



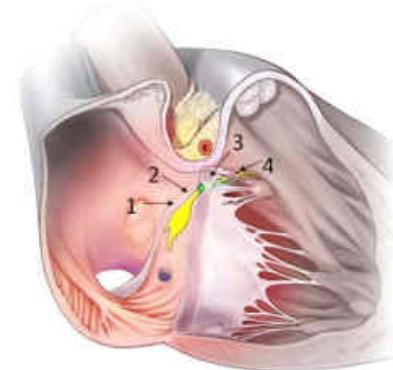
Napoli, 1-2 ottobre 2021
Hotel Excelsior

His Bundle Pacing: a chi e quando

Dott. M. Viscusi – AORN S. Anna e San Sebastiano Caserta

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)



His Bundle Pacing is used in lieu of RV pacing, in lieu of biventricular pacing, and as His optimized CRT (HOT-CRT), which exploits a synergistic effect between HBP and RV pacing, LV pacing, or biventricular pacing to improve synchrony.

There is growing evidence, mainly from observational studies, that HBP may be safe and effective in these settings although large RCTs and long-term follow up are still lacking.

With more data on safety and effectiveness, **HBP is likely to play a growing role in pacing therapy in the future**

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)

Table 9 Advantages and disadvantages of a ‘backup’ ventricular lead with His bundle pacing

Advantages
<ul style="list-style-type: none"> Increased safety (in case of loss of capture of the HBP lead) Can be used for sensing (lower risk of ventricular undersensing, no risk of His or atrial oversensing) Programming of pacing output with lower safety margins May serve to narrow the QRS with fusion pacing in the case of selective-HBP with uncorrected RBBB
Disadvantages
<ul style="list-style-type: none"> Higher cost More transvenous hardware Risk associated with the additional lead (e.g. ventricular perforation) More complex programming “Off-label” use (current regulatory approval and MRI-conditionality for HBP is only granted for His leads connected to the RV port)

Recommendations for using His bundle pacing

Recommendations	Class ^a	Level ^b
In patients treated with HBP, device programming tailored to specific requirements of HBP is recommended. ^{430,431}	I	C
In CRT candidates in whom coronary sinus lead implantation is unsuccessful, HBP should be considered as a treatment option along with other techniques such as surgical epicardial lead. ^{318,424,440,443}	IIa	B
In patients treated with HBP, implantation of an RV lead used as ‘backup’ for pacing should be considered in specific situations (e.g. pacemaker dependency, high-grade AVB, infranodal block, high pacing threshold, planned AVJ ablation) or for sensing in the case of issues with detection (e.g. risk of ventricular undersensing or oversensing of atrial/His potentials). ^{423,426,444}	IIa	C
HBP with a ventricular backup lead may be considered in patients in whom a ‘pace-and-ablate’ strategy for rapidly conducted supraventricular arrhythmia is indicated, particularly when the intrinsic QRS is narrow. ^{197,199,200,318}	IIIb	C
HBP may be considered as an alternative to RV pacing in patients with AVB and LVEF >40%, who are anticipated to have >20% ventricular pacing. ^{42,433}	IIIb	C

How to perform permanent His bundle pacing in routine clinical practice

Gopi Dandamudi, MD, FHRS,^{*} Pugazhendhi Vijayaraman, MD, FHRS[†]

From the ^{*}Indiana University School of Medicine, Indianapolis, Indiana, and [†]Geisinger Wyoming Valley Hospital, Wilkes-Barre, Pennsylvania.

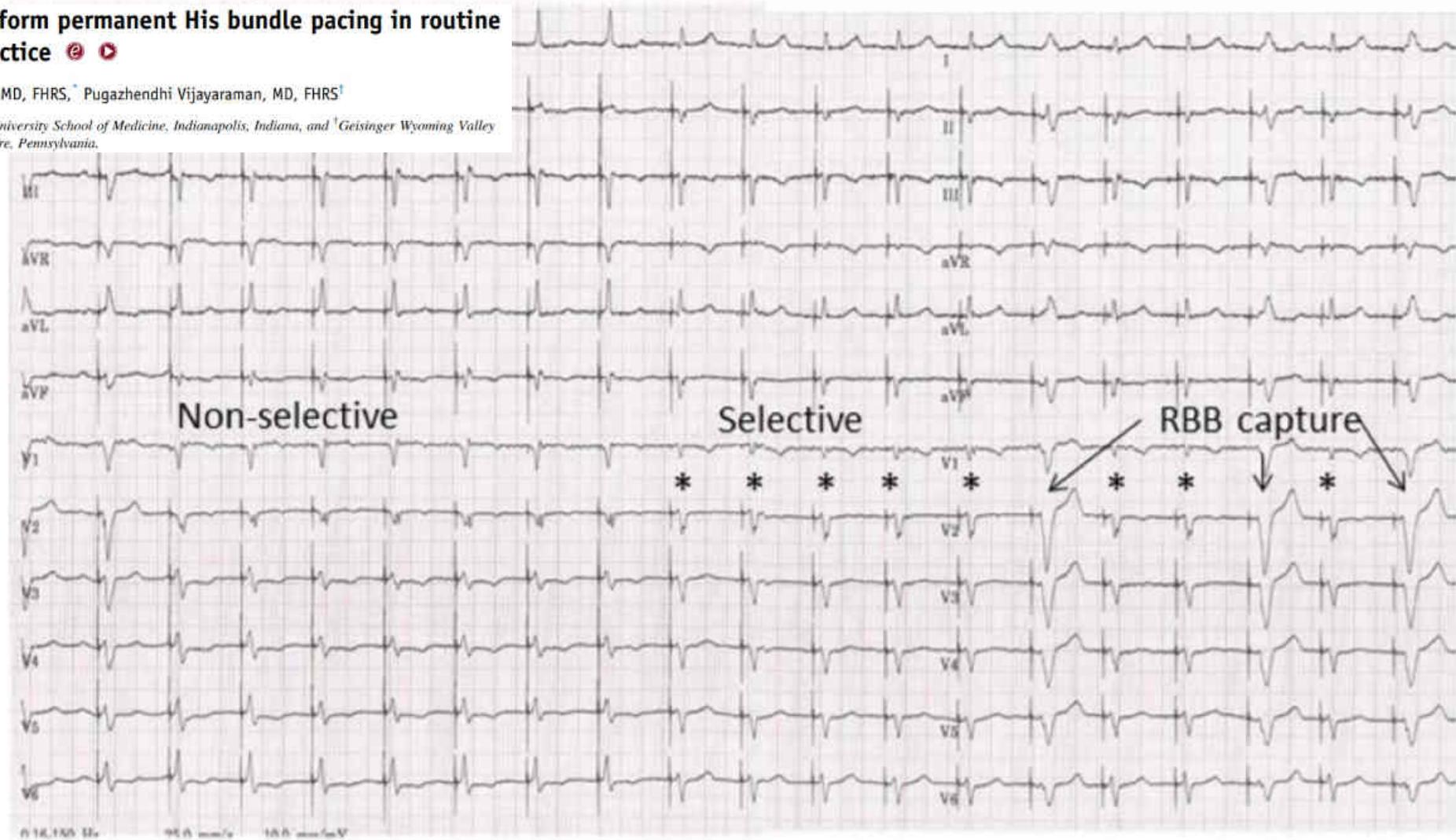
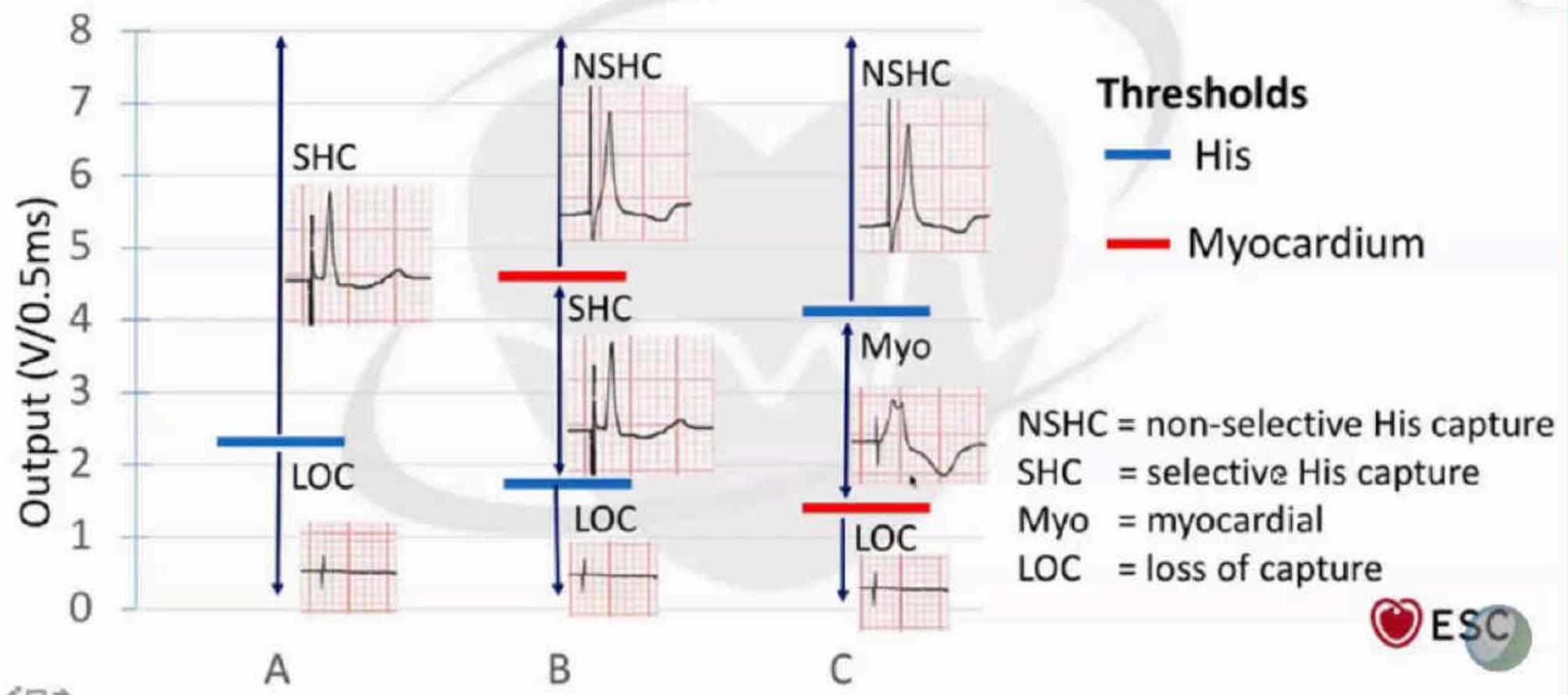
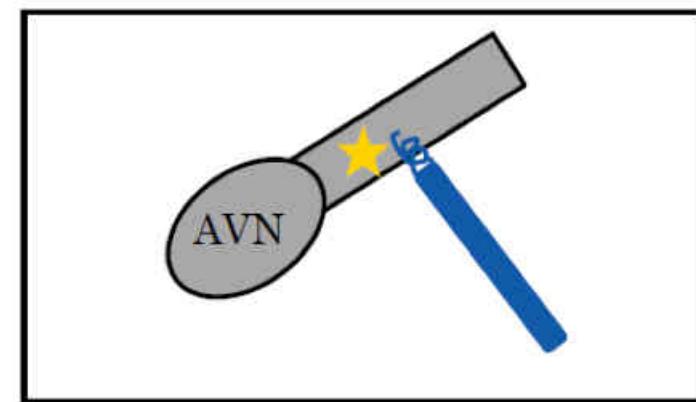
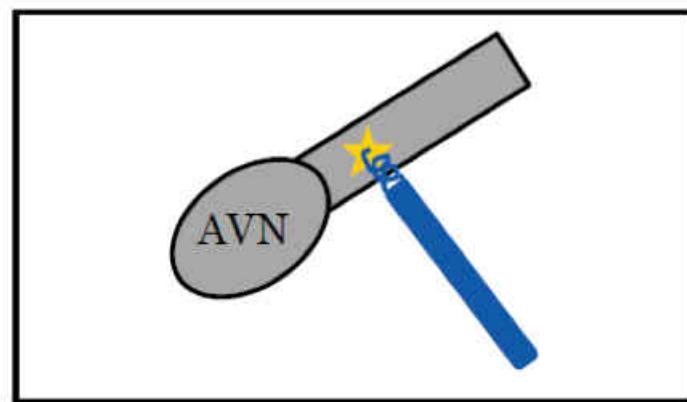
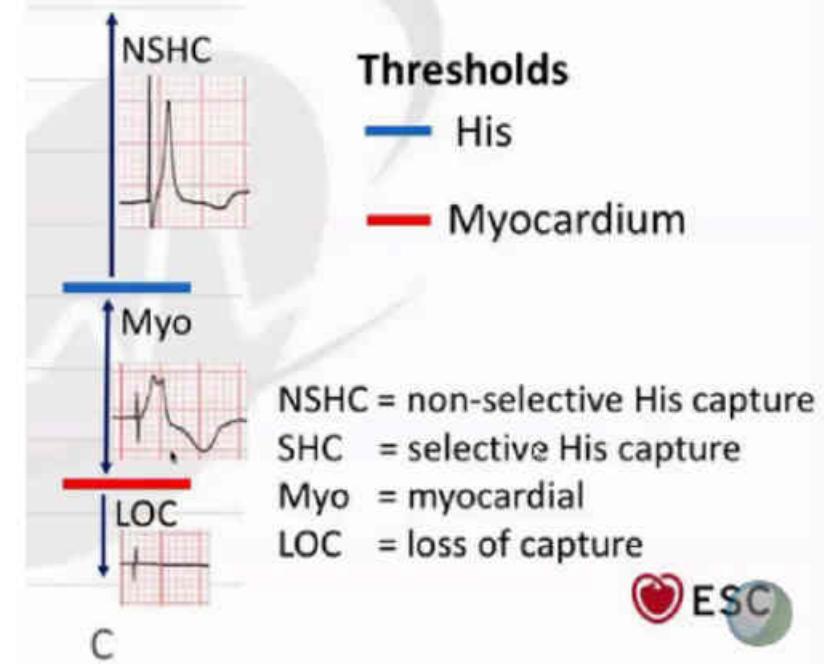
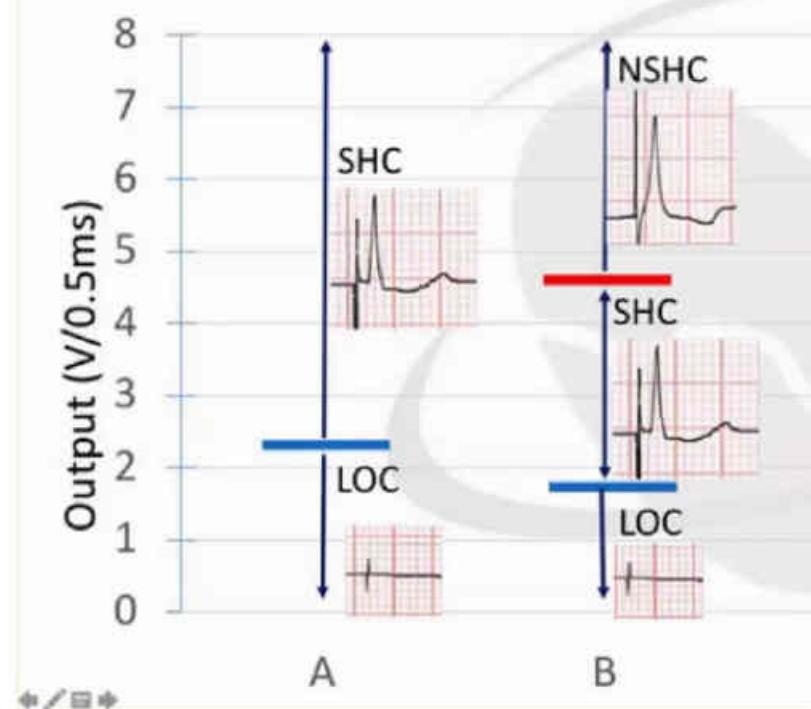


Figure 3 At higher output (up to 1.5 V @ 1 ms), there is fusion between His bundle and local myocardial capture (nonselective response). At lower outputs (up to 0.5 V @ 1 ms), there is pure His bundle capture with stimulus to QRS onset (S-QRS) equal to the native HV interval (selective response, *). Below this output, there is selective right bundle branch (RBB) capture.

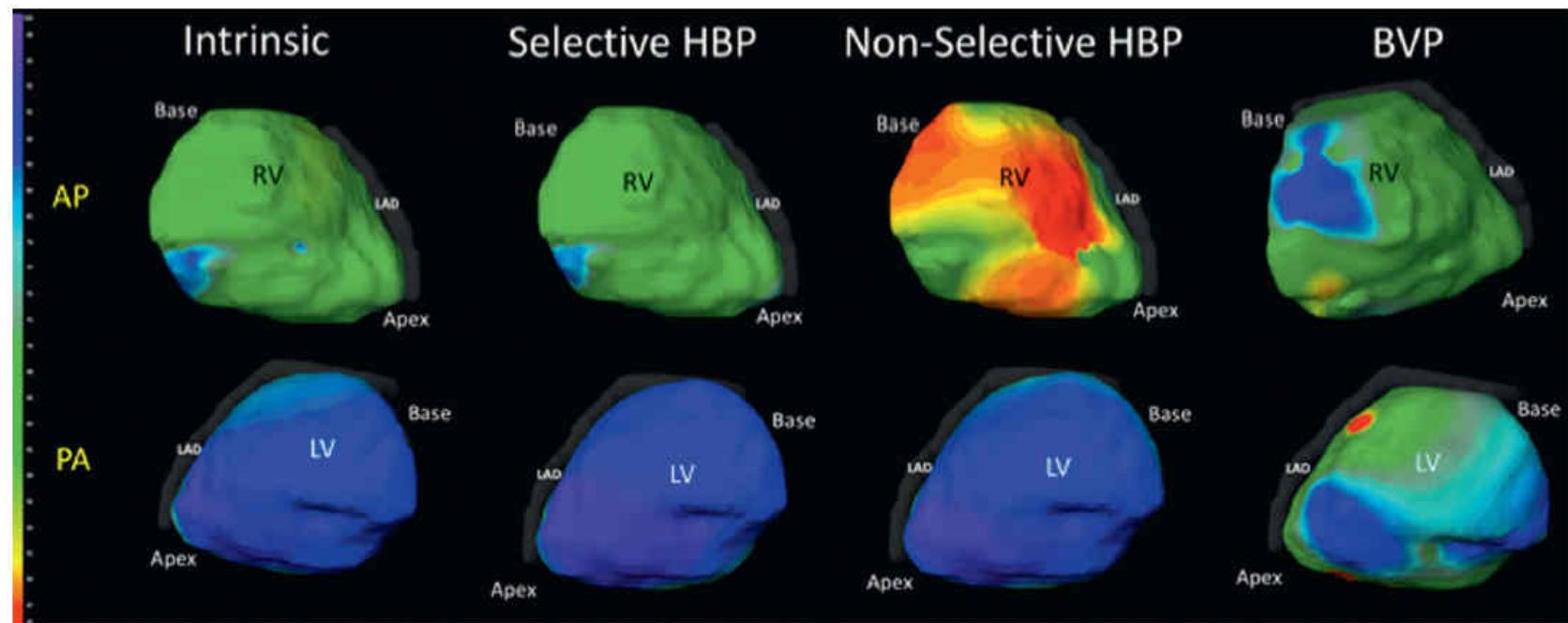
Transitions with decrementing output





SELECTIVE VS NON-SELECTIVE

FIGURE 10 Electrical Synchrony of His Bundle Pacing



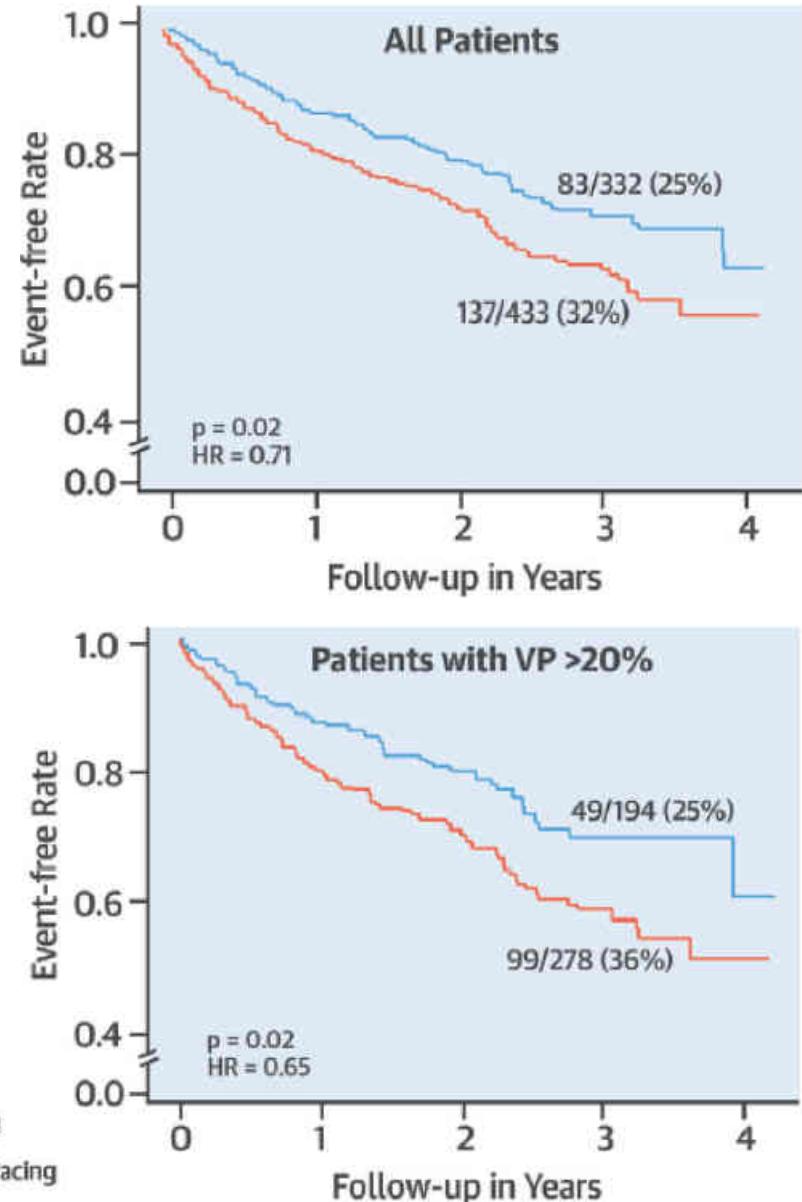
From left to right, ECG Imaging epicardial activation maps for intrinsic QRS, selective His bundle pacing, nonselective His bundles pacing and biventricular pacing (BVP) in a single patient with a normal QRS duration and morphology. Above are maps of the right ventricle (RV) and below of the left ventricle (LV). The color scale on the left indicates the activation times. Selective HBP activates both ventricles identically to intrinsic rhythm. Nonselective HBP pacing activates the LV identical to selective HBP and intrinsic rhythm but on the RV maps there is evidence of early (red) activation in the basal and mid ventricle, indicate capture of local right ventricular myocardium alongside the bundle of His. Biventricular pacing activates the heart with an entirely different pattern with earliest activation (red) in the LV. Courtesy of Ahran Arnold and Zachary Whinnett, Imperial College London, United Kingdom.

Clinical Outcomes of His Bundle Pacing
Compared to Right Ventricular Pacing
Abdelrahman et al. JACC 2018, 71:2319–30

HBP 332 pts vs RVP 433 pts – Median Fup 2yrs

HBP was associated with significant reduction in the composite outcome of all-cause mortality, HFH, or upgrade to BiVP compared to conventional RVP. These differences in clinical outcomes were primarily realized in patients who required **>20% ventricular pacing**

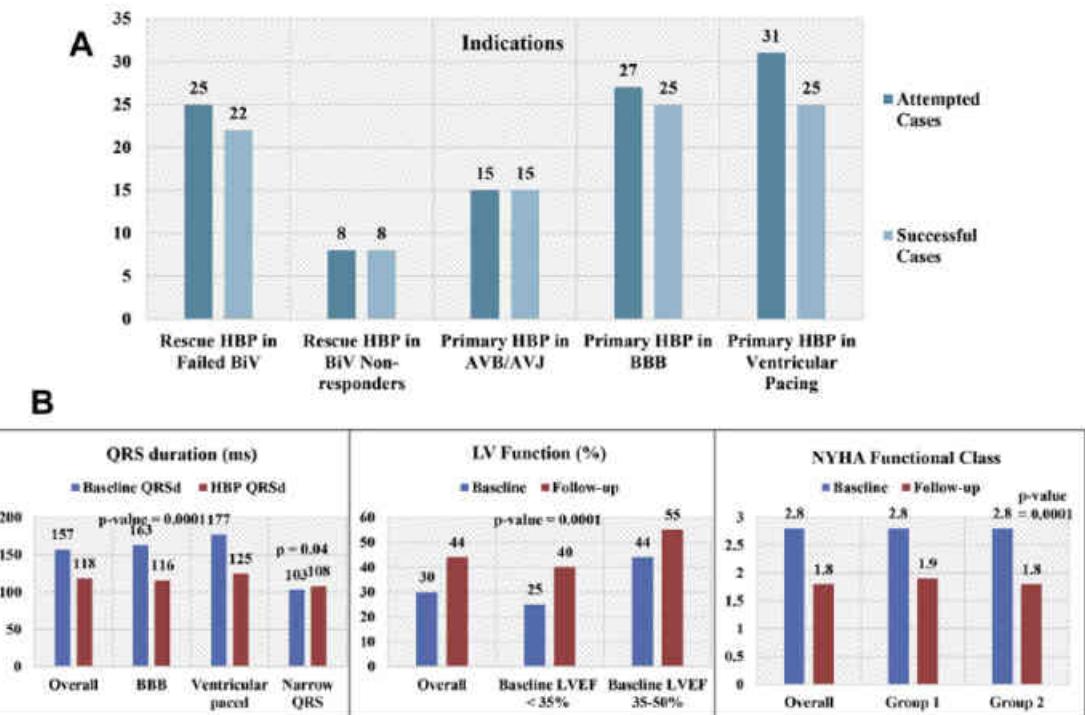
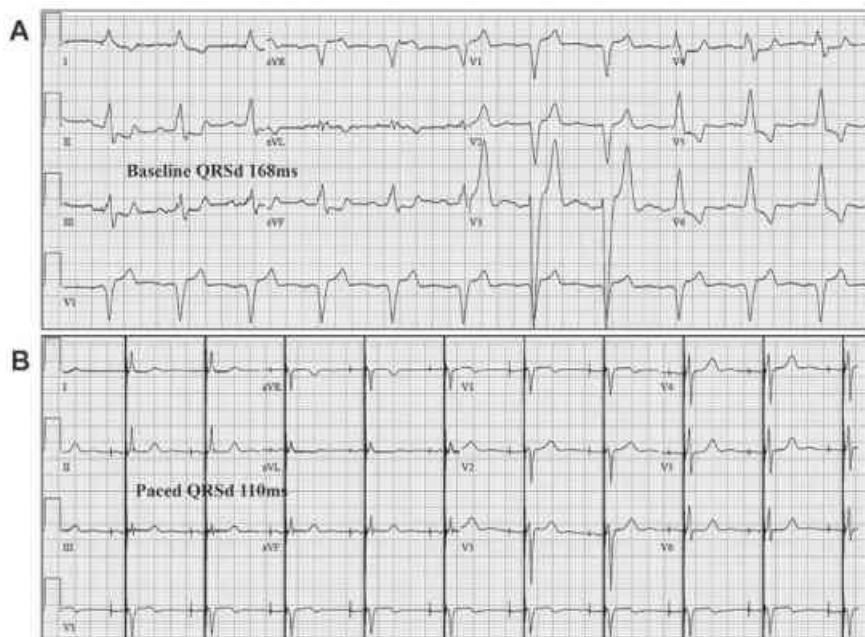
— His Bundle Pacing
— Right Ventricular Pacing



Permanent His-bundle pacing as an alternative to biventricular pacing for cardiac resynchronization therapy: A multicenter experience

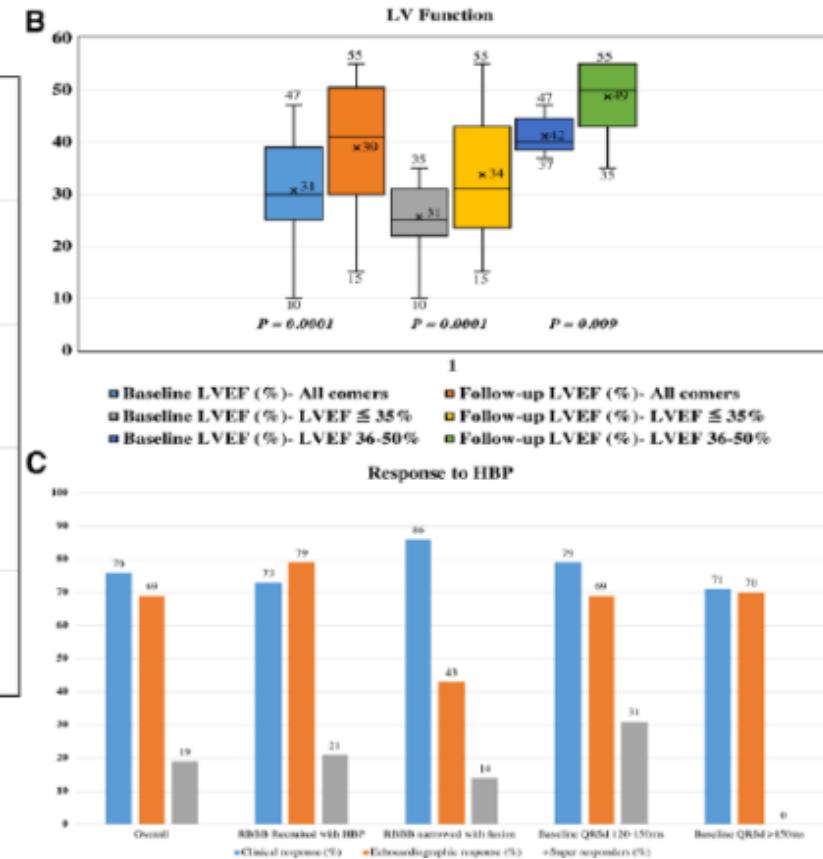
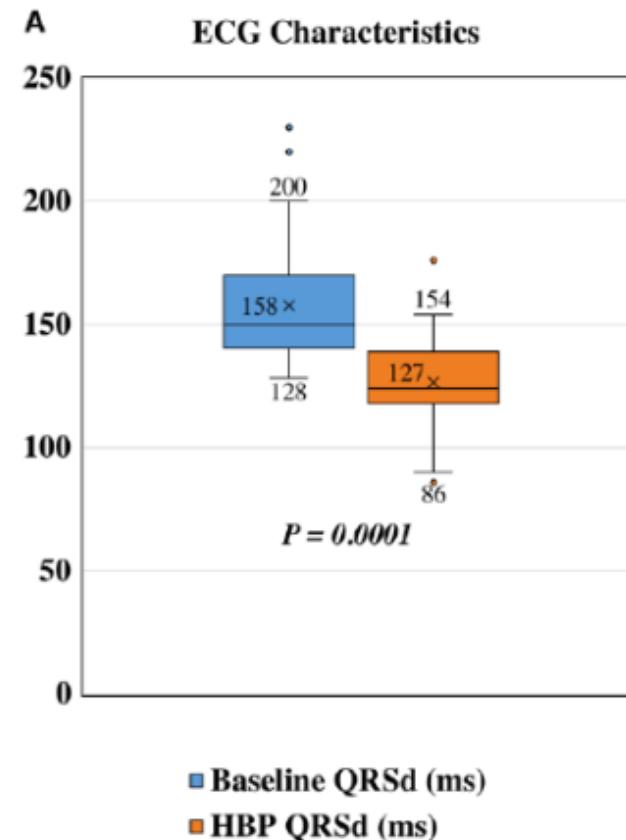
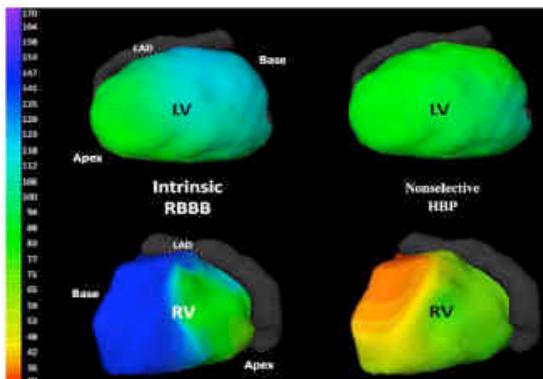
HR 2017

Parikshit S. Sharma, MD, MPH, FACC,* Gopi Dandamudi, MD, FHRS,† Bengt Herweg, MD,‡



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

Parikshit S. Sharma, MD,
MPH
Angela Naperkowski, RN,
CCDS, CEPS
Terry D. Bauch, MD
Joseph Y.S. Chan, MD
Ahran D. Arnold, MBBS
Zachary I. Whinnett, BM,
BS
Kenneth A. Ellenbogen,
MD
Pugazhendhi Vijayaraman,
MD



HBP ha delle limitazioni, che includono:

- Difficoltà nell'identificare precisamente la posizione del fascio di His
- Una soglia di pacing più alta e instabile tra il 5% e il 10% dei pazienti
- Bassa ampiezza dell'onda R o ampio far field atriale che possono complicare la programmazione
- Danneggiamento del fascio di His durante l'impianto
- Blocco AV distale alla posizione del catetere
- Potenziali limitazioni nelle performance a lungo termine

Left Bundle Branch Pacing



European Society
of Cardiology

European Heart Journal (2021) 00, 1–94
doi:10.1093/eurheartj/ehab364

ESC GUIDELINES

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)

With **left bundle branch area pacing**, the lead is implanted slightly distal to the His bundle and is screwed deep in the LV septum, ideally to capture the left bundle branch.

Advantages of this technique are that **electrical parameters are usually excellent**, it may be **successful in blocks that are too distal** to be treated with HBP, and it also **facilitates AVJ ablation**, which may be challenging with HBP.

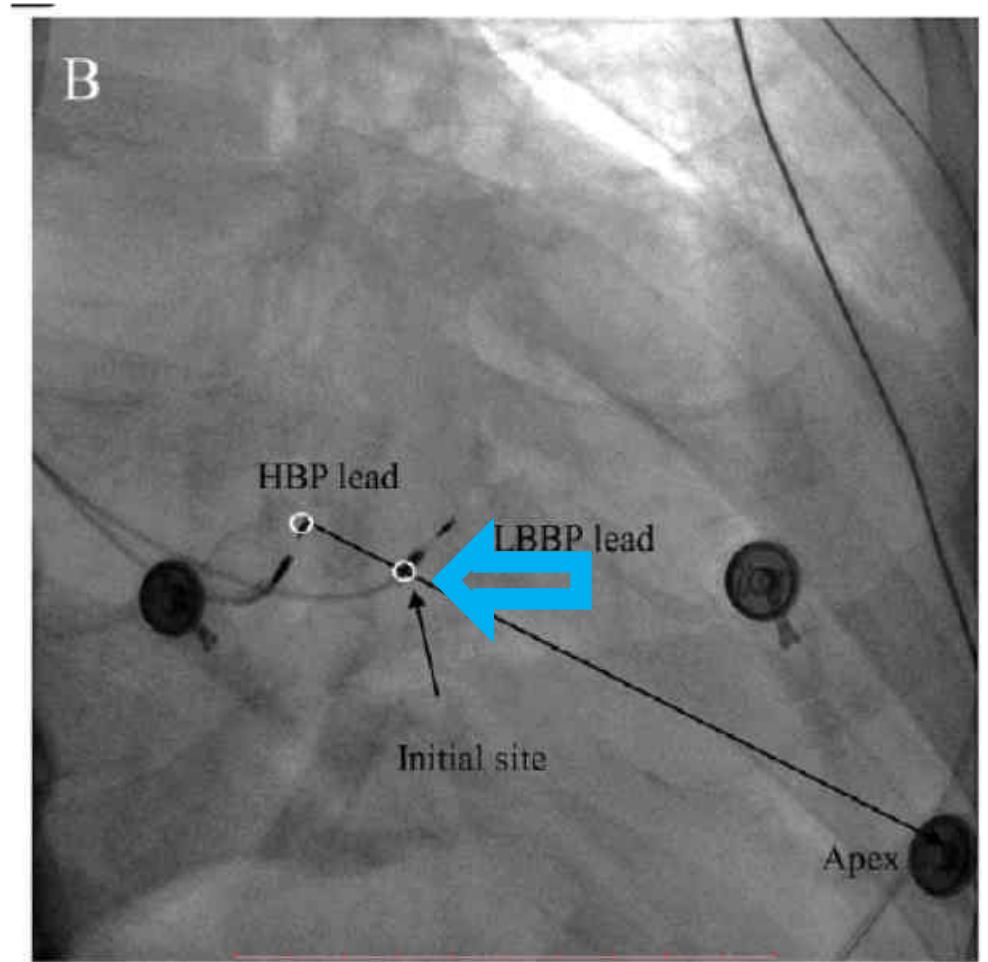


However, although the technique is very promising, **data on this modality are still scarce**, and there is **concern regarding long-term lead performance and feasibility of lead extraction**



Come determinare il sito iniziale per LBBP

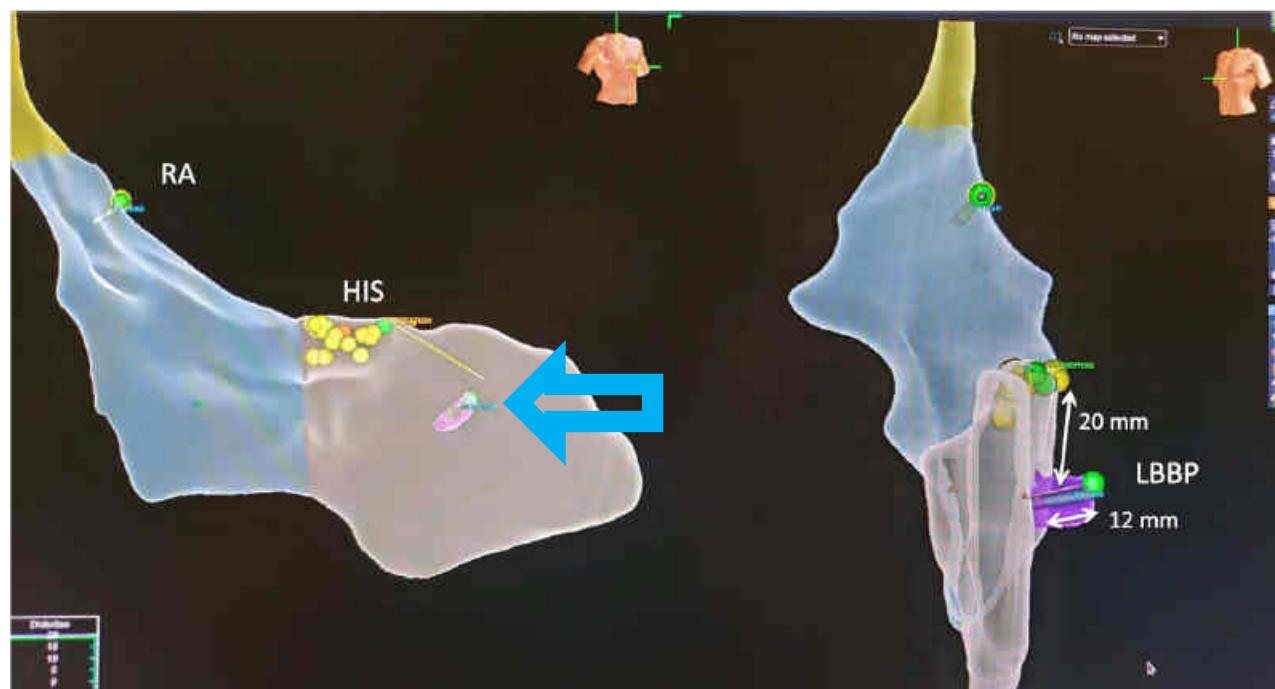
Il sito iniziale per il pacing della branca sinistra è approssimativamente 1-1.5 cm distale rispetto alla posizione del catetere hissiano, lungo la linea che congiunge il sito hissiano con l'apice del cuore in una proiezione RAO 30°



Come determinare il sito iniziale per LBBP

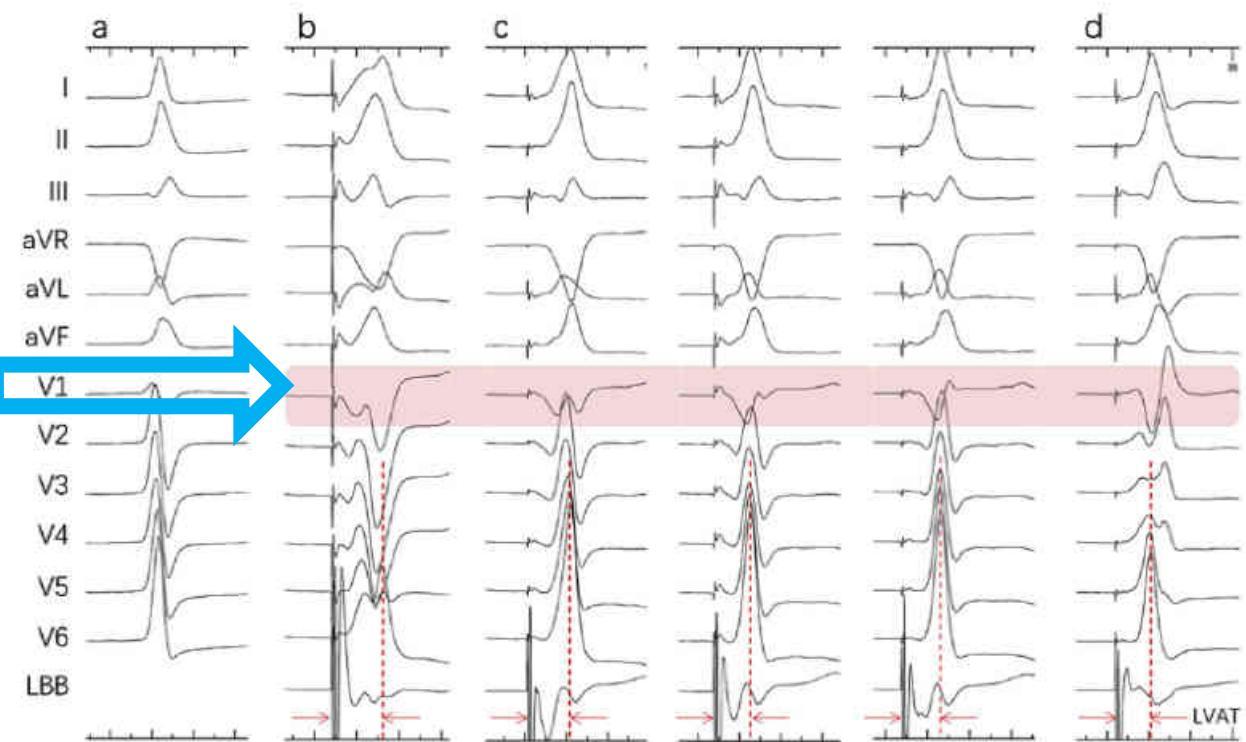
Il mappaggio 3D può facilitare il posizionamento del catetere.

Localizzata la nuvola hissiana basta spostarsi 1-2 cm distalmente, quando si individua il tipico pattern "W" sull'ECG si può iniziare ad avanzare all'interno del setto.



Come assicurarsi del corretto avanzamento del catetere

TECHNIQUE 1: PACING



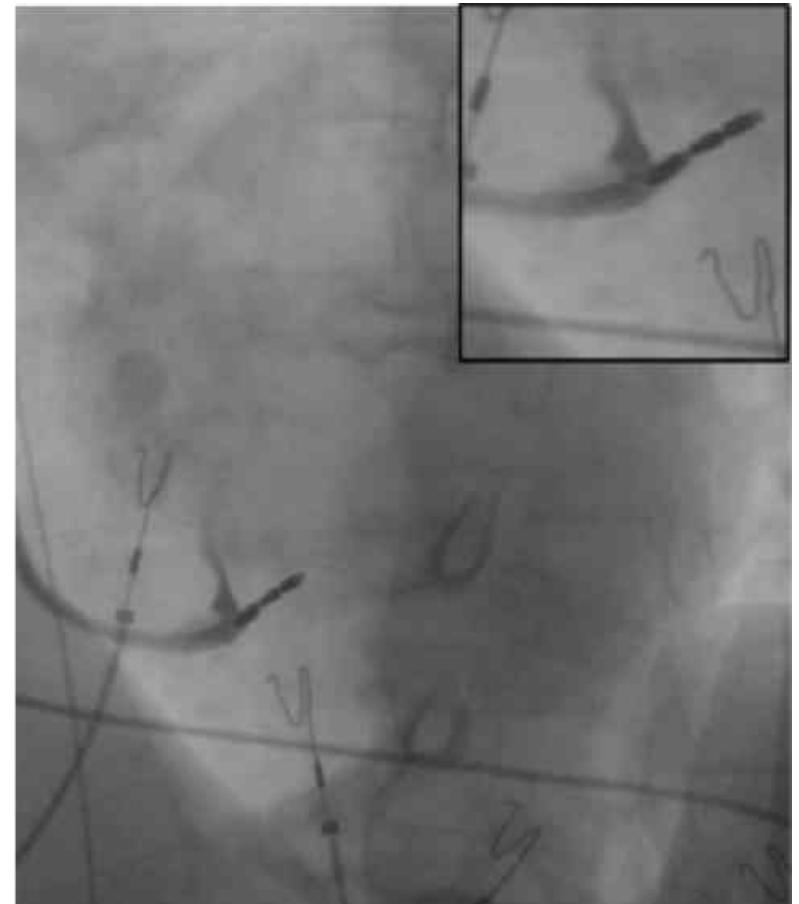
In pacing la morfologia del QRS varia da un pattern LBBB ad uno RBBB.

Left Bundle Branch Pacing- Zhang – JACC 2019

Come confermare il corretto posizionamento

FLUORO CONFIRMATION

In una proiezione LAO con una piccola iniezione di contrasto attraverso il delivery bisogna notare che l'intero bipolo sia penetrato all'interno del setto.



Left bundle branch pacing by standard stylet-driven lead: Preliminary experience of two case reports –Zanon –Heart Rhythm 2020

Left Bundle Branch Area Pacing for Cardiac Resynchronization Therapy



Results From the International LBBAP Collaborative Study Group

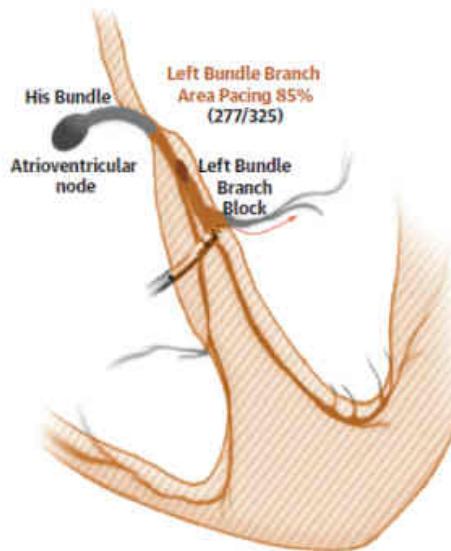
Pugazhendhi Vijayaraman, MD,^a ShunmugaSundaram Ponnusamy, MD, DM,^b Óscar Cano, MD, PhD,^c Parikshit S. Sharma, MD, MPH,^d Angela Naperkowski, RN, CEPs, CCDS,^a Faiz A. Subsposh, MD,^a Paweł Moskal, MD, PhD,^a Agnieszka Bednarek, MD, PhD,^e Alexander R. Dal Forno, MD,^f Wilson Young, MD, PhD,^a Sudip Nanda, MD,^g Dominik Beer, DO,^a Bengt Herweg, MD,^h Marek Jastrzebski, MD, PhD^e

TABLE 2 Procedural Outcomes

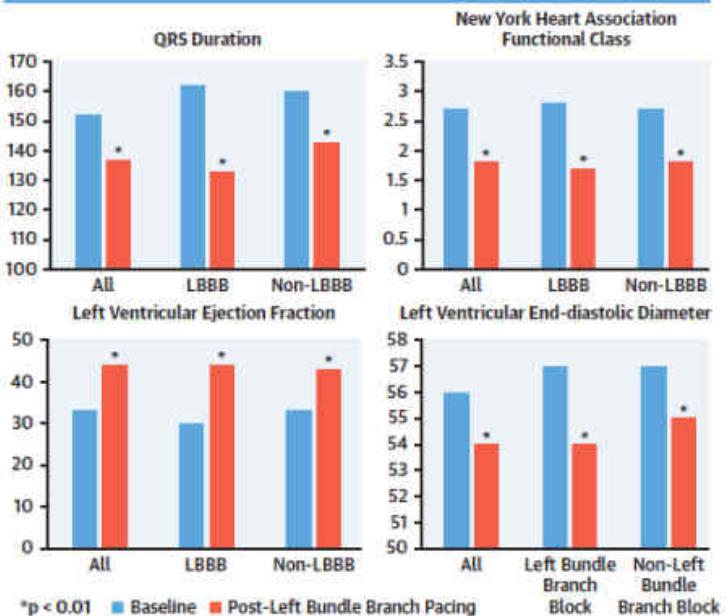
	n = 325
Procedural outcomes	
Total number of successful cases	277 (85)
Procedure duration (min)	105 ± 54
Fluoroscopy duration (min)	19 ± 15
LBBP lead fluoroscopy time (n = 153) (min)	16 ± 13
Type of device	
CRT	162 (58)
CRT pacemaker	56 (20)
CRT defibrillator	106 (38)
Dual-chamber defibrillator	5 (2)
Dual-chamber pacemaker (DDD)	87 (31)
Single-chamber pacemaker (VVI)	23 (8)
Pacing characteristics	
R-wave amplitude (mV)	10.6 ± 6 12.5 ± 5.7 0.06
Impedance (Ω)	674 ± 193 530 ± 123 <0.001
LBBP threshold (V at 0.5 ms)	0.6 ± 0.3 0.7 ± 0.3 0.17
Stimulus to peak LV activation time (ms)	83 ± 16
Complications	
Pneumothorax	3 (1)
Pericardial effusion	0
Device infection	2 (0.7)
Stroke	0
LV perforation	0
Lead dislodgement	7 (2.5)
Loss of left septal capture	2 (0.7)

CENTRAL ILLUSTRATION Left Bundle Branch Area Pacing for Cardiac Resynchronization Therapy

Left Bundle Branch Area Pacing for Cardiac Resynchronization Therapy



Changes in Cardiac Variables



Vijayaraman, P. et al. J Am Coll Cardiol EP. 2021;7(2):135-47.

Left Bundle Branch Pacing for Cardiac Resynchronization Therapy: Nonrandomized On-Treatment Comparison With His Bundle Pacing and Biventricular Pacing

Shengjie Wu, MD,^{a,b,*} Lan Su, MD,^{a,b,*} Pugazhendhi Vijayaraman, MD,^c Ruijie Zheng, MD,^{a,b}

Mengxing Cai, MD,^{a,b} Lei Xu, MD,^{a,b} Ruiyu Shi, MD,^{a,b} Zhouqing Huang, MD,^{a,b}

Zachary I. Whinnett, BM, BS, PhD,^d and Weijian Huang, MD^{a,b}

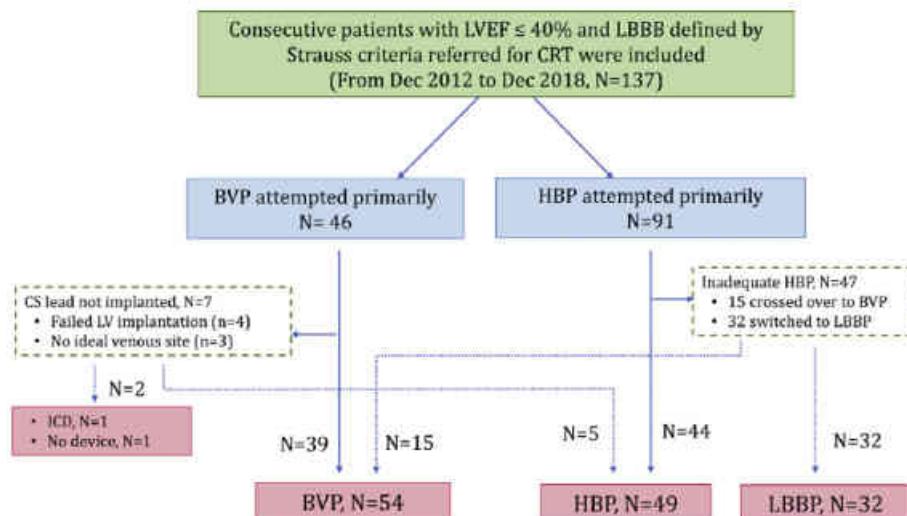


Table 1. Baseline and electrophysiology characteristics

	HBP, N = 49	LBBP, N = 32	BVP, N = 54	P value
Age, y, mean ± SD	68.3 ± 10	67.2 ± 13	68.3 ± 10	0.875
Male, n (%)	31 (63.3%)	14 (43.8%)	29 (53.7%)	0.224
Hypertension, n (%)	20 (40.8%)	16 (50.0%)	27 (50.0%)	0.595
Diabetes, n (%)	6 (12.2%)	12 (37.5%)	16 (29.6%)	0.023
Renal dysfunction, n (%)	10 (20.4%)	5 (15.6%)	13 (24.1%)	0.650
ICM, n (%)	8 (16.3%)	1 (3.1%)	7 (13.0%)	0.192
NICM, n (%)	41 (83.7%)	31 (96.9%)	47 (87.0%)	0.192
AF, n (%)	16 (32.7%)	7 (21.9%)	11 (20.4%)	0.322
AV block, n (%)	1 (2.0%)	1 (3.1%)	2 (3.7%)	0.882
Device upgrades, n (%)				
BVP nonresponse	4 (8.2%)	0	0	0.019
Single-chamber ICD	1 (2.0%)	0	0	0.600
Intrinsic QRS duration, ms	170.3 ± 19.3	166.2 ± 16.2	161.1 ± 18.2	0.037
Baseline LVEF, %	30.4 ± 5.5	30.9 ± 7.3	30.0 ± 6.2	0.788
Mitral regurgitation	1.8 ± 1.0	1.7 ± 1.0	2.0 ± 0.9	0.400
BNP, pg/dL	467 (229, 846)	562 (309, 1262)	524 (323,1043)	0.794
NYHA functional class				0.918
II, n (%)	15 (30.6%)	7 (21.9%)	16 (29.6%)	
III, n (%)	27 (55.1%)	23 (71.9%)	33 (61.1%)	
IV, n (%)	7 (14.3%)	2 (6.3%)	5 (9.3%)	
Medicine				
β-blockers	46 (93.9%)	27 (84.4%)	48 (88.9%)	0.380
ACE inhibitors/ARBs	44 (89.8%)	29 (90.6%)	49 (90.7%)	0.985
Diuretics	48 (98.0%)	31 (96.9%)	53 (98.1%)	0.922
Aldosterone antagonist	45 (91.8%)	29 (90.6%)	53 (98.1%)	0.255

Table 2. Procedure and pacing characteristics

	HBP, N = 49	LBBP, N = 32	BVP, N = 54
			RV lead
			CS lead
Total procedure duration, min	109.7 ± 52.1	98.4 ± 36.5	122.7 ± 53.5
Fluoroscopy time for lead (His/LBBP)	12.8 ± 5.1	5.2 ± 4.1	10.3 ± 4.4

Left Bundle Branch Pacing for Cardiac Resynchronization Therapy: Nonrandomized On-Treatment Comparison With His Bundle Pacing and Biventricular Pacing

Shengjie Wu, MD,^{a,b,*} Lan Su, MD,^{a,b,*} Pugazhendhi Vijayaraman, MD,^c Rujie Zheng, MD,^{a,b}

Mengxing Cai, MD,^{a,b} Lei Xu, MD,^{a,b} Ruiyu Shi, MD,^{a,b} Zhouqing Huang, MD,^{a,b}

Zachary I. Whinnett, BM, BS, PhD,^d and Weijian Huang, MD^{a,b}

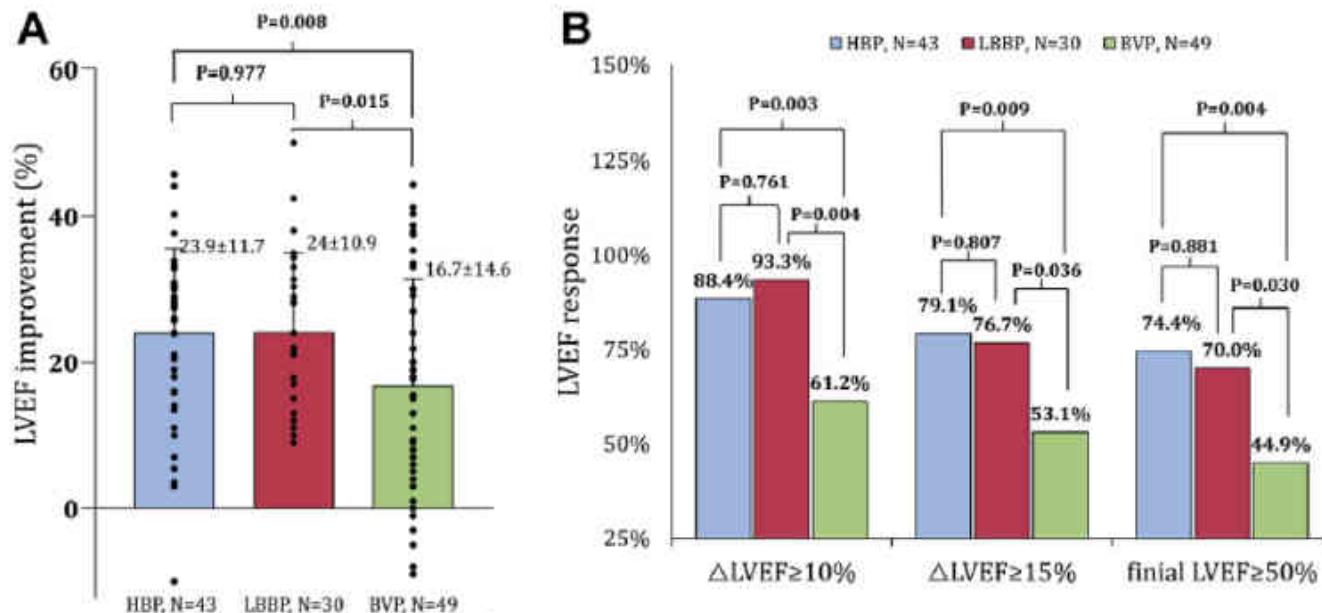


Table 3. Echocardiographic and clinical outcomes

	HBP		LBBP		BVP		P values ^f		
	Baseline	1 year	Baseline	1 year	Baseline	1 year	HBP vs LBBP	HBP vs BVP	LBBP vs BVP
NYHA class	2.8 ± 0.7	1.2 ± 0.5*	2.8 ± 0.5	1.3 ± 0.5*	2.8 ± 0.6	1.9 ± 0.9*	0.068	< 0.001	0.002

Conclusioni

- Il pacing del fascio di His è una metodica sicura ed efficace;
- Il pacing del fascio di His può essere una valida alternativa al pacing RV nei pazienti con % di pacing maggiore del 20%;
- Il pacing del fascio di His può essere una alternativa alla CRT nei pazienti non responder o in presenza di una failure nell'impianto del catetere LV;
- Sebbene la metodica sia promettente mancano ancora studi randomizzati, multicentrici;
- Nel 5-10% dei pazienti ci potrebbero essere problemi di stabilità e aumento di soglie;
- Il pacing della branca sinistra risolve le problematiche correlate al pacing del fascio di His e sembra avere la stessa efficacia clinica, ma resta ancora una metodica in cui occorrono più studi per essere raccomandata.

Left Bundle Branch Pacing- Zhang – JACC 2019



Napoli, 1-2 ottobre 2021
Hotel Excelsior

Grazie!