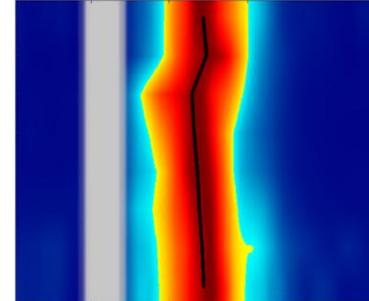
VED 42 ms
VD 75 ms

BiV, VV 0ms
180/100 1-RV



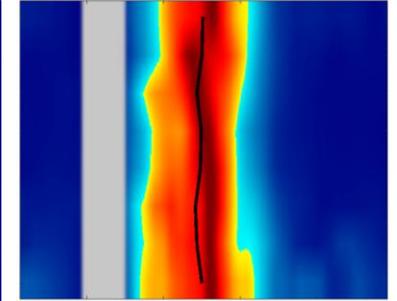
VED 19 ms
VD 57 ms

BiV, VV 0ms
140/60, 1-RV

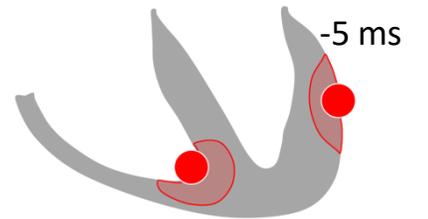
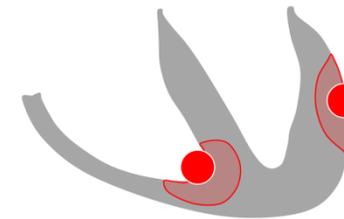
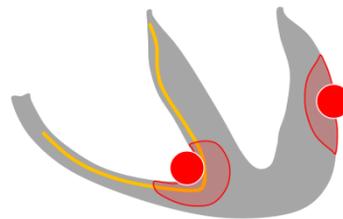
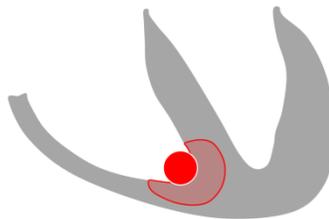


VED -9 ms
VD 55 ms

BiV, VV 5ms
140/60, 1-RV/2-1



VED -5 ms
VD 58 ms



BiV CRT !

Circulation

CURRENT ISSUE

RESEARCH ARTICLE | Originally Published 26 January 2023 | 

 Check for updates

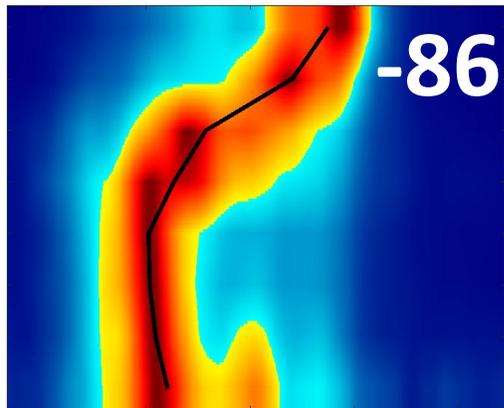
Cardiac Resynchronization Therapy Improves Outcomes in Patients With Intraventricular Conduction Delay But Not Right Bundle Branch Block: A Patient-Level Meta-Analysis of Randomized Controlled Trials

Daniel J. Friedman, MD  , Sana M. Al-Khatib, MD, MHS , Frederik Dalgaard, MD, PhD , Marat Fudim, MD, MHS , William T. Abraham, MD , John G.F. Cleland, MD, PhD , Anne B. Curtis, MD , ... [SHOW ALL](#) ... , and Gillian D. Sanders, PhD | [AUTHOR INFO &](#)

Typy poruch elektrické aktivace - RBBB

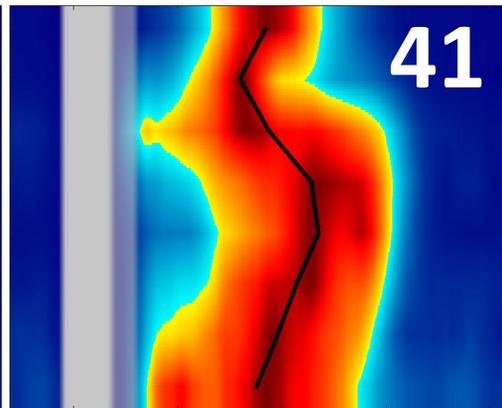
QRSd 188 ms, VD 64

RBBB



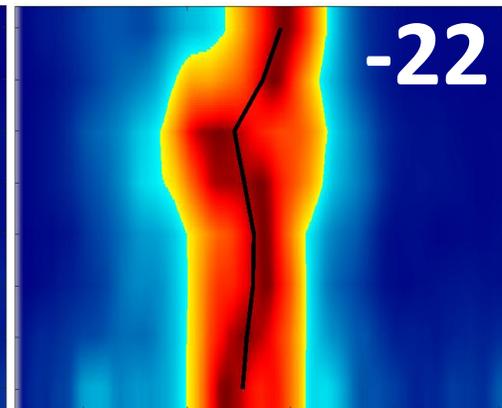
164, 81

BiV



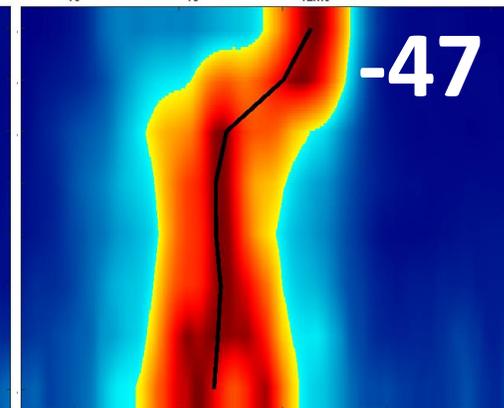
159, 65

DSP



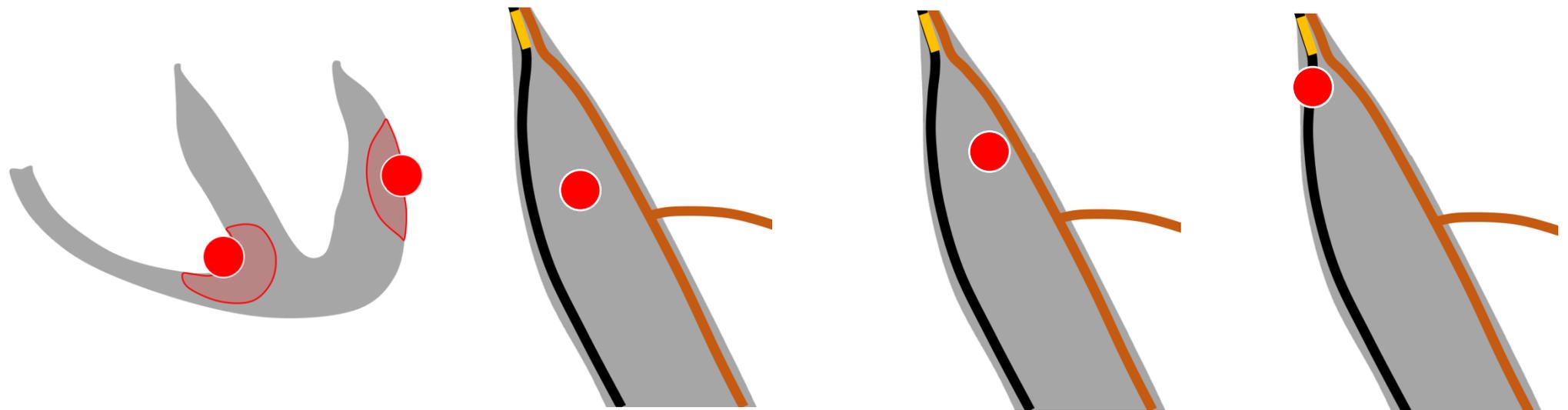
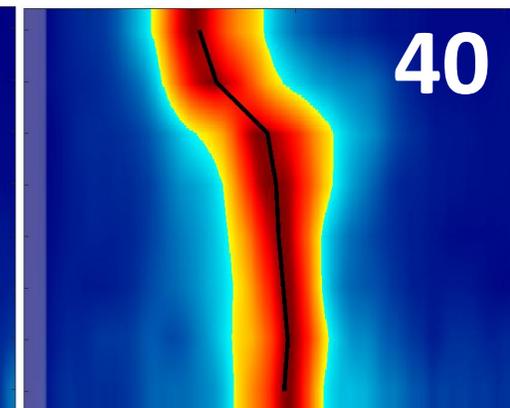
161, 64

LVSP



180, 53

proximal RBBP



CRT vyžaduje patient-specific přístup

UHF-ECG

- je v současnosti nejlepší metoda pro měření komorové dyssynchronie a zobrazení aktivačního vzoru.
- Interpretace je velmi jednoduchá a jasná.
- Technologie je již certifikovaná a dostupná.

Děkuji za pozornost