

Conduction system pacing preserves both mechanical and electrical interventricular dyssynchrony – a UHF-ECG validation study

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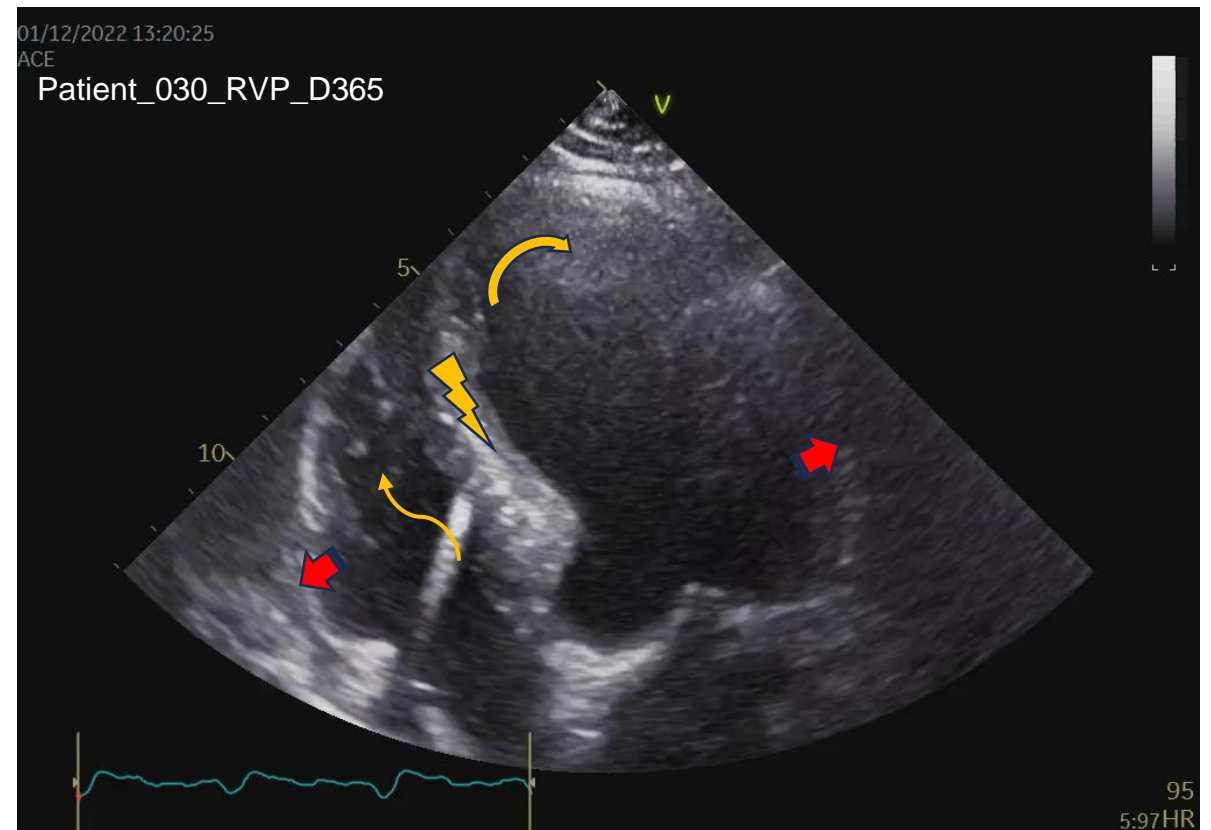
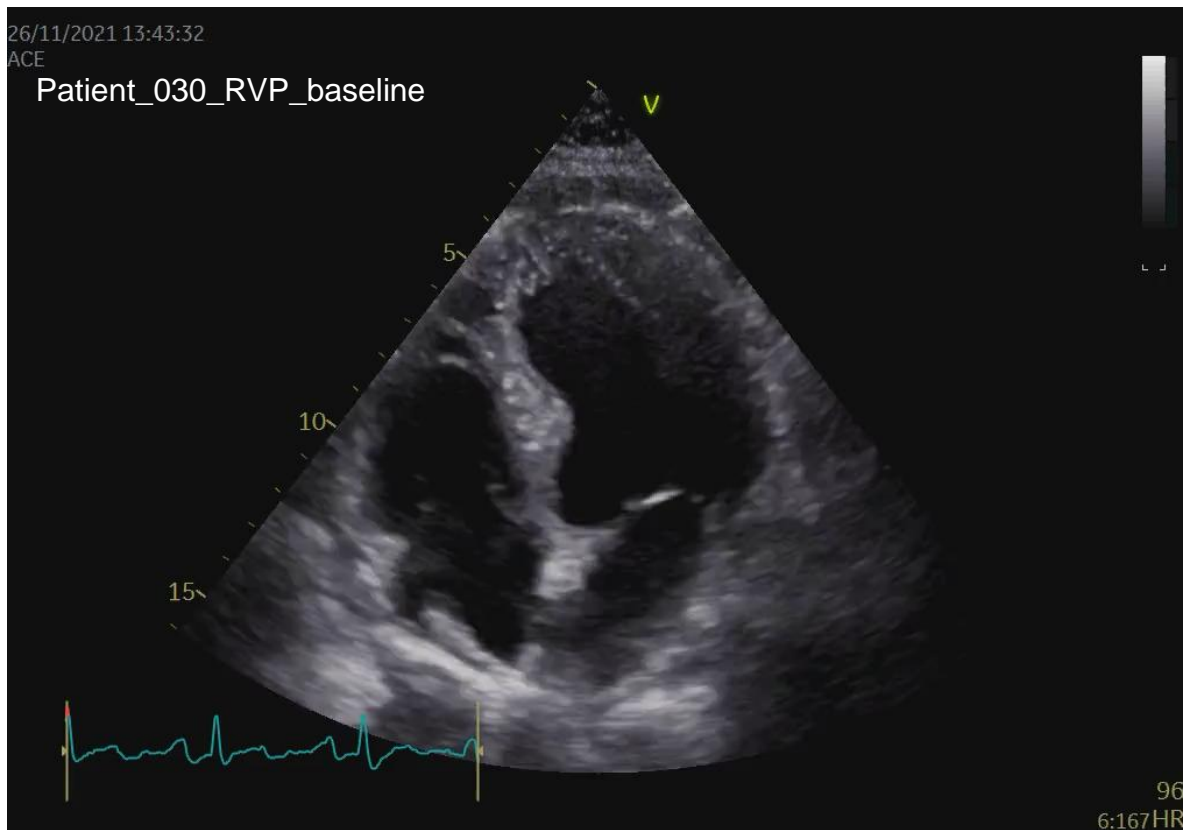


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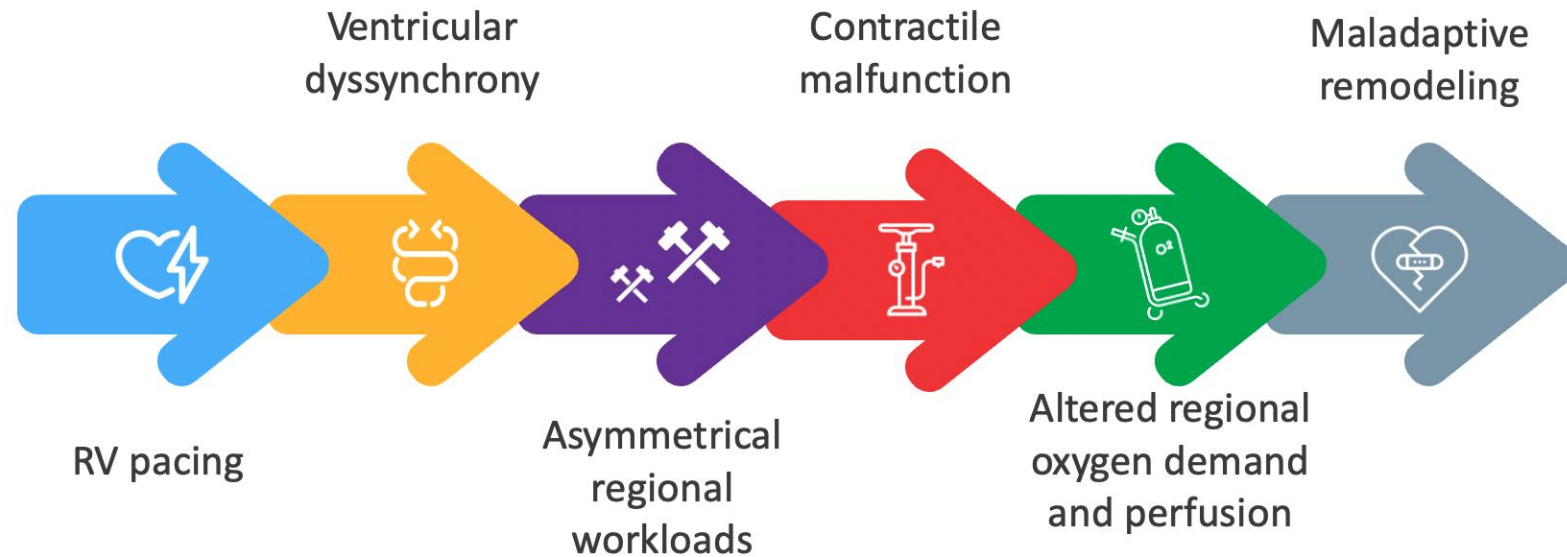


Electro-mechanical ventricular dyssynchrony

- INTRAventricular x INTERventricular

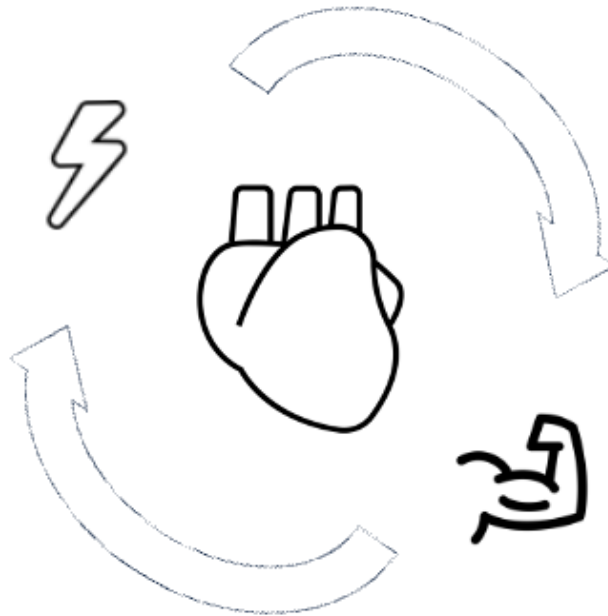


Pathophysiology of pacing-induced cardiomyopathy



Aims:

- To understand the relationship between interventricular dyssynchrony assessed by UHF-ECG and by echocardiography
- To assess and compare interventricular dyssynchrony during CSP and RVP in bradycardia patients



Methods – Population

- Patients with **bradycardia** due to **AV conduction disease** are randomized to **RV myocardial pacing** and **Conduction system pacing (2:1)**

ClinicalTrials.gov BETA

NIH National Library of Medicine
National Center for Biotechnology Information

Record 1 of 3

RECRUITING

ClinicalTrials.gov Identifier: NCT04908033

Ultra-high-frequency ECG for Prediction of Left Ventricular Remodeling

Information provided by Karol Curila, Faculty Hospital Kralovske Vinohrady (Responsible Party)

Last Update Posted: 2023-02-14

Methods – Inclusion and Exclusion Criteria

1. Indication for permanent pacing due to bradycardia
2. Sufficient quality of echocardiographic windows
3. Willingness to attend clinical check-ups in the implanting center for at least two years
4. Life expectancy of at least 2 years

1. LVEF below 50 % and/or RV fractional area change below 35 %
2. Indication for ICD or CRT implantation
3. Hypertrophic cardiomyopathy
4. Active myocarditis
5. Persistent/permanent atrial fibrillation during randomization
6. Cardiac surgery or coronary revascularization in the last ten days
7. Severe aortic stenosis or mitral valvular disease with an indication to intervention.

Methods – interventricular mechanical delay assessment

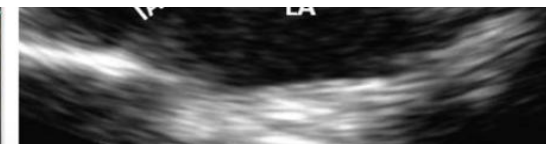
Journal of Interventional Cardiac Electrophysiology
<https://doi.org/10.1007/s10840-019-00602-2>



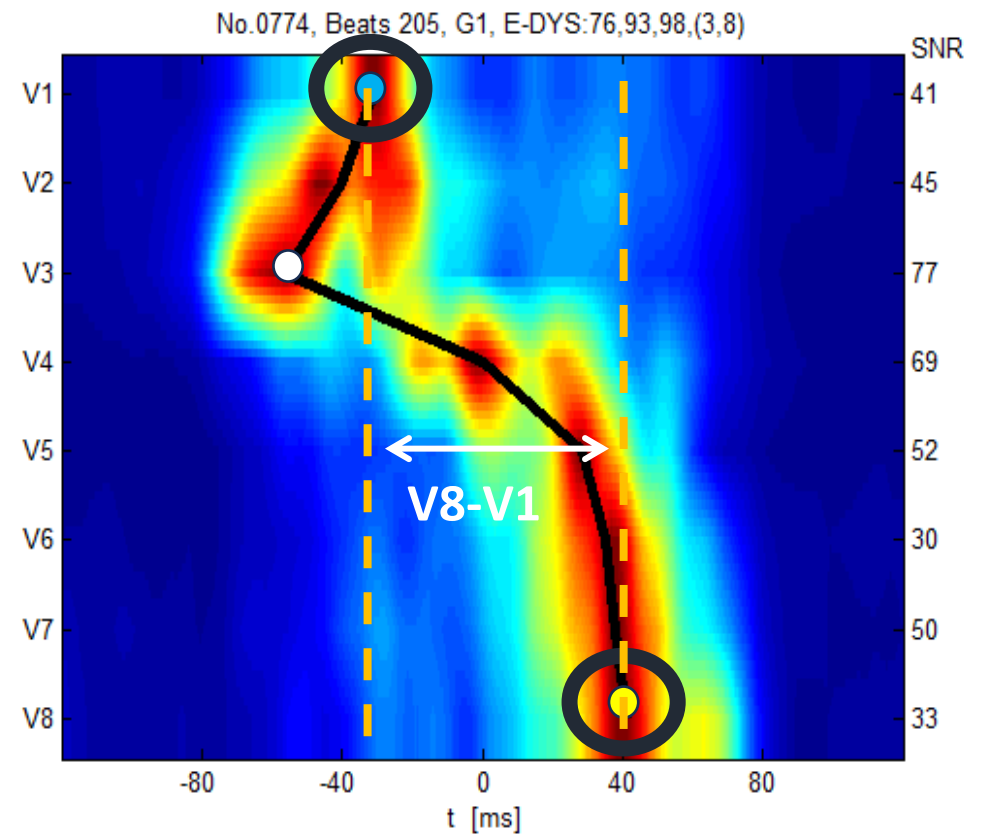
J Interv Card Electrophysiol

Table 5 Multivariate analysis for identification of predictors of PiCMP

Characteristic	Hazard ratio	<i>p</i> value	Confidence intervals
Age (years)	1.35	0.433	0.63–2.91
Sex (% males)	0.84	0.662	0.39–1.79
Diabetes	0.65	0.298	0.29–1.46
Hypertension	1.61	0.202	0.77–3.37
CAD	0.87	0.798	0.32–2.41
Dual vs single chamber	0.819	0.585	0.40–1.67
Site (apical vs non-apical)	1.44	0.355	0.66–3.14
pQRSd (≥ 150 msec vs < 150 msec)	1.74	0.130	0.85–3.57
Baseline LVEF	1.63	0.405	0.51–5.21
% pacing ($< 60\%$ vs $> 60\%$)	4.26	0.004	1.59–11.41
Aortopulmonary ejection delay (msec)	3.15	0.002	1.52–6.55
Septal-posterior wall activation delay (msec)	1.41	0.666	0.29–6.83



Methods – UHF-ECG acquisition



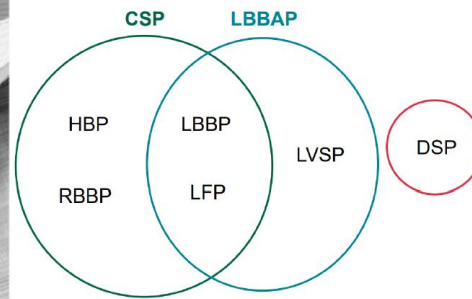
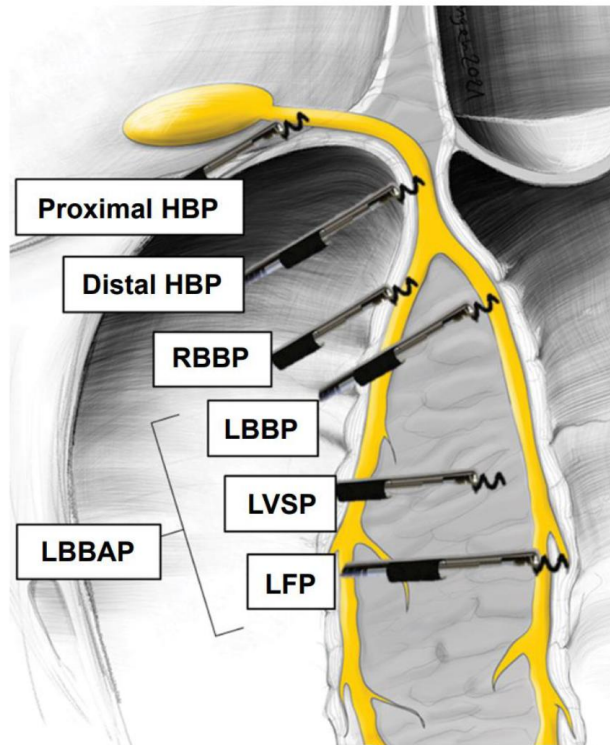
V8 – V1 = electrical interventricular dys

Methods – pacemaker implantation

Conduction system pacing

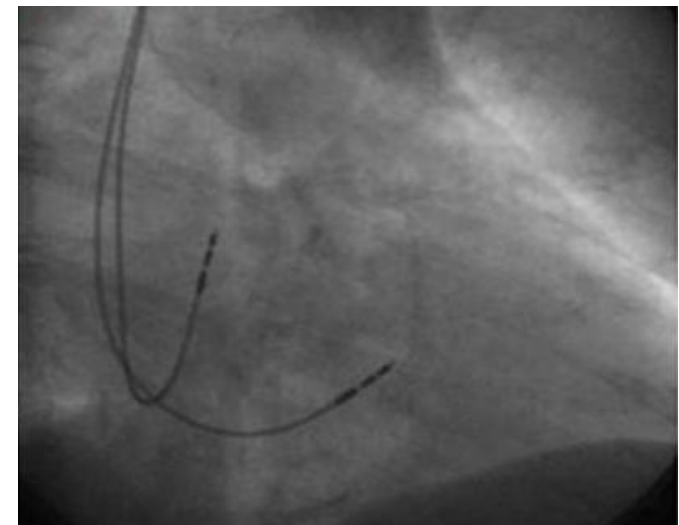
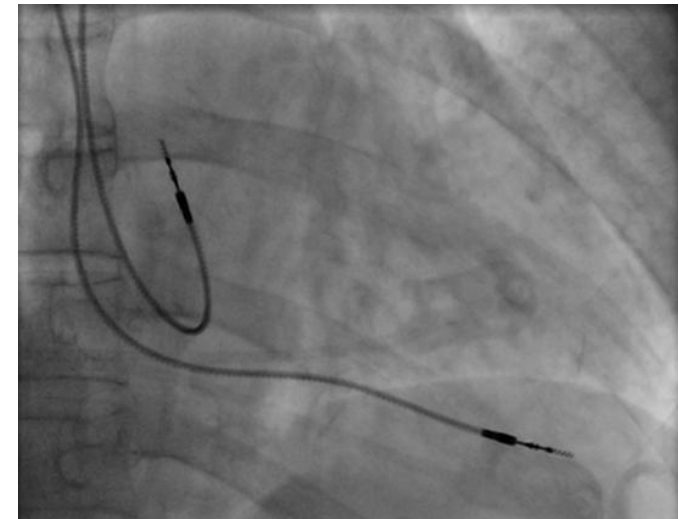
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RV pacing

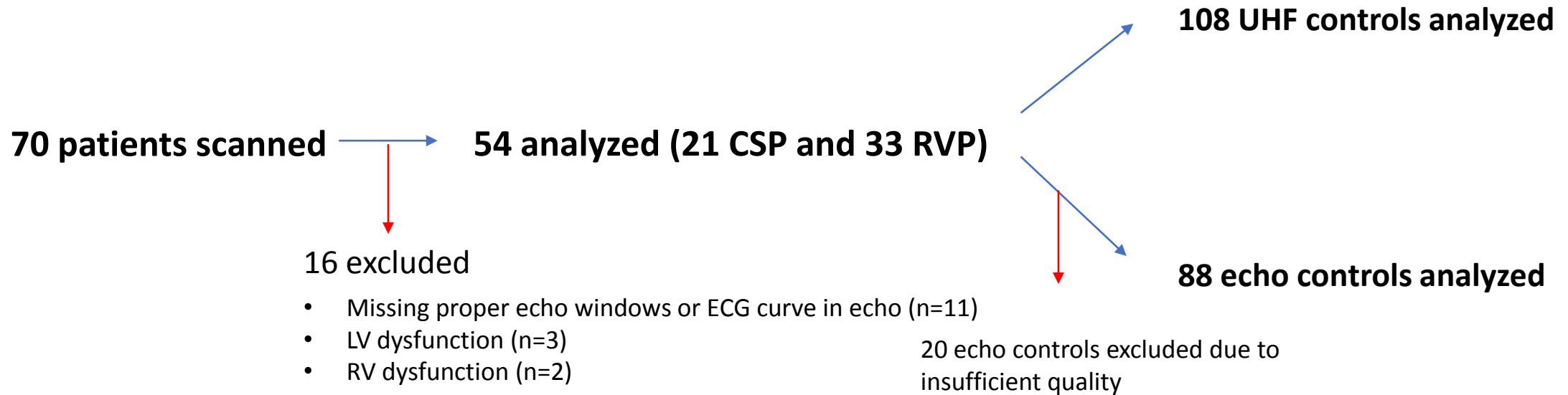


CSP: conduction system pacing; DSP: deep septal pacing; HBP: His bundle pacing
LBBAP: left bundle branch area pacing; LBBP: left bundle branch pacing
LFP: left fascicular pacing; RBBP: right bundle branch pacing

[EHRA clinical consensus statement on conduction system pacing implantation; executive summary. Endorsed by the Asia-Pacific Heart Rhythm Society \(APHRS\), Canadian Heart Rhythm Society \(CHRS\) and Latin-American Heart Rhythm Society \(LAHRS\) | EP Europace | Oxford Academic \(oup.com\)](#)



Results – flowchart

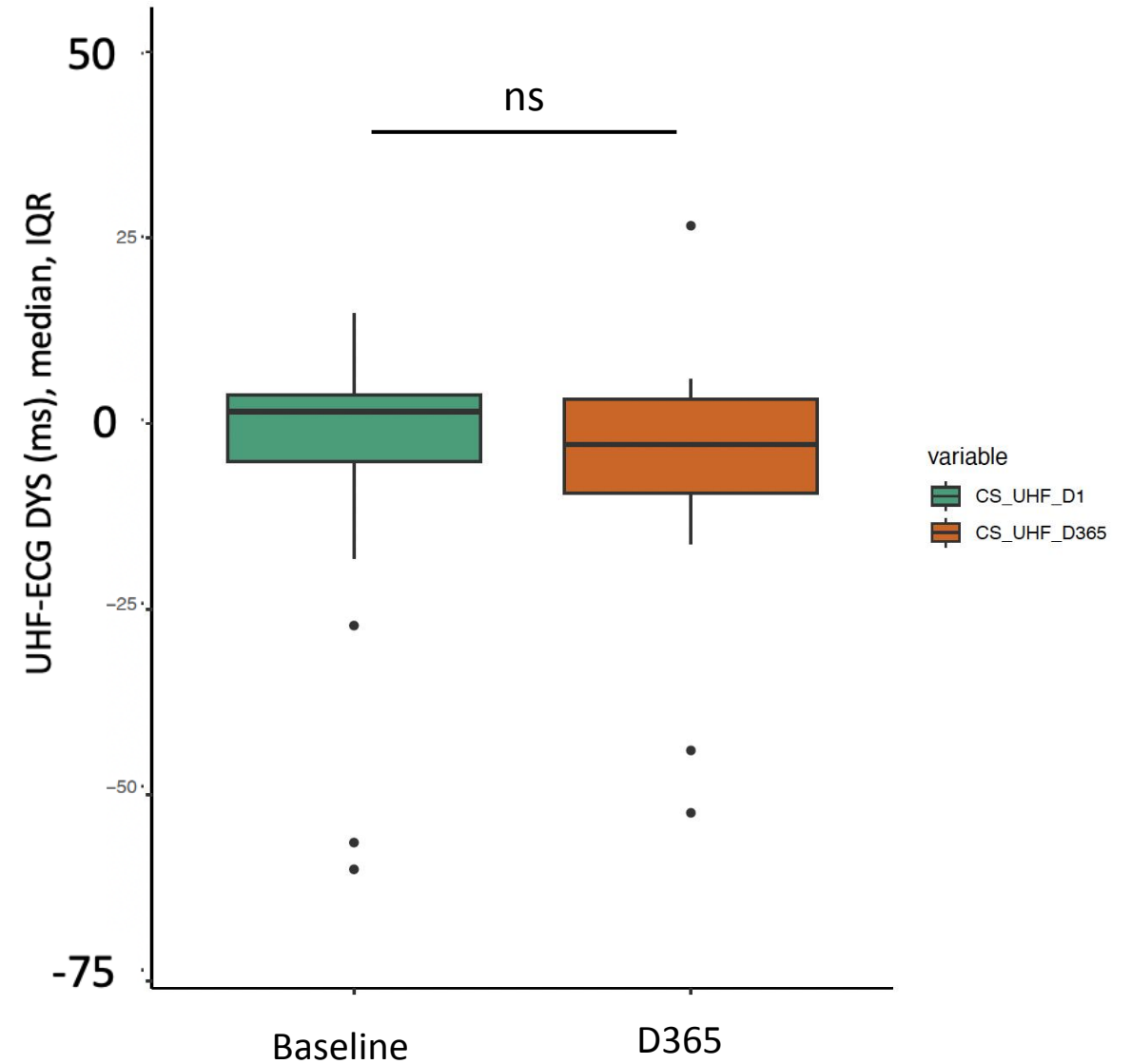
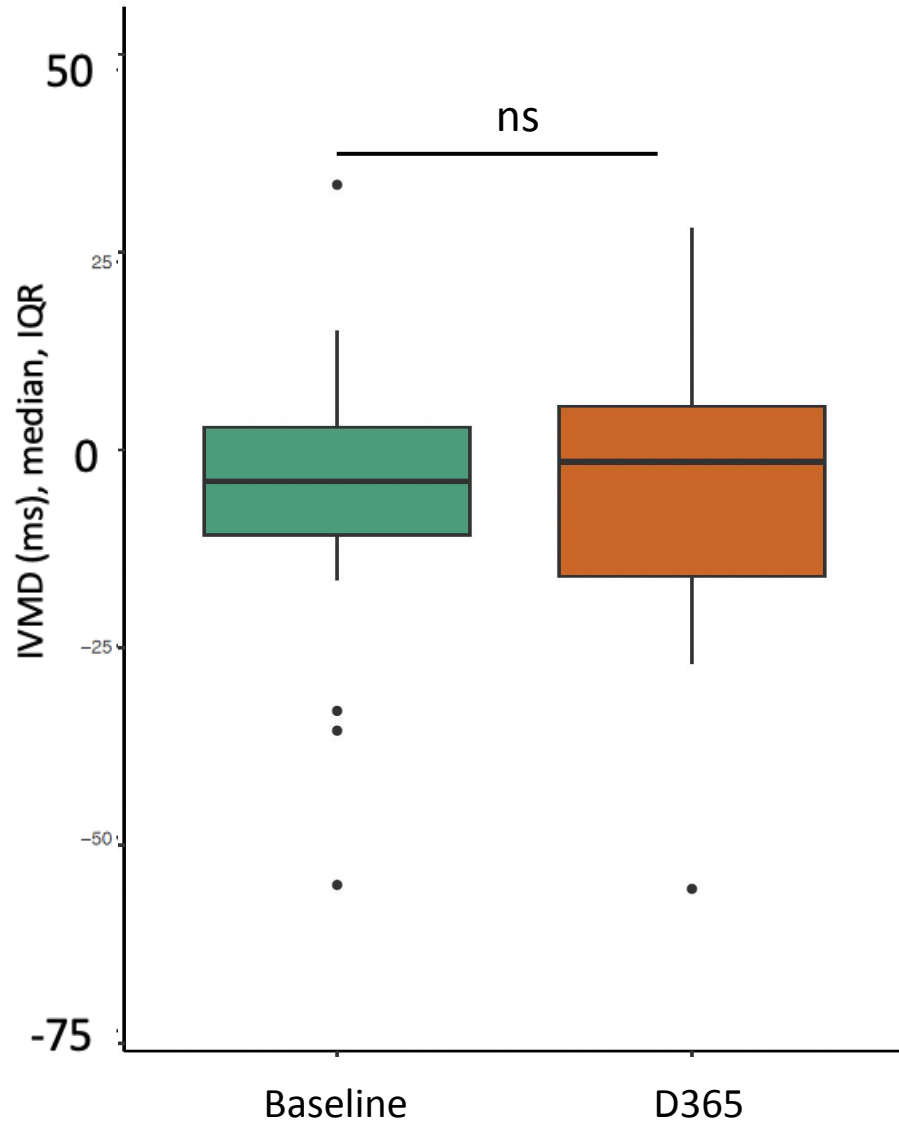


Results – baseline clinical and pacing characteristics

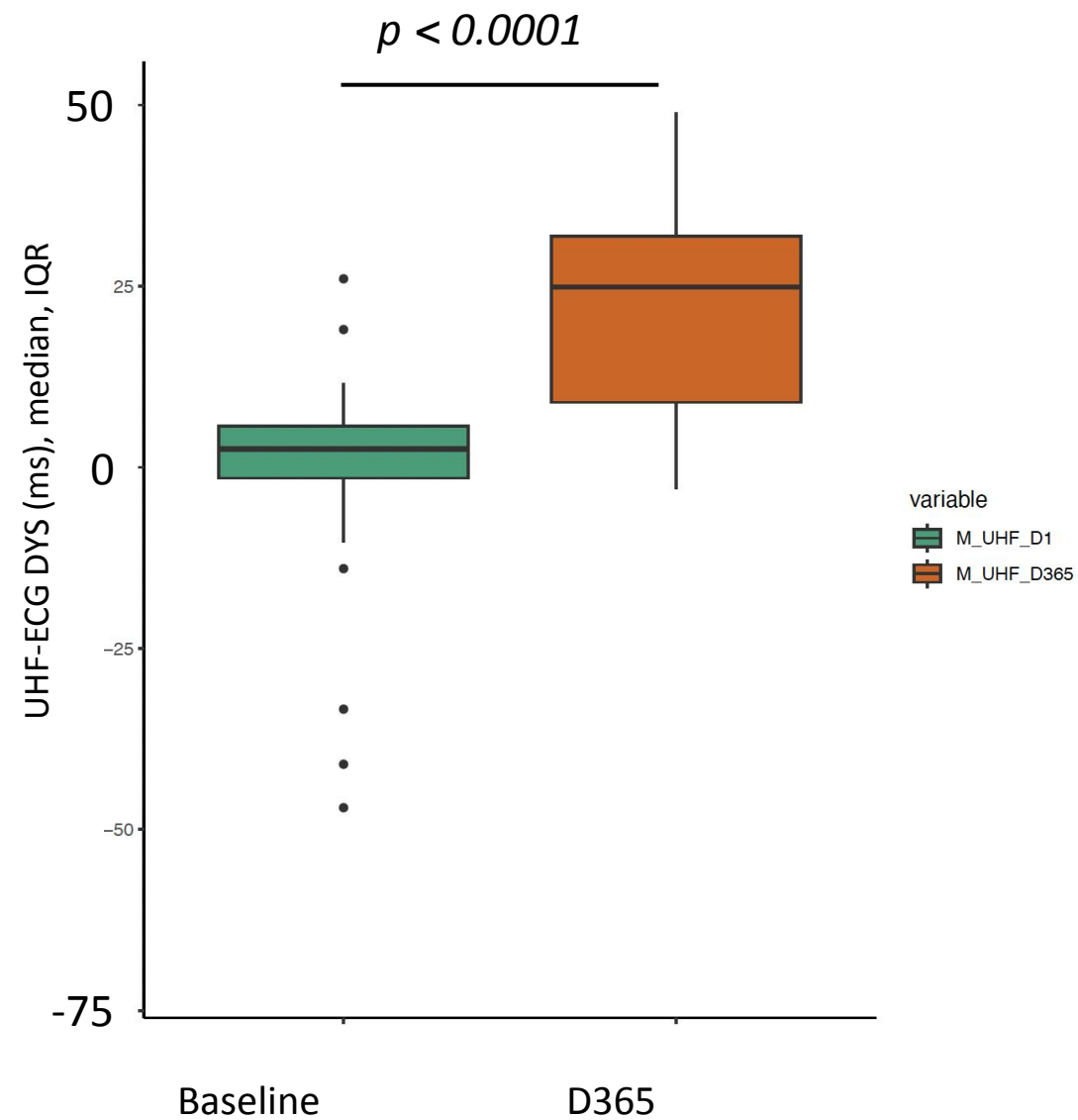
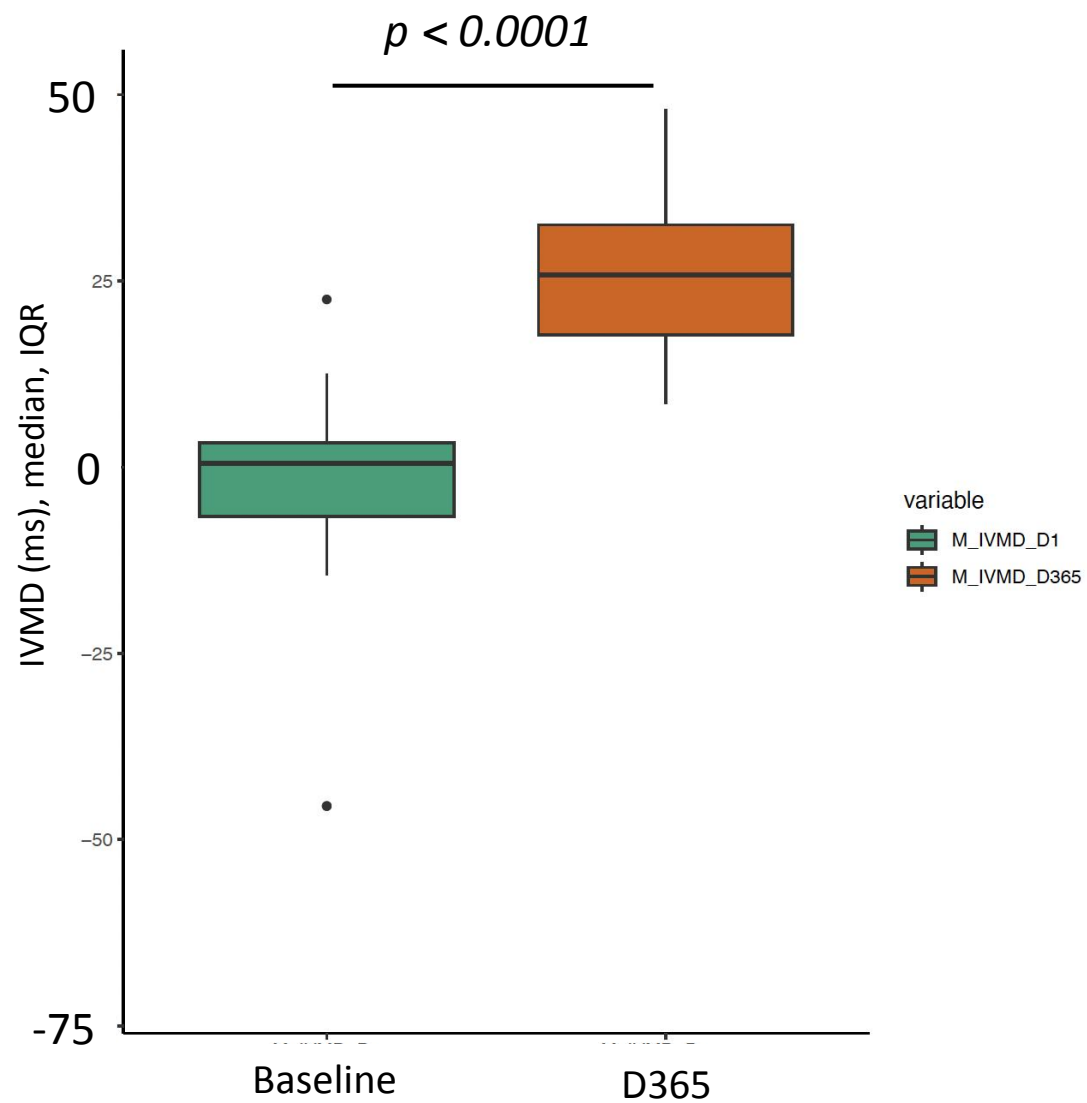
	RVP	CSP	P-value
Age (years), mean ± SD	75 ± 8	74 ± 6	0.55
Male gender (%)	65	66	0.90
BMI (kg/m ²), mean, 95% CI	27 (25; 28)	28 (27; 30)	0.07
DM, n (%)	17 (52)	13 (62)	0.58
HT, n (%)	22 (67)	14 (67)	> 0.99
CAD, n (%)	12 (36)	4 (19)	0.23
LVEF (%), median, IQR	64 (62; 67)	65 (59; 69)	0.72
QRSd (ms), mean, 95% CI	112 (104; 121)	110 (101; 120)	0.77

	RVP	CSP	P-value
Pacing threshold (V), median, IQR	0.6 (0.5; 0.75)	0.5 (0.5; 0.95)	0.33
Procedure time (min.), mean, 95% CI	38 (35; 42)	66 (60; 73)	< 0.0001
Fluoroscopy time (sec.), mean, 95% CI	245 (182; 308)	518 (402; 634)	0.0003

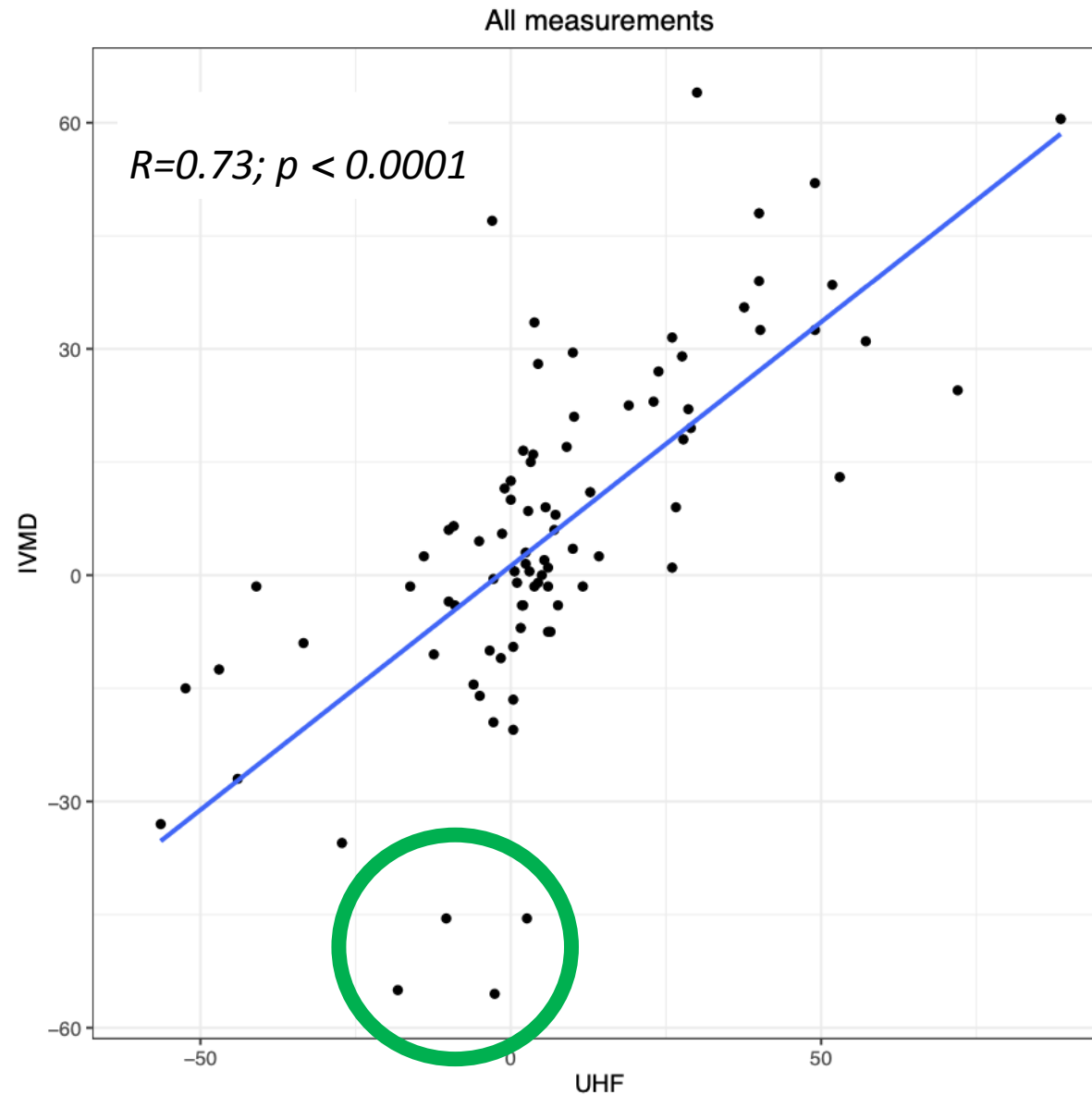
Results – dyssynchrony in CSP



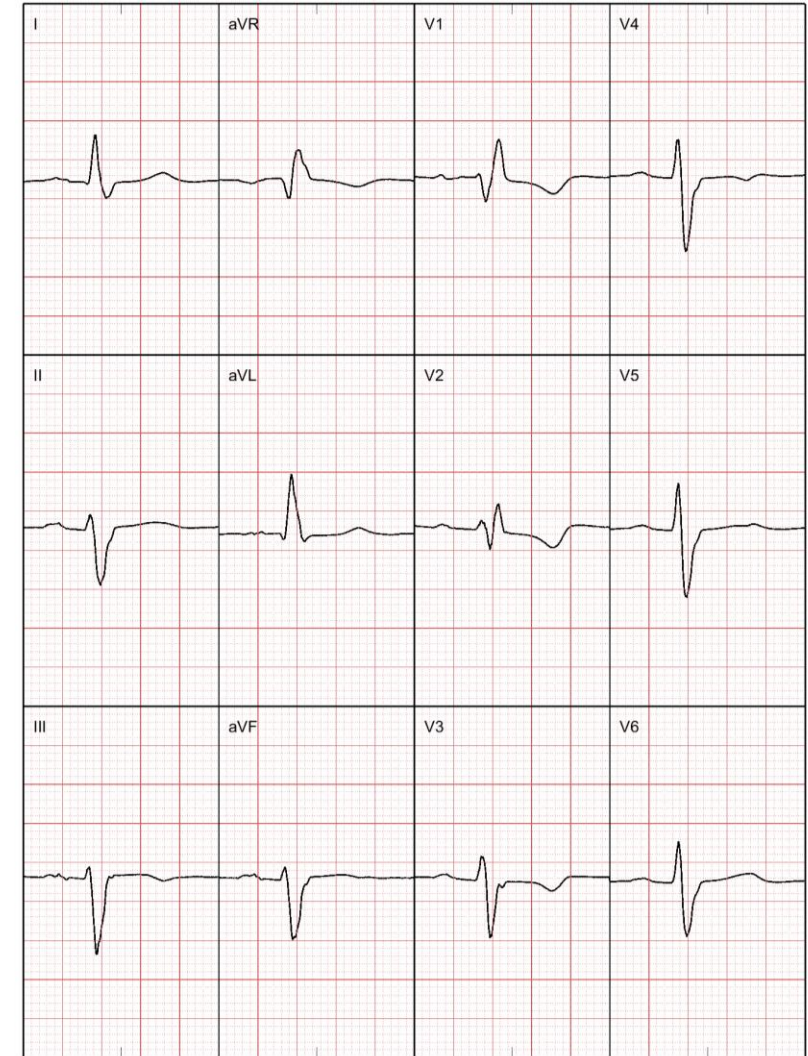
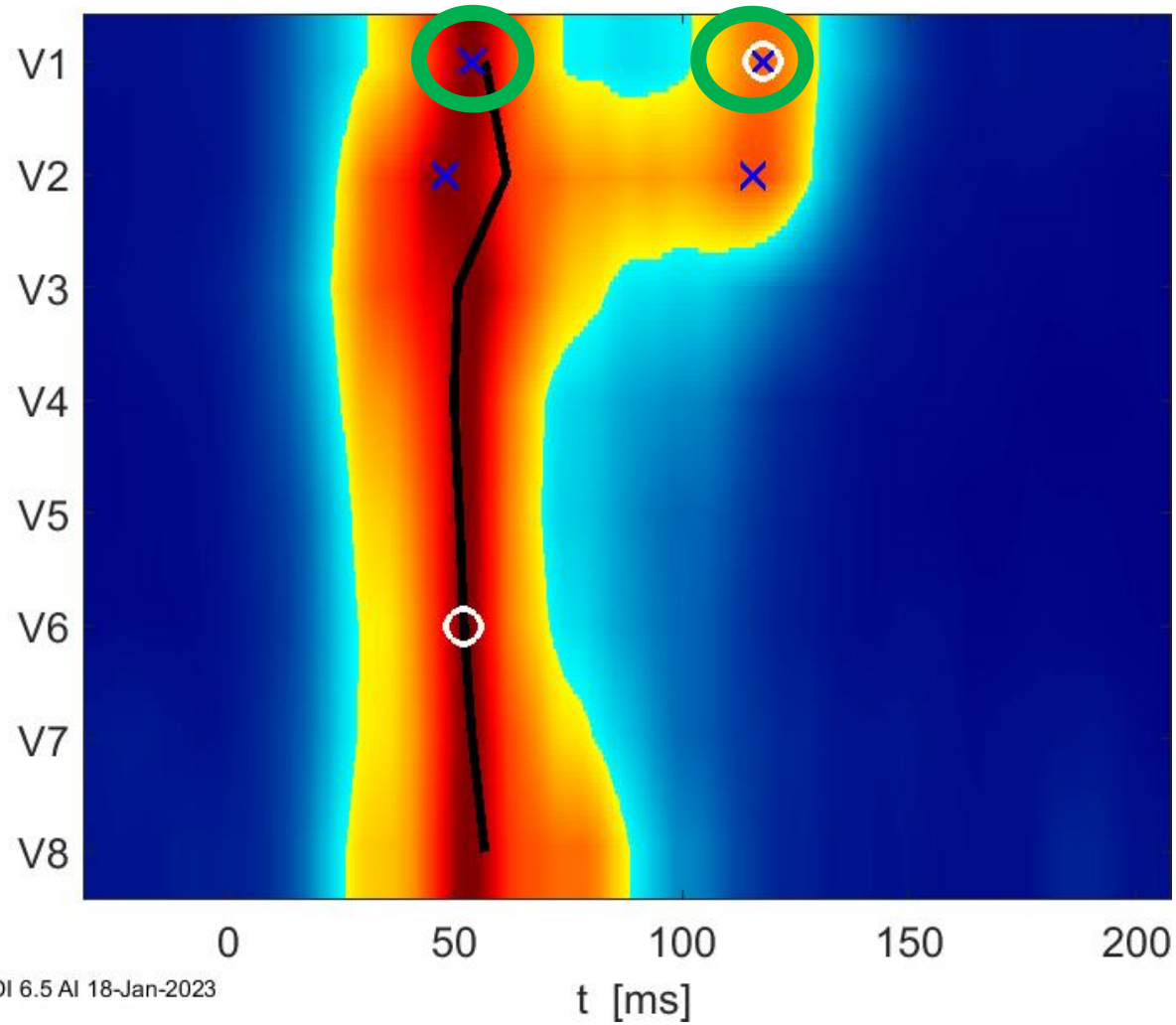
Results – dyssynchrony in RVP



UHF-ECG a IVMD korelace



Outliers



Conclusions and clinical implications:

- Interventricular dyssynchrony assessed by UHF-ECG correlates with interventricular mechanical delay
- In general RV pacing leads to higher INTERventricular dyssynchrony, in contrary to CSP which preserves synchronous ventricular activation

UHF-ECG

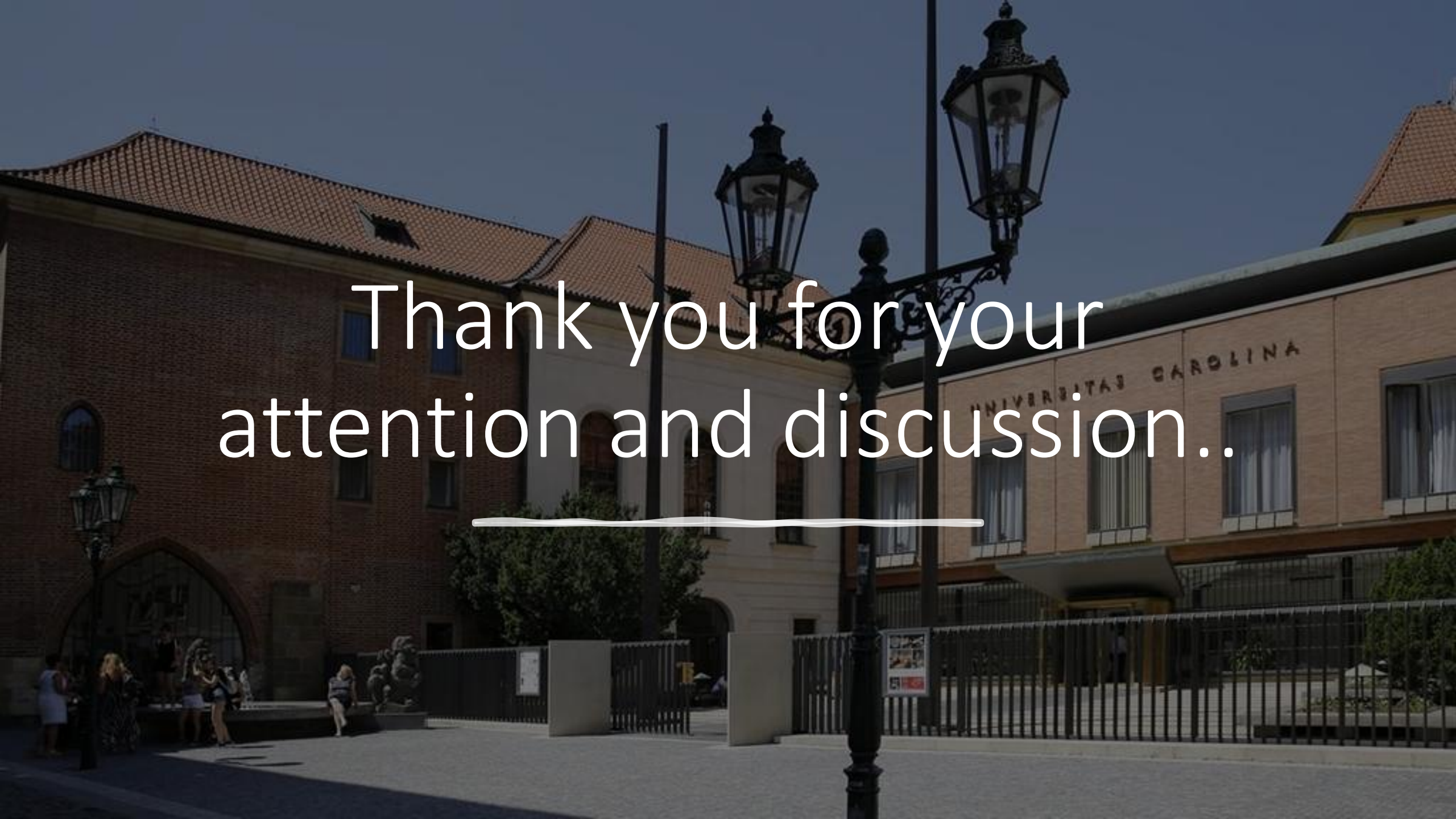
- Limited clinical data, only available for research purposes
- Limited information about the RV

Echocardiography

- Takes more time and involves M.D. for assessment
- Non-feasible in some patients and during procedures
- Manual assessment

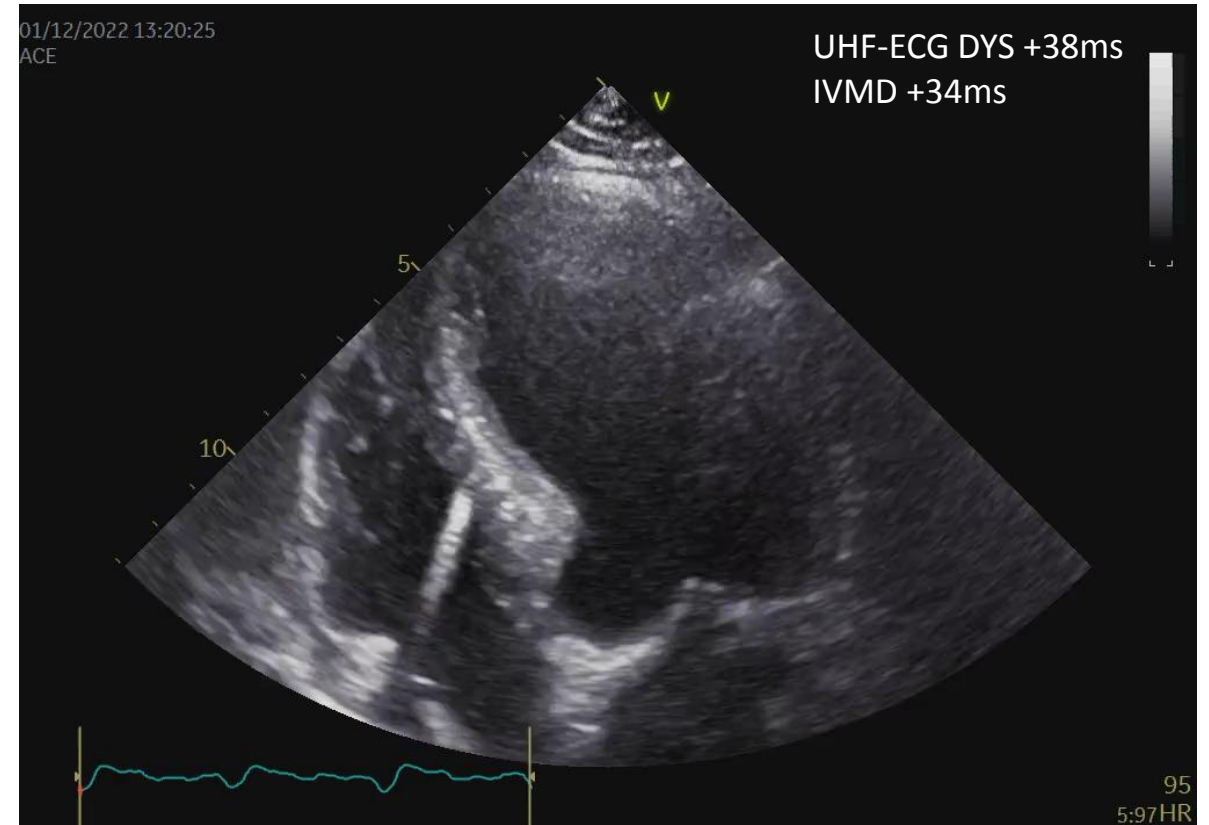
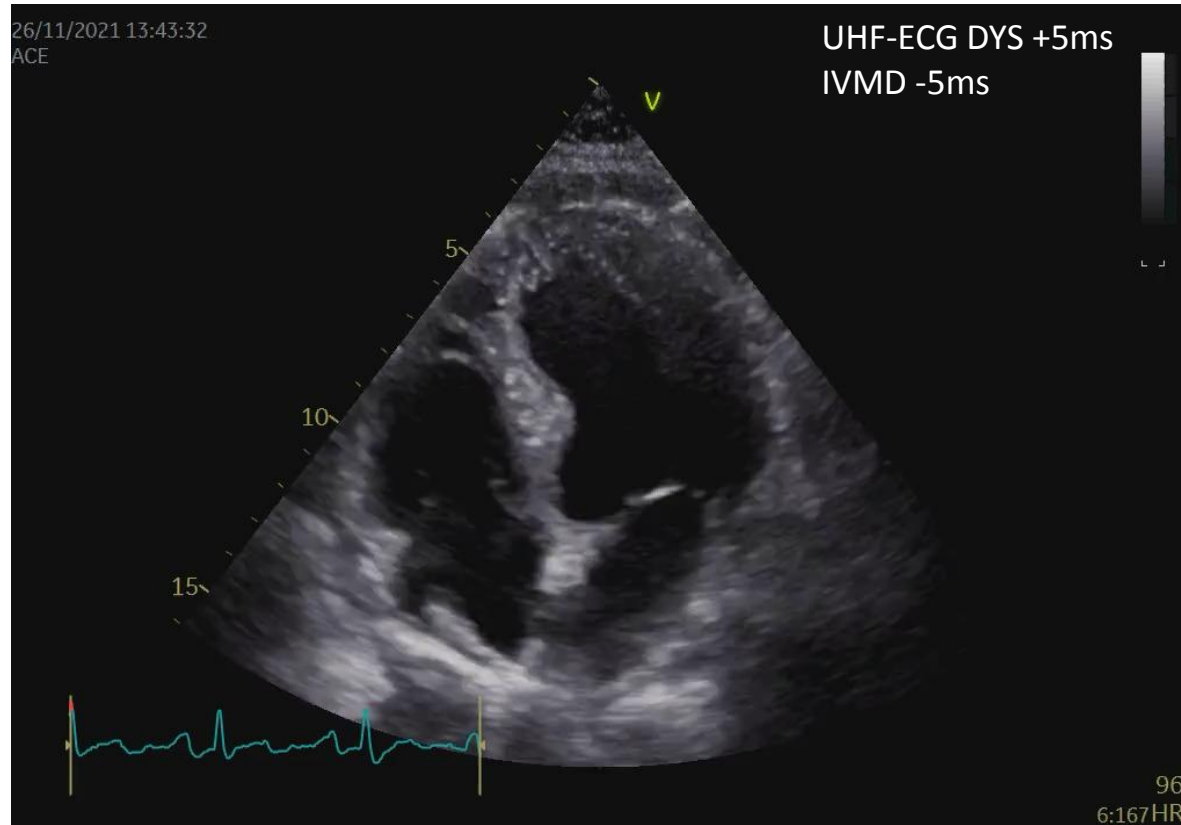
What next:

- Semi-automatic evaluation or software optimization of the UHF maps for better RBBB-like pattern detection?
- Analysis of the “**Ultra-high-frequency ECG for Prediction of Left Ventricular Remodeling**” full data and establishing the power of electrical and mechanical dyssynchrony for PICM prediction and detection

A photograph of a large, multi-story brick building with a tiled roof, identified as the University of Gävle. The building features arched windows and a prominent entrance on the left. In the foreground, there is a paved plaza with a black metal fence and several ornate street lamps. The text "Thank you for your attention and discussion.." is overlaid in white, centered on the image. A white horizontal line is positioned below the text.

Thank you for your
attention and discussion..

Outliers



Outliers

