KHRS 2023

Physiological Pacing in non-LBBB Patients

Dr Joseph YS Chan

Head of Division of Cardiology
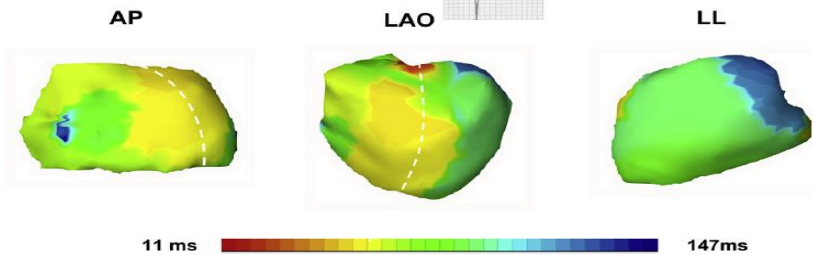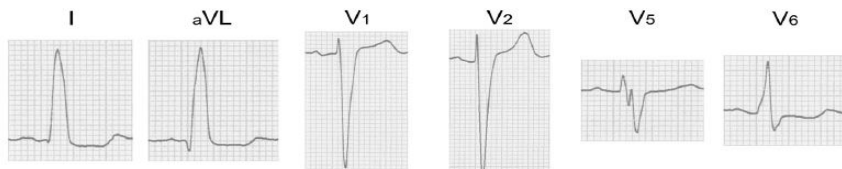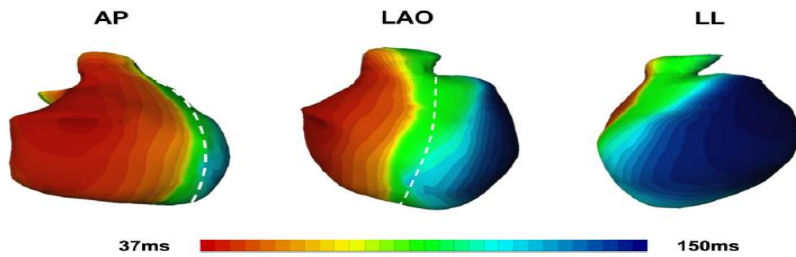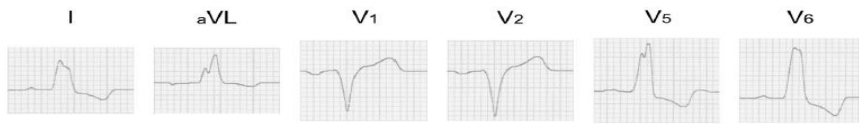
Prince of Wales Hospital

Chinese University of Hong Kong

Declaration of Interest

- Honorarium from Medtronic, Boston Scientific
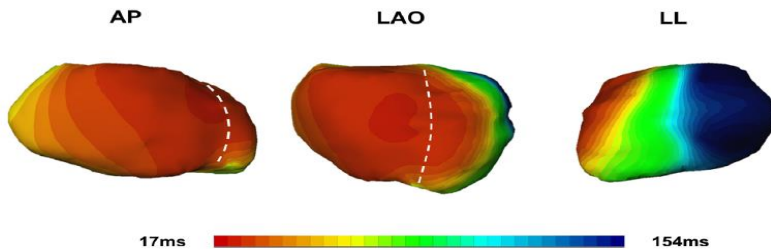
Baseline Characteristics	Responders (n = 21)	Nonresponders (n = 11)	p Value
Age, yrs	65 ± 8	67 ± 11	0.5
Male	17 (81)	11 (100)	0.3
Ischemic cardiomyopathy	8 (38)	6 (55)	0.5
Ejection fraction	26 ± 4	26 ± 4	0.9
QRS duration, ms	157 ± 19	139 ± 24	<0.05
LBBB pattern	16 (76)	2 (18)	0.003
RVTAT, ms	60 ± 30	59 ± 25	0.9
LVTAT, ms	112 ± 29	89 ± 29	0.04
VEU, ms	72 ± 16	38 ± 23	<0.001

Ploux S et al JACC 2013

BiV induced Dyssynchrony

Ploux S et al Heart Rhythm 2015
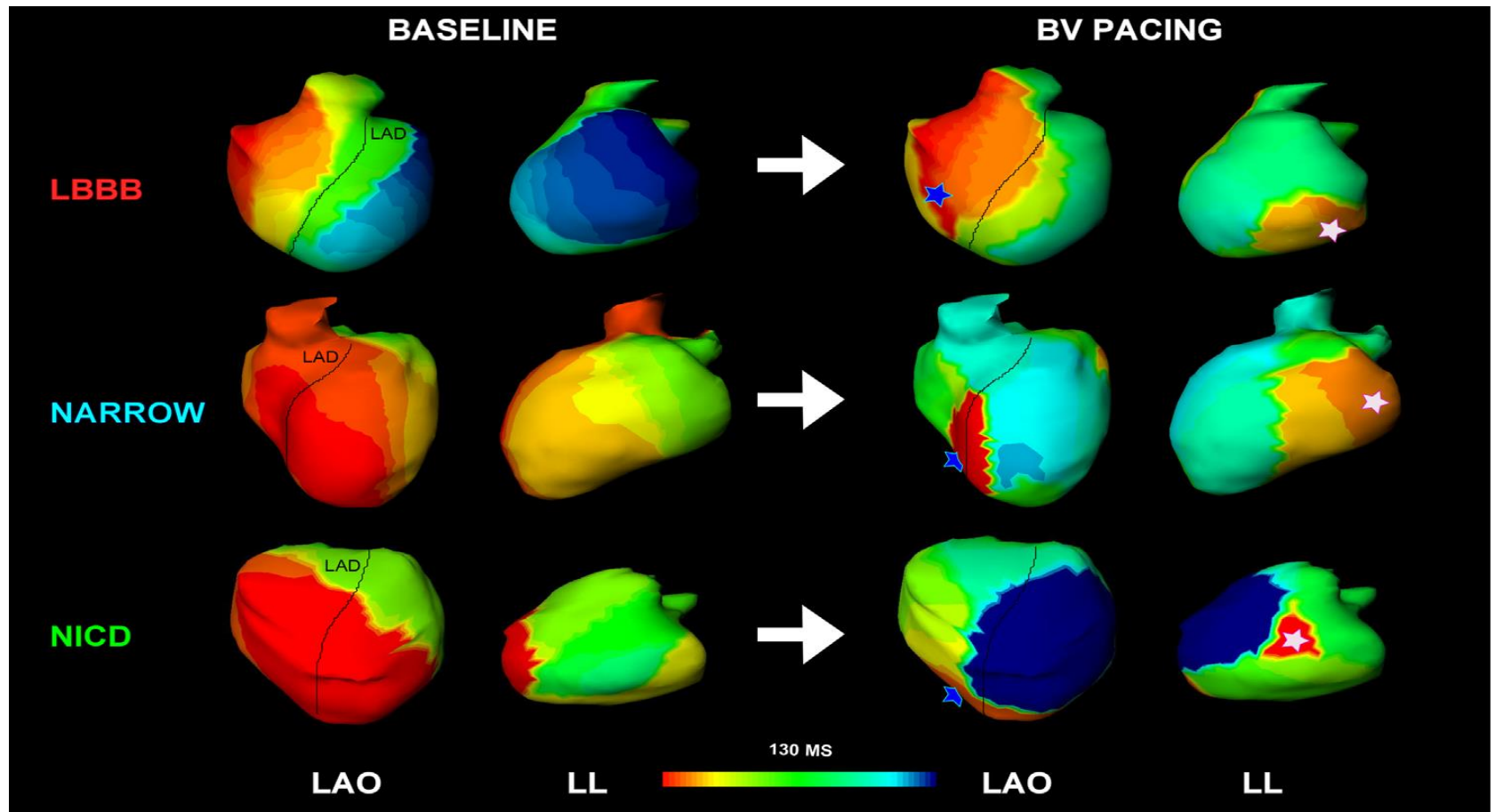
Non LBBB

| Study | Sample size | RBBB | | Hard endpoints evaluated† | Hard endpoint outcome | Soft endpoint outcome |
		CRT group	Non-CRT group			
MIRACLE and Contak CD	1,034	34	27	No	N/A	NYHA class change favorable for CRT, others (LVEF, VO$_2$, 6-minute walk distance) all neutral
CARE-HF	813	20	15	Yes	Neutral	Not published
MADIT-CRT*	1,820	137	91	Yes	Neutral	Not published
RAFT	1,789	68	93	Yes	Neutral	Not published
Totals	5,456	259	226	—	—	—

Study name	Risk Ratio	Lower Limit	Upper Limit	Z-Value	p-Value	Risk ratio and 95% CI
COMPANION[10] – Non-LBBB	0.86	0.63	1.17	-0.96	0.34	
CARE-HF[11,32] – RBBB	0.81	0.54	1.22	-0.99	0.32	
CARE-HF[11,32] – IVCD	0.75	0.24	2.33	-0.50	0.62	
MADIT-CRT[12,13,15] – RBBB	0.99	0.55	1.79	-0.03	0.97	
MADIT-CRT[12,13,15] – IVCD	1.44	0.88	2.36	1.45	0.15	
RAFT[14] – RBBB	1.00	0.62	1.62	0.00	1.00	
RAFT[14] – IVCD	1.10	0.71	1.69	0.43	0.67	
Meta Analysis	0.97	0.82	1.15	-0.32	0.75	

0.5   Favors CRT   1   Favors Control   2

Nery P et al Heart Rhythm 2011
Sipahi I et al AMJ 2012

Non LBBB

Hara H et al EHJ 2012

ORIGINAL ARTICLE

Permanent His Bundle Pacing for Cardiac Resynchronization Therapy in Patients With Heart Failure and Right Bundle Branch Block

Sharma PS..Chan JYS..Vijayaraman et al Cir EP 2018

No Correction with SHBP

Sharma PS..Chan JYS..Vijayaraman et al Cir EP 2018

QRSd and LVEF pre-and post HBP

HBP with RBBB correction was seen in 78% of patients (S-HBP 34% and NS-HBP in 66%).

Sharma PS..Chan JYS..Vijayaraman et al Cir EP 2018

RBBB

	Intrinsic	RV	BiV	His with partial correction

I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6

182ms   238ms   174ms   122ms

RBBB cases

Intrinsic

RV

BIV

His

	Intrinsic	RV	BiV	HIS
RV activation Time (ms)	64	75	64	51
LV activation Time (ms)	41	129	64	59
Total Activation Time (ms)	109	143	85	59

RBBB

Intrinsic — BiV — NSHP — His 40ms LV — His AVD 80
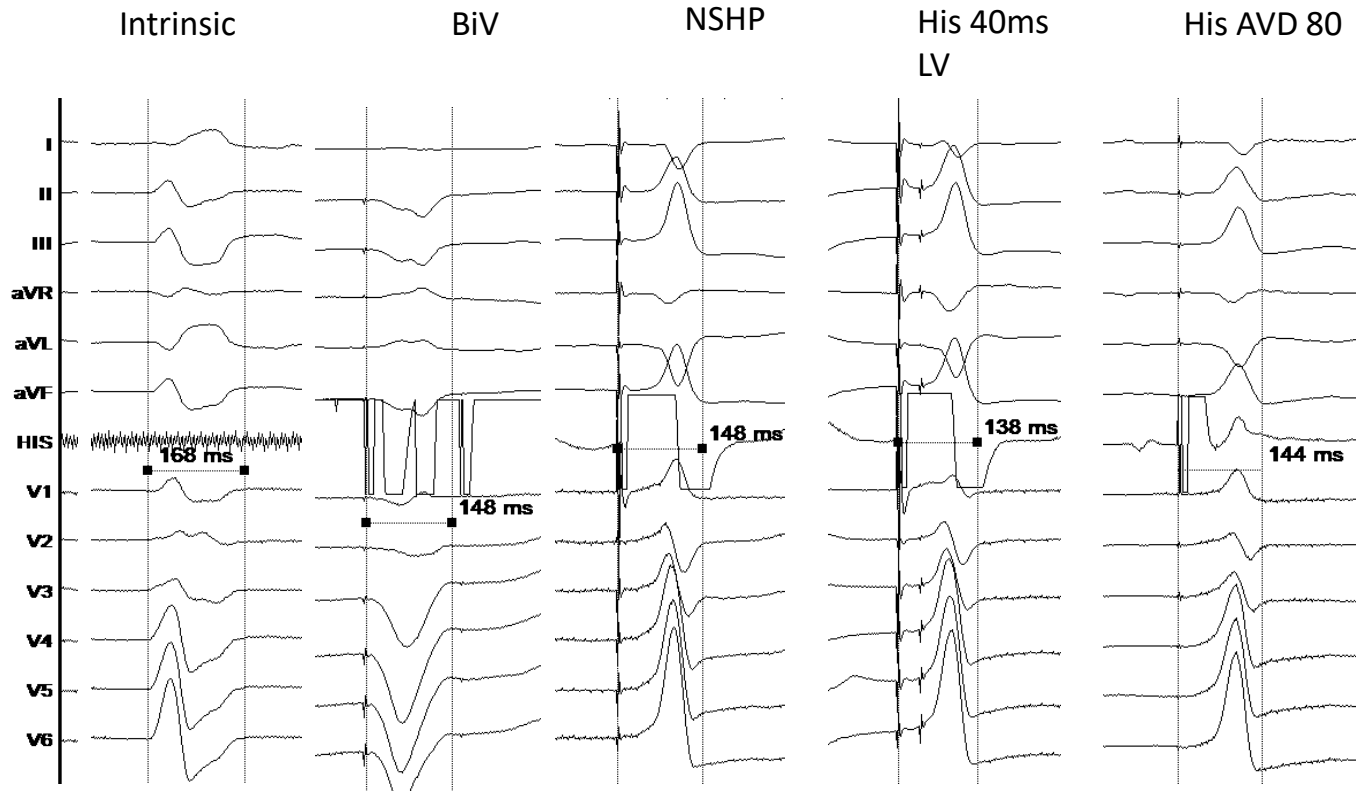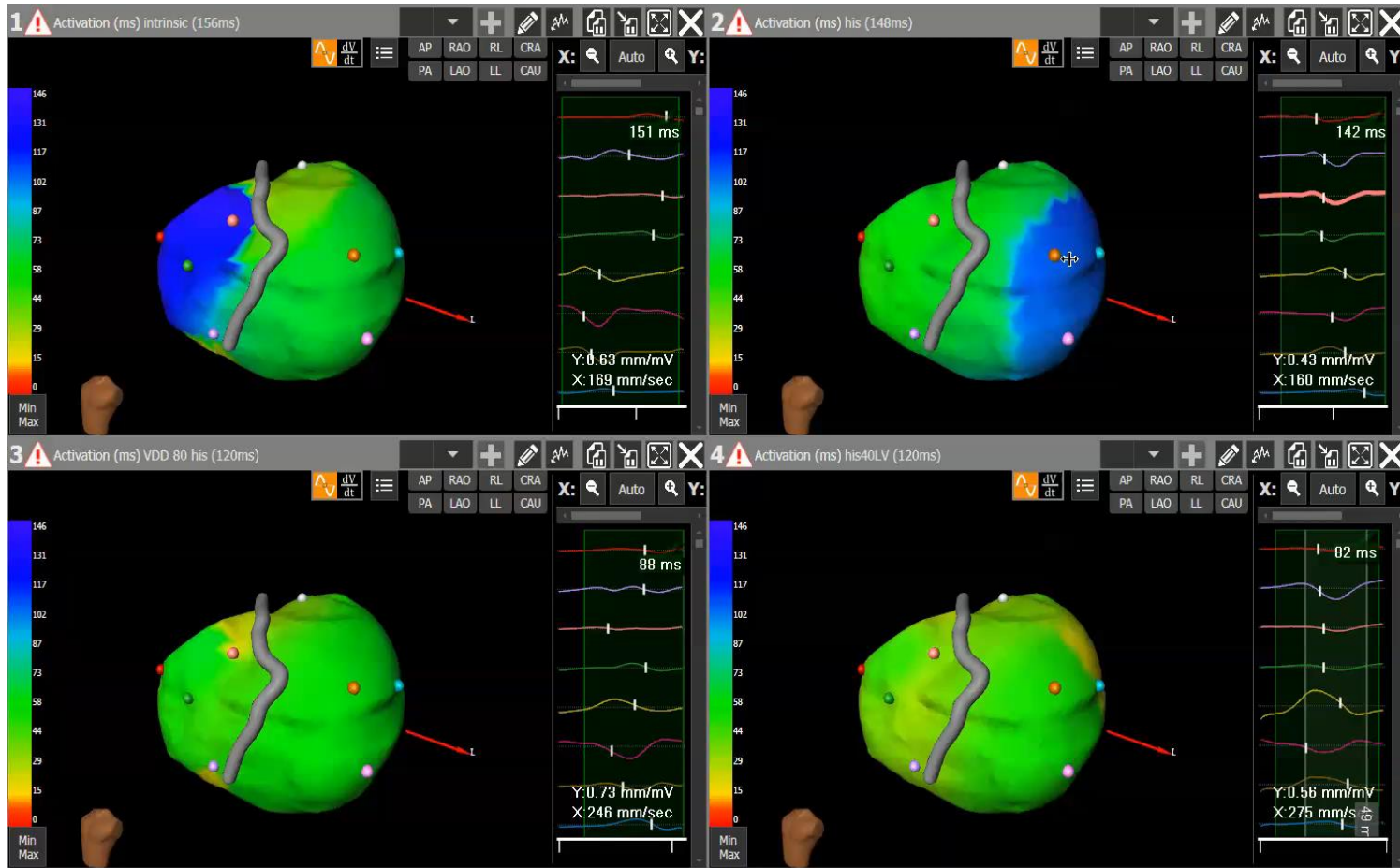
Intrinsic

NSHBP

His AVD 80msec

His 40ms LV

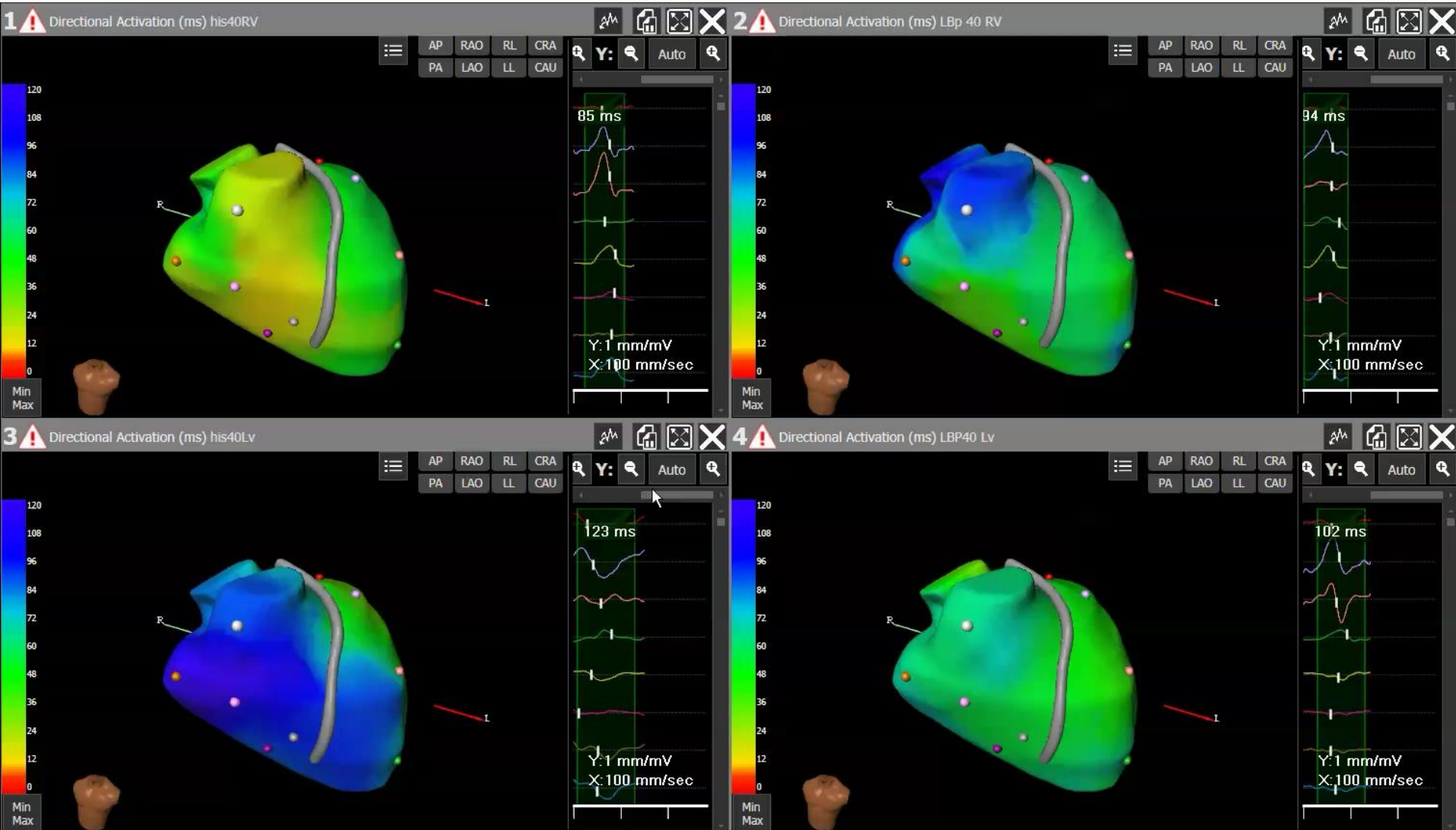| Intrinsic	BiV	NSHP	His AVD 80	His 40 LV
156ms	136ms	148ms	120ms	120ms

RBBB
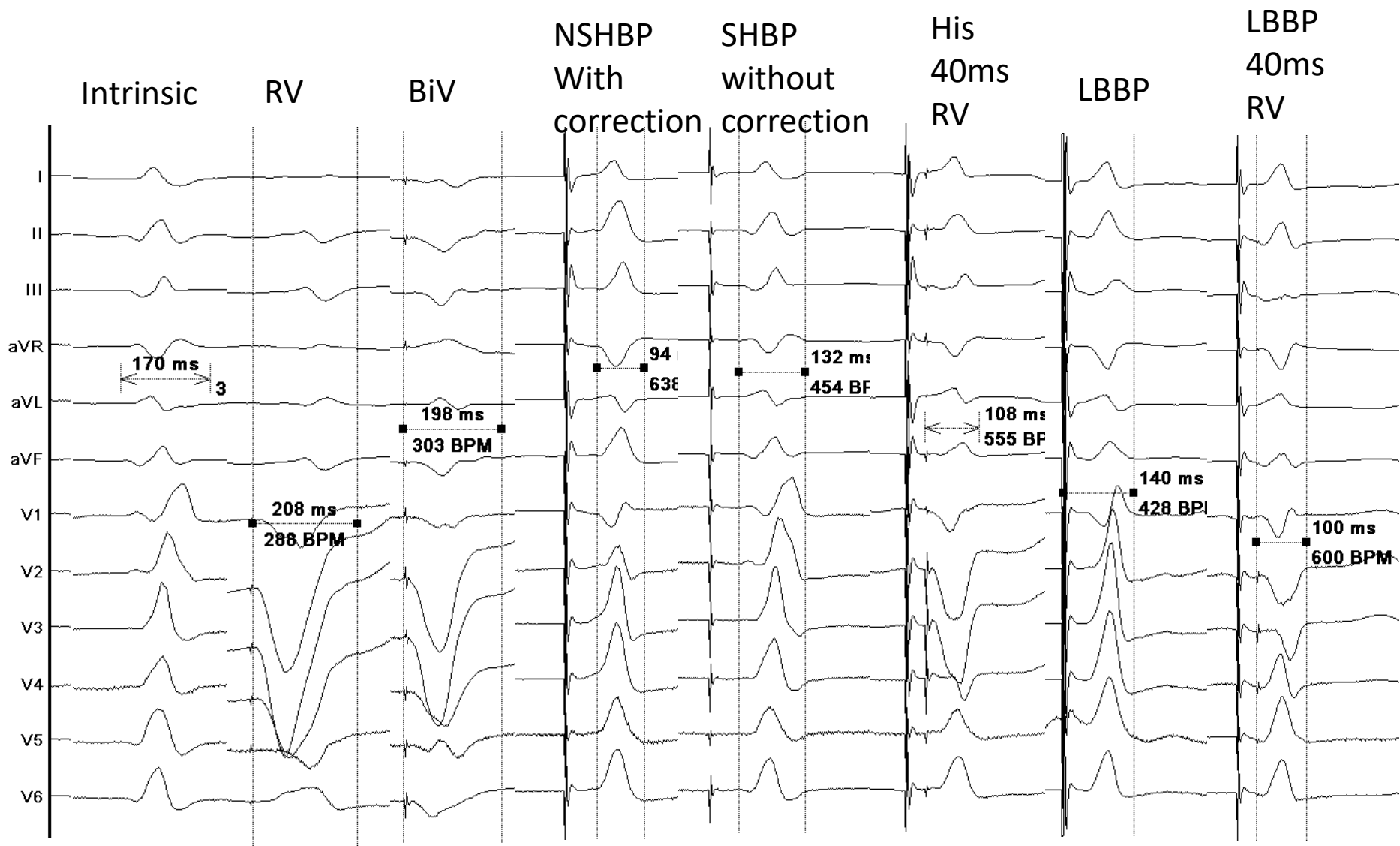
Intrinsic

SHBP without correction
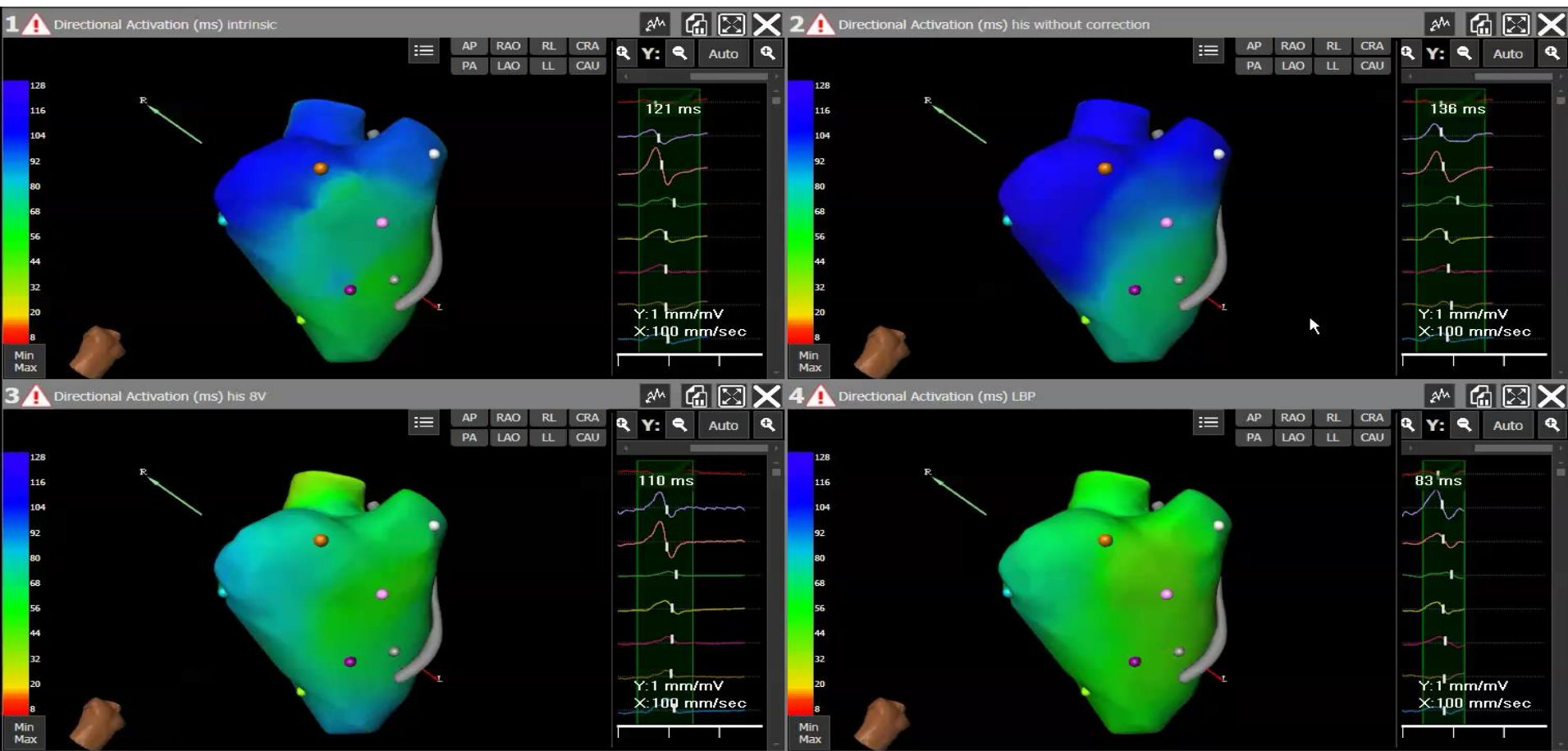
NSHBP with correction

LBBP

HIS40RV

LBBP40RV

HIS40LV

LBBP40LV

	Intrinsic	NSHBP With correction	SHBP without correction	LBBP	BiV	His40RV	LBBP40RV	His40LV	LBBP40LV
RV activation Time (ms)	38	22	47	31	57	63	37	78	60
LV activation Time (ms)	45	40	46	31	72	58	44	77	76
Total Activation Time (ms)	76	41	72	40	86	63	49	142	86

RBBB/IVCD

Intrinsic   BiV   NSHP   LBBP   LBBP to His

202 ms
297 BPM

196 ms
306 BPM

222 ms
270 BPM

180 ms
333 BPI

142 ms
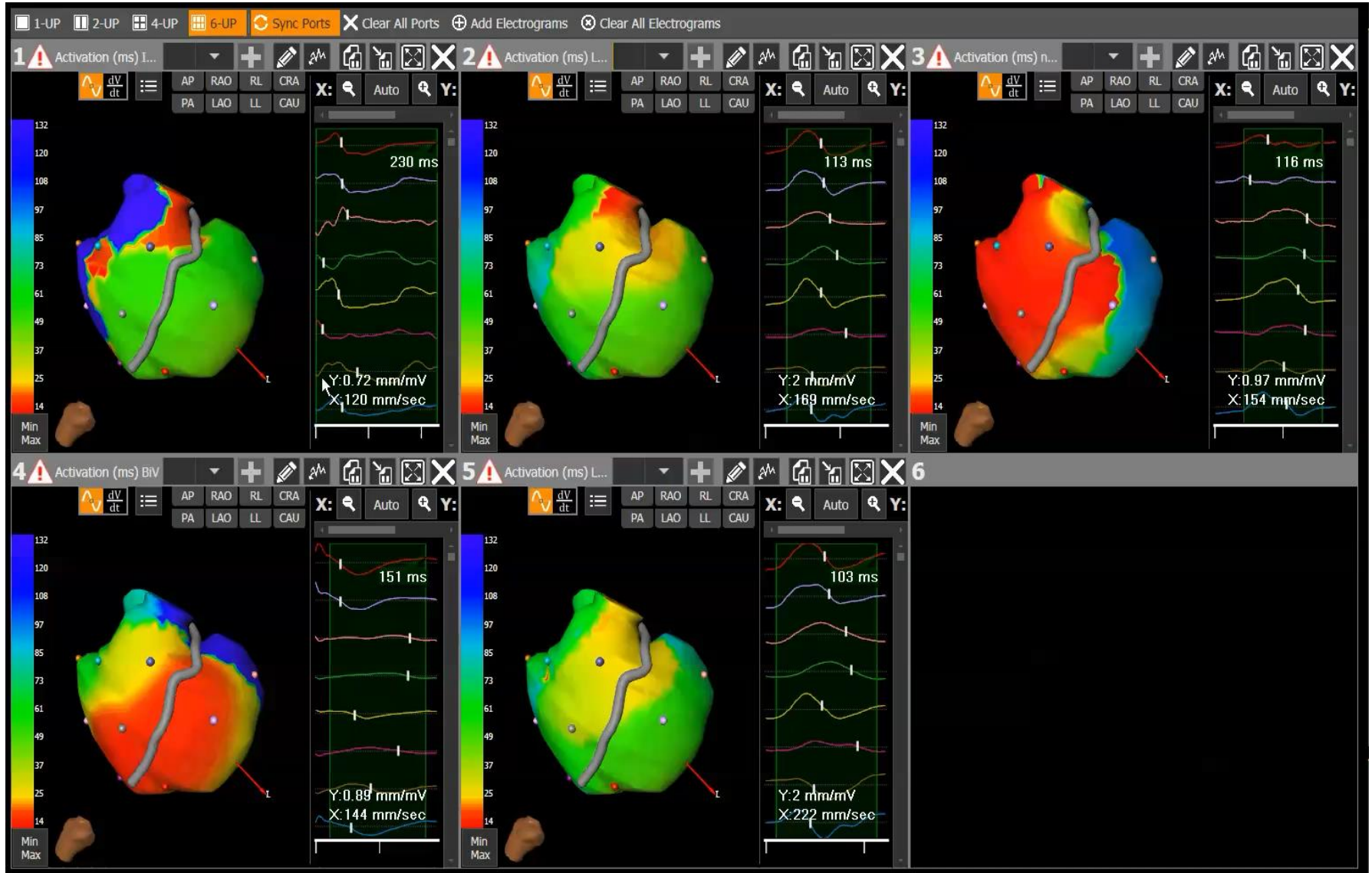422 BPM
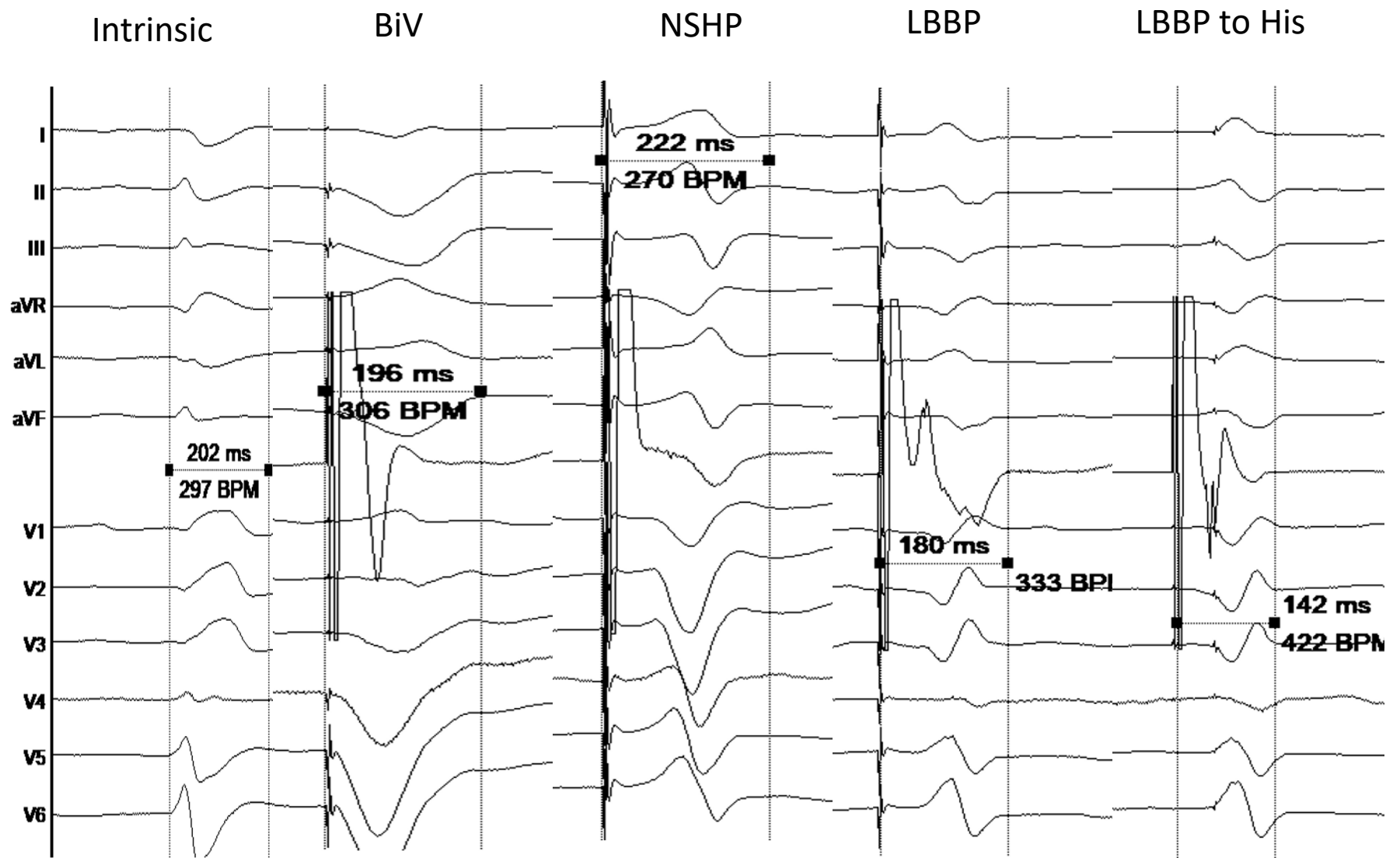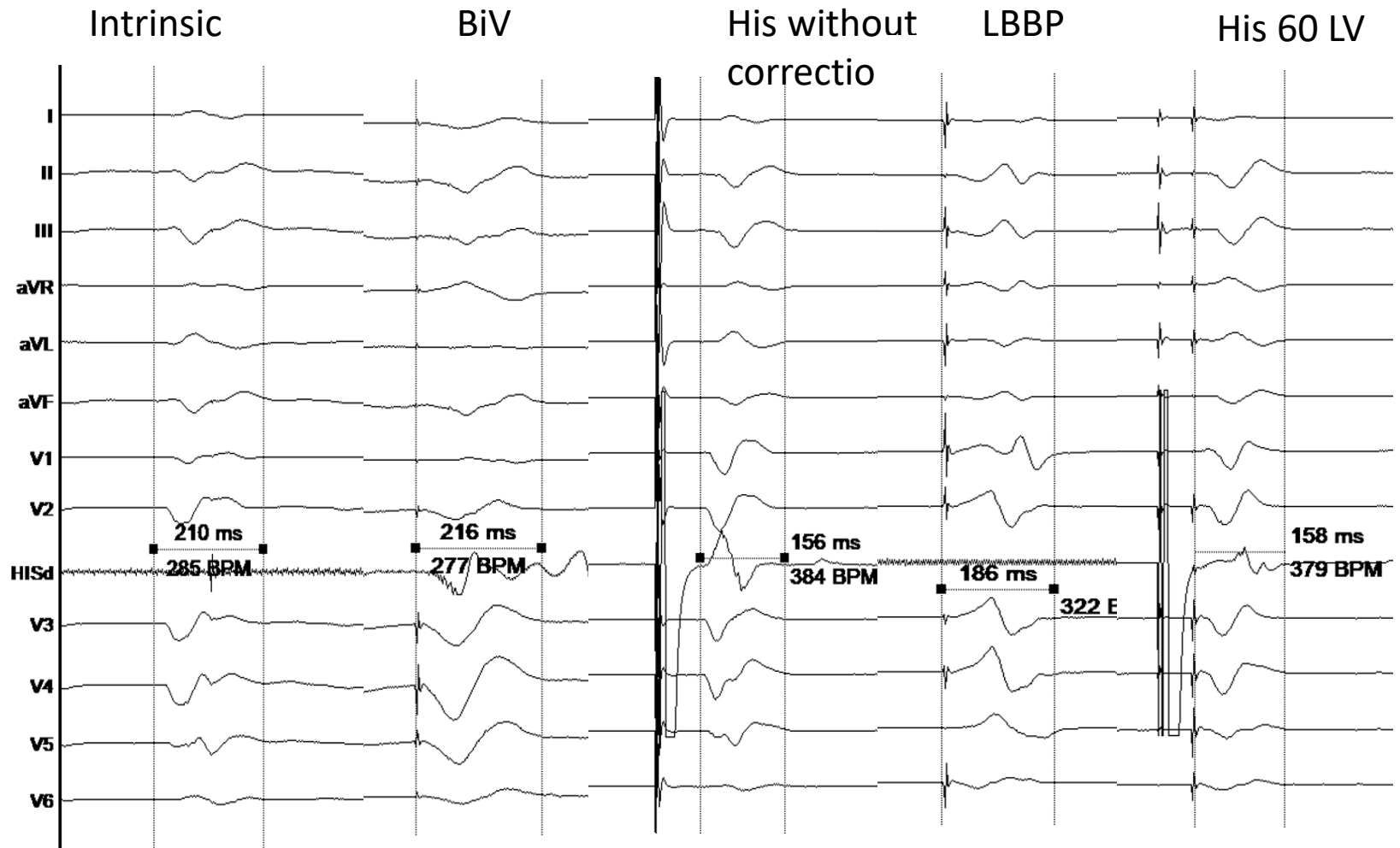
Intrinsic

LBBP

NSHP

BiV

LBBP to His

IVCD

IVCD

Intrinsic

His

BiV

His 60 LV

RBBB cases

- His (distal His)
- His + LV or adjustment of AVD
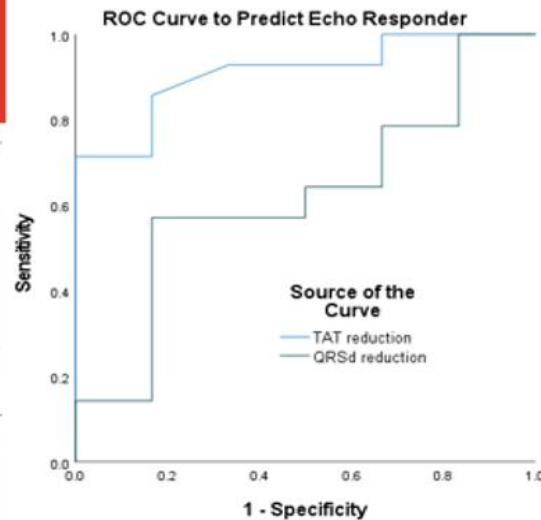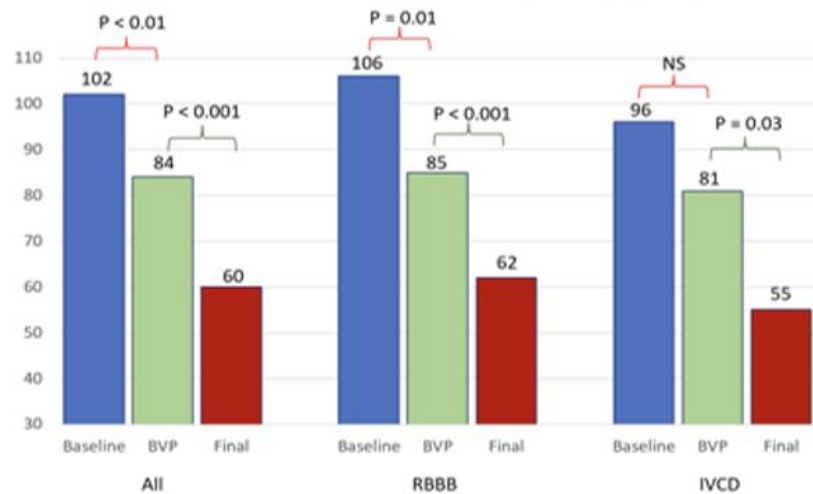- CSP + RV
- Direct right bundle capture

20 patients with **non-LBBB** and CRT indication
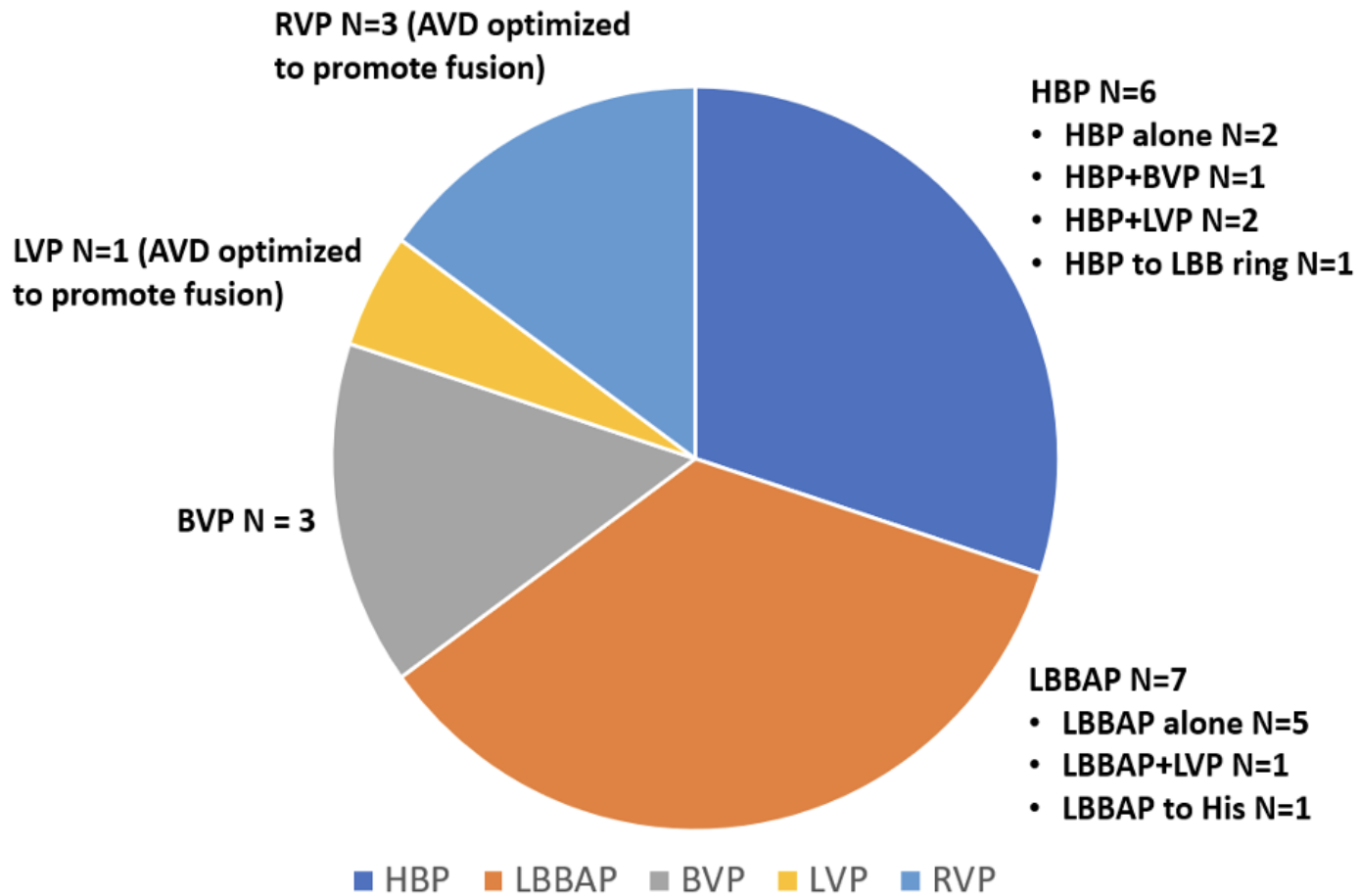## Implantation of **RV, LV, HIS bundle, Left Bundle, RA leads**
Real-time ECG imaging to pick pacing configuration that produced the **shortest total activation time**

Total activation time (TAT) (ms)
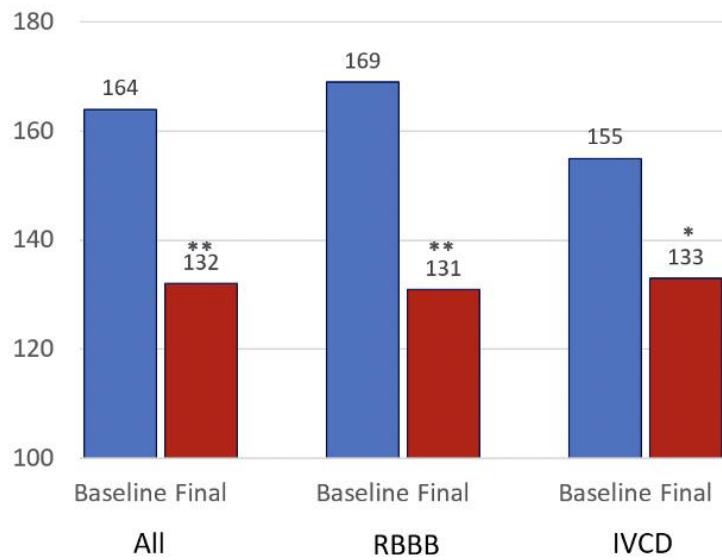

ROC Curve to Predict Echo Responder
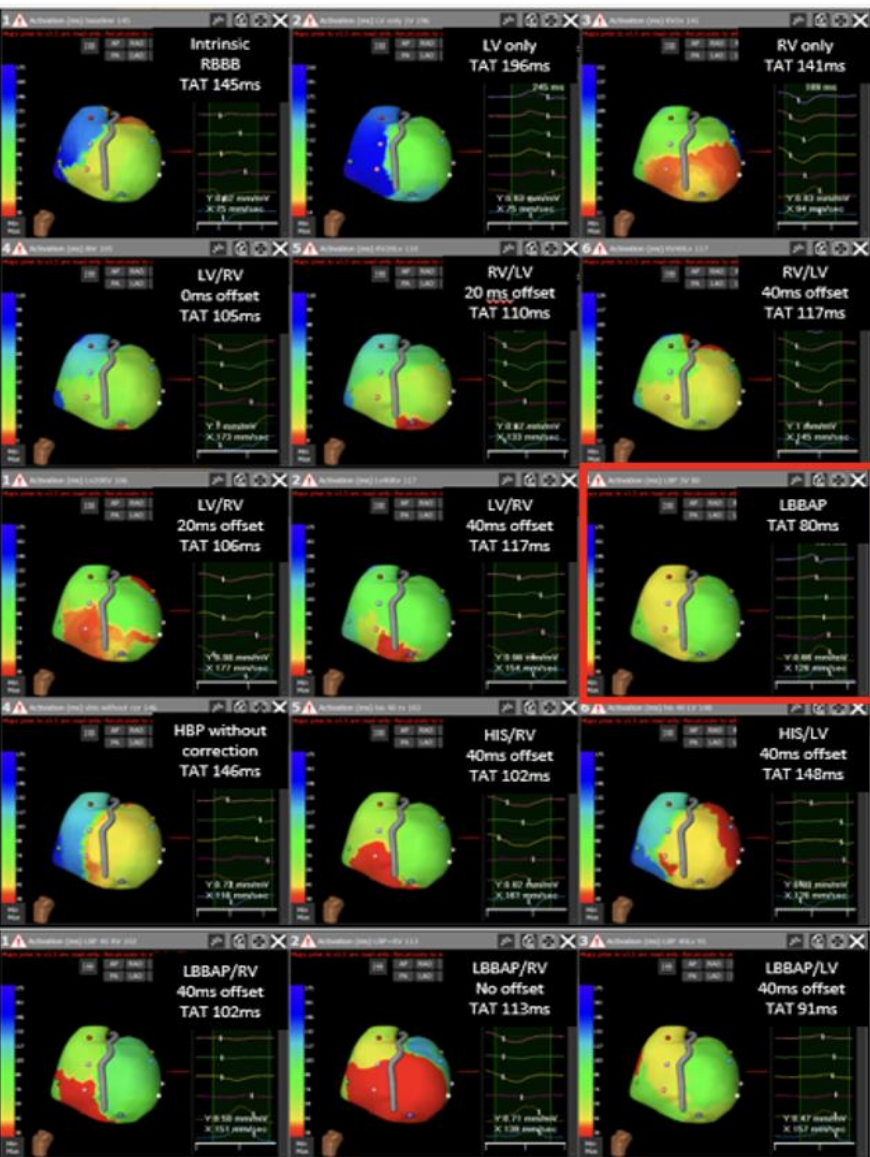
- ECGi guided approach produce better electrical resynchronization than BVP.
- Acute TAT reduction is a good predictor for subsequent echo response.
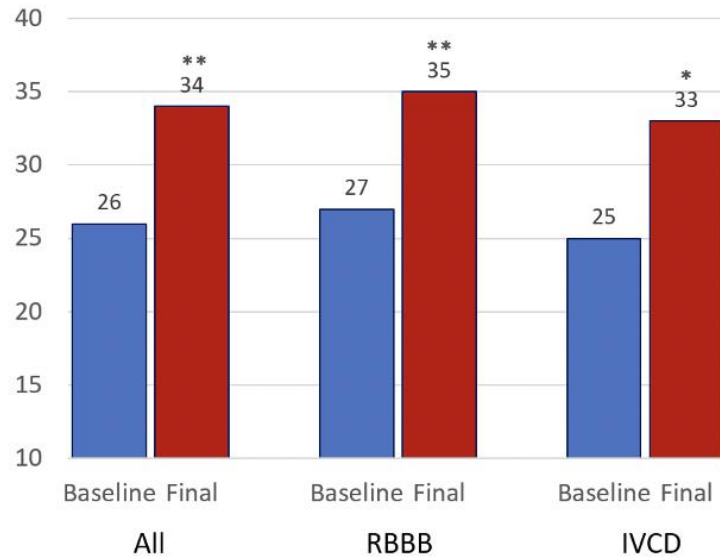- Overall response rate 70% in this cohort

RVP N=3 (AVD optimized to promote fusion)

HBP N=6
- HBP alone N=2
- HBP+BVP N=1
- HBP+LVP N=2
- HBP to LBB ring N=1

LVP N=1 (AVD optimized to promote fusion)

BVP N = 3

LBBAP N=7
- LBBAP alone N=5
- LBBAP+LVP N=1
- LBBAP to His N=1

HBP LBBAP BVP LVP RVP

Mean procedural time: 172 ± 33mins

QRS duration (ms)

LVEF (%)

Conclusions

- ECGi can provide information on global picture of the activation pattern and timing that may not be provided by 12 lead ECG

- ECGi guided physiological pacing implantation for patient with heart failure and non LBBB may provide a better guide for lead configuration to achieve best synchronization