L'aire de la branche gauche ou le nouvel eldorado de la stimulation cardiaque

Dr Pierre-Antoine Catalan

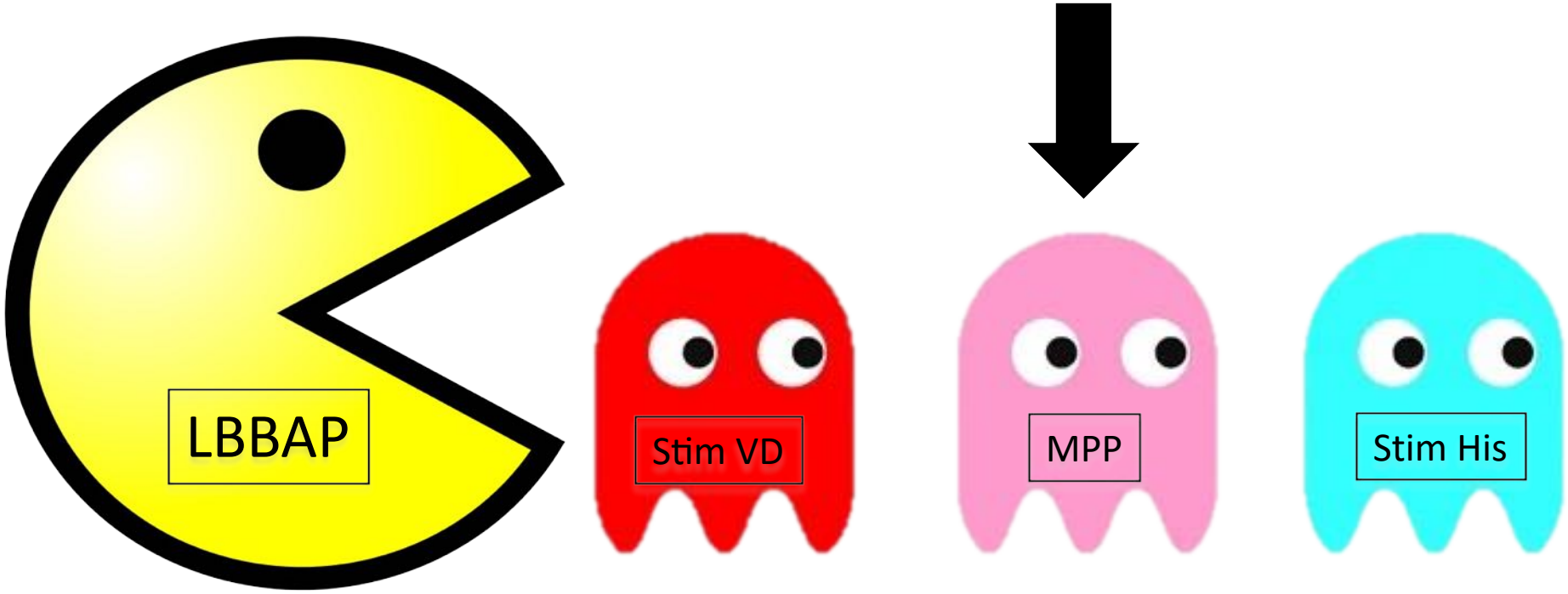
Rythmologie et Cardio-Génétique

CHU Gabriel-Montpied ; Clermont-Ferrand

Conflits d’intérêt

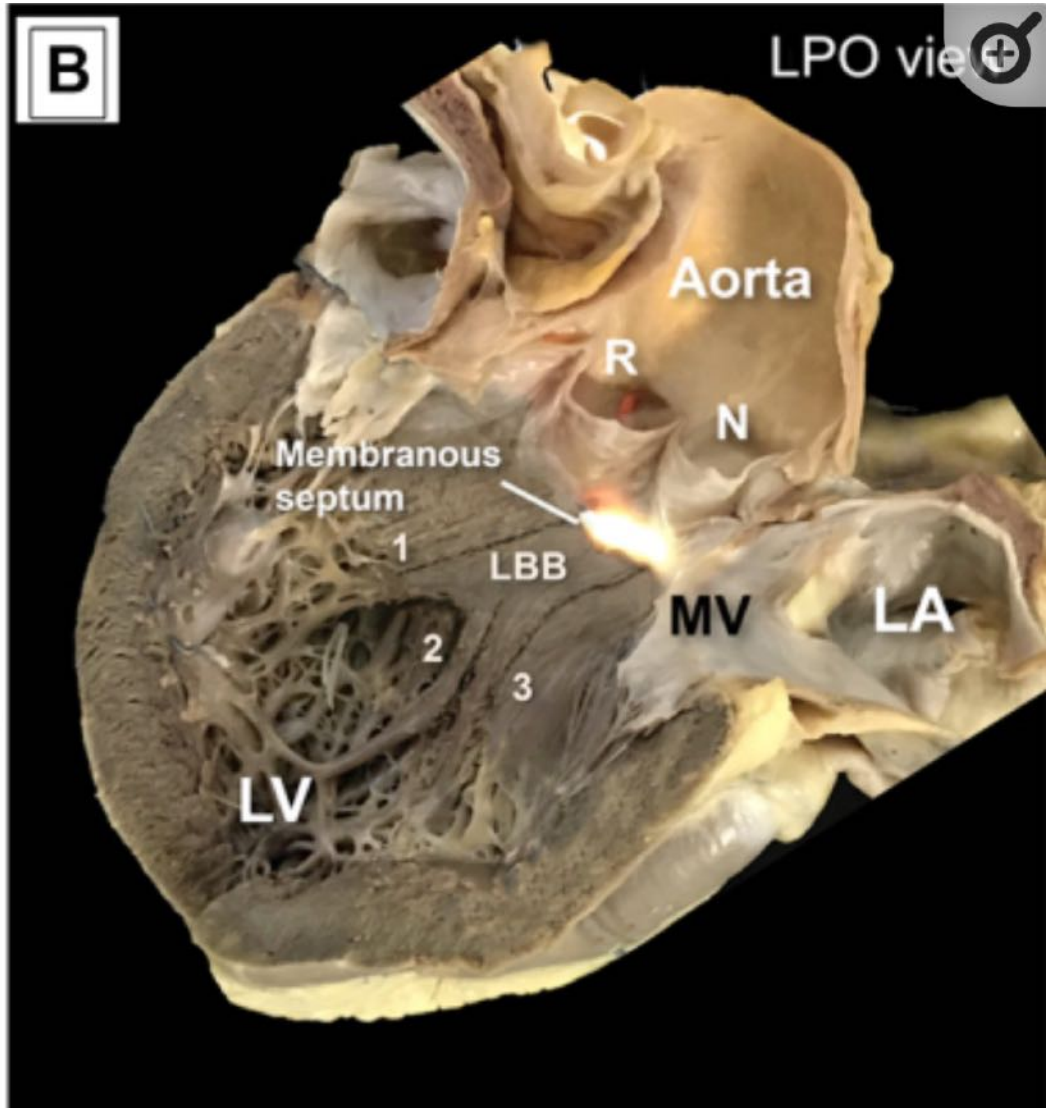
- Consulting BIOTRONIK, MEDTRONIC, MICROPORT, BOSTON et ABBOTT
- Intervention pour le compte de PFIZER

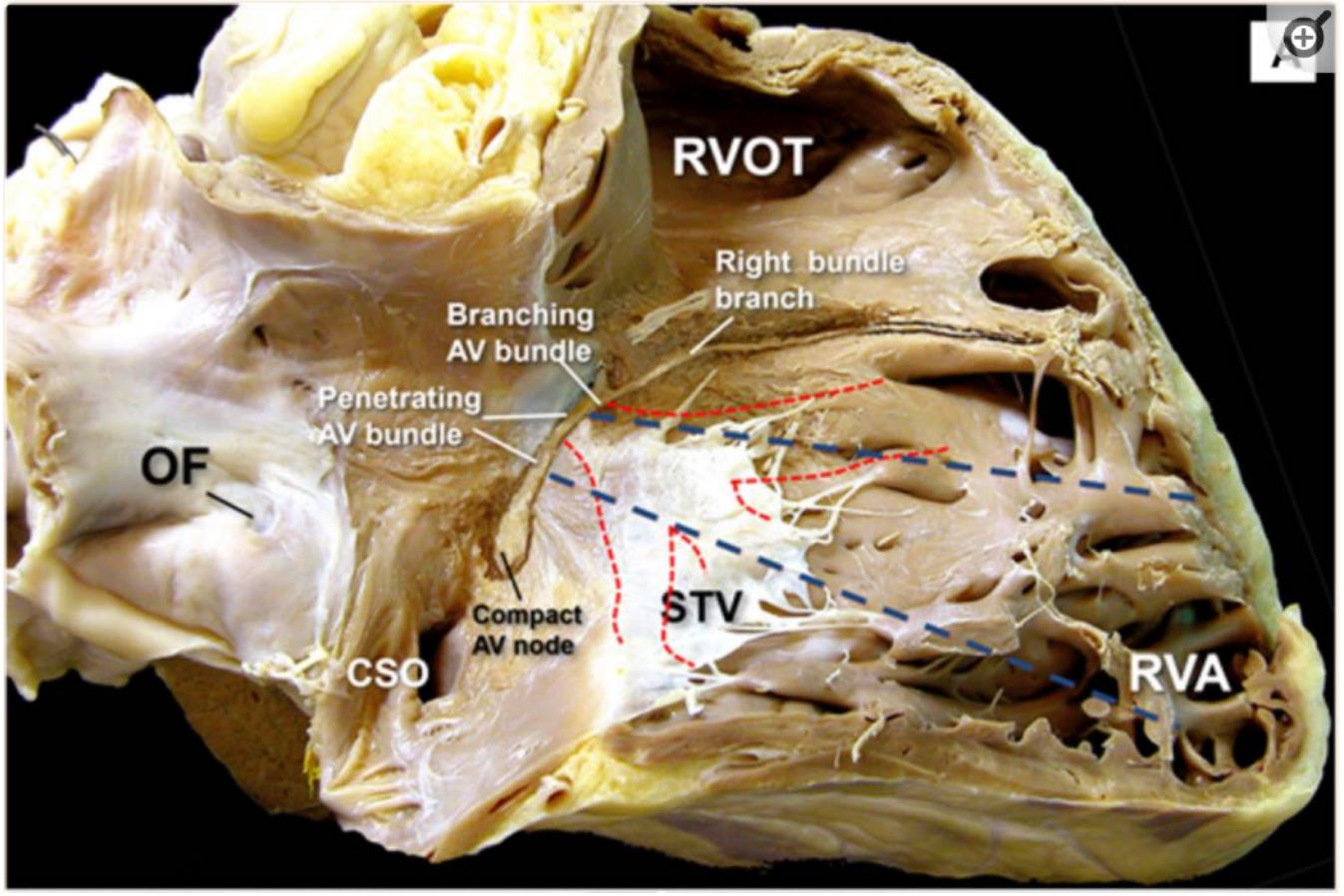
- Cardiopathie de stimulation
- Non répondeurs à la CRT
- Risque à multiplier le nombre de sondes



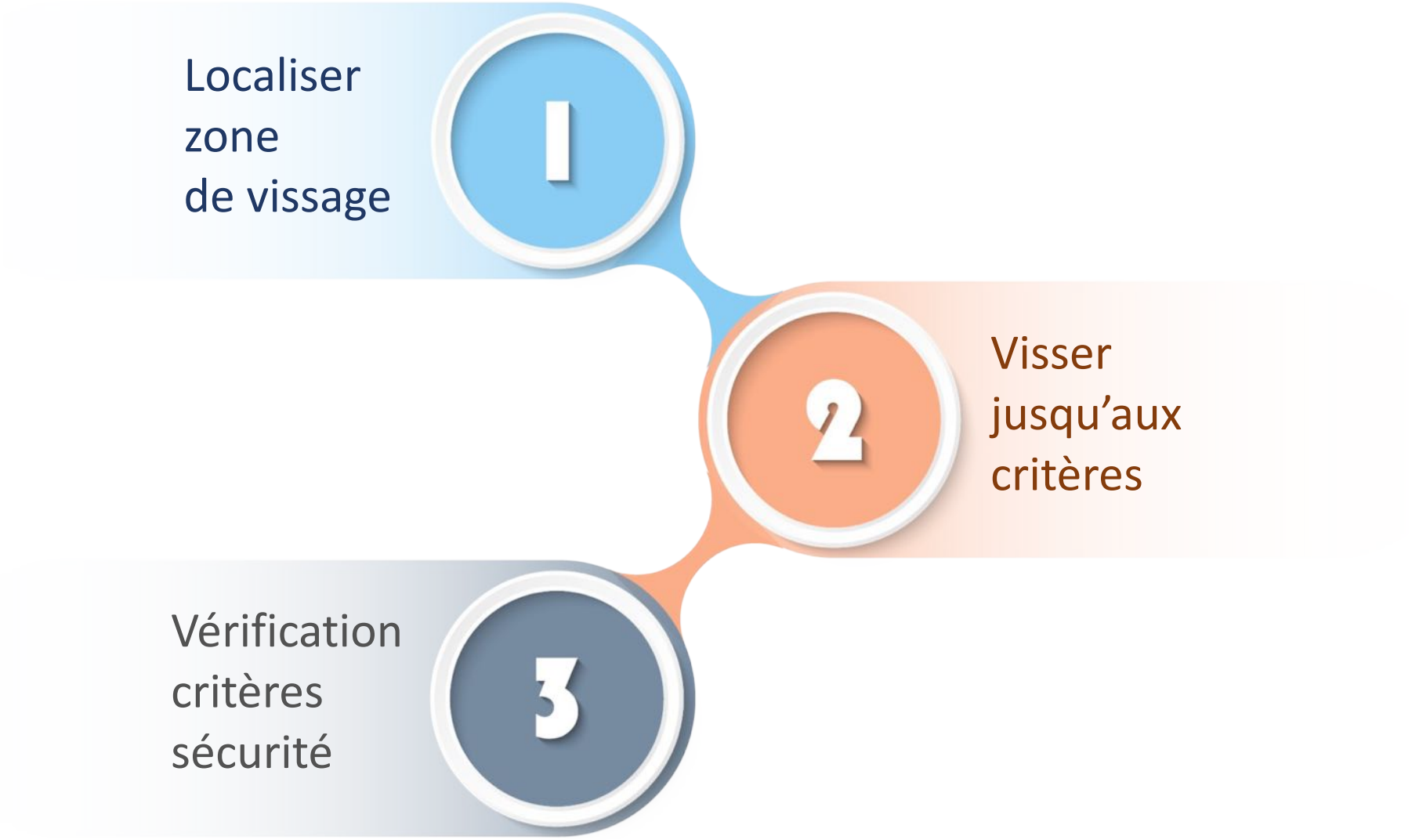
La stimulation de branche gauche

En pratique





Cabrera, J.-Á., Porta-Sánchez, A., Tung, R. & Sánchez-Quintana, D. Tracking Down the Anatomy of the Left Bundle Branch to Optimize Left Bundle Branch Pacing. *JACC Case Rep* **2**, 750–755 (2020).
Cabrera, J.-Á. *et al.* The Atrioventricular Conduction Axis and its Implications for Permanent Pacing. *Arrhythm Electrophysiol Rev* **10**, 181–189 (2021).


Localiser
zone
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1
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Visser
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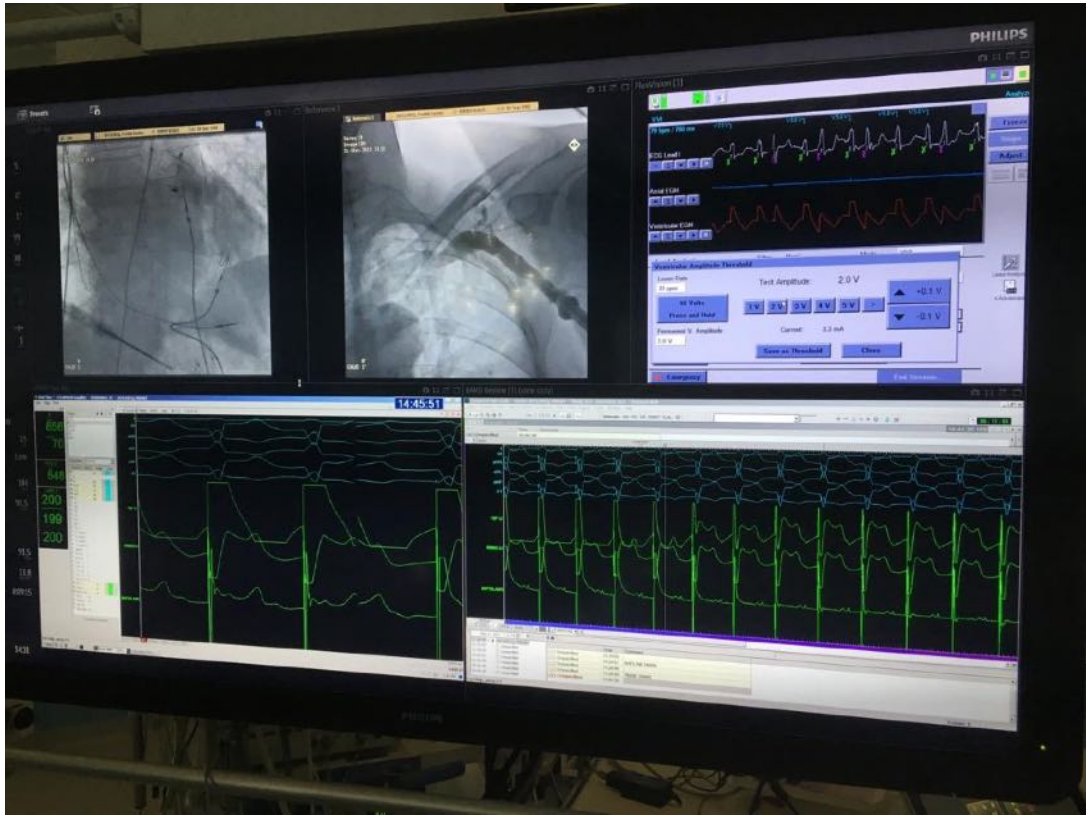
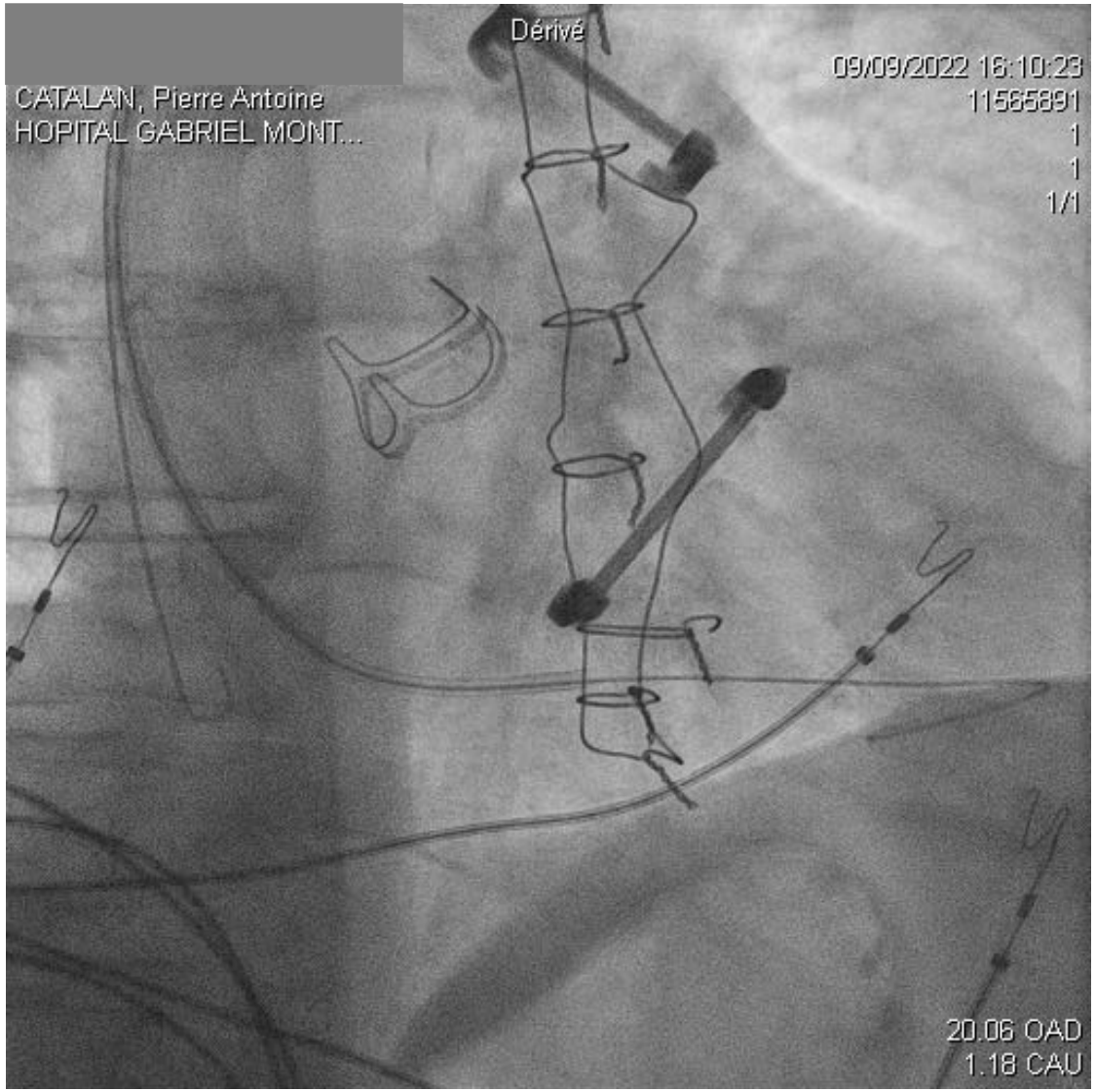
critères
Vérification
critères
sécurité
3

Localiser zone de vissage





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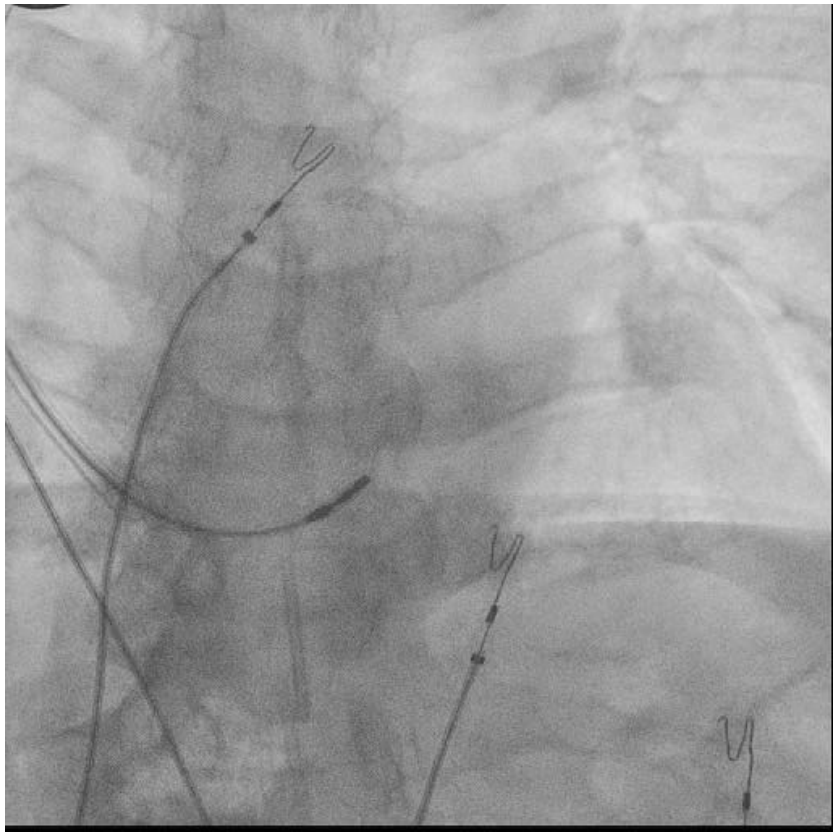

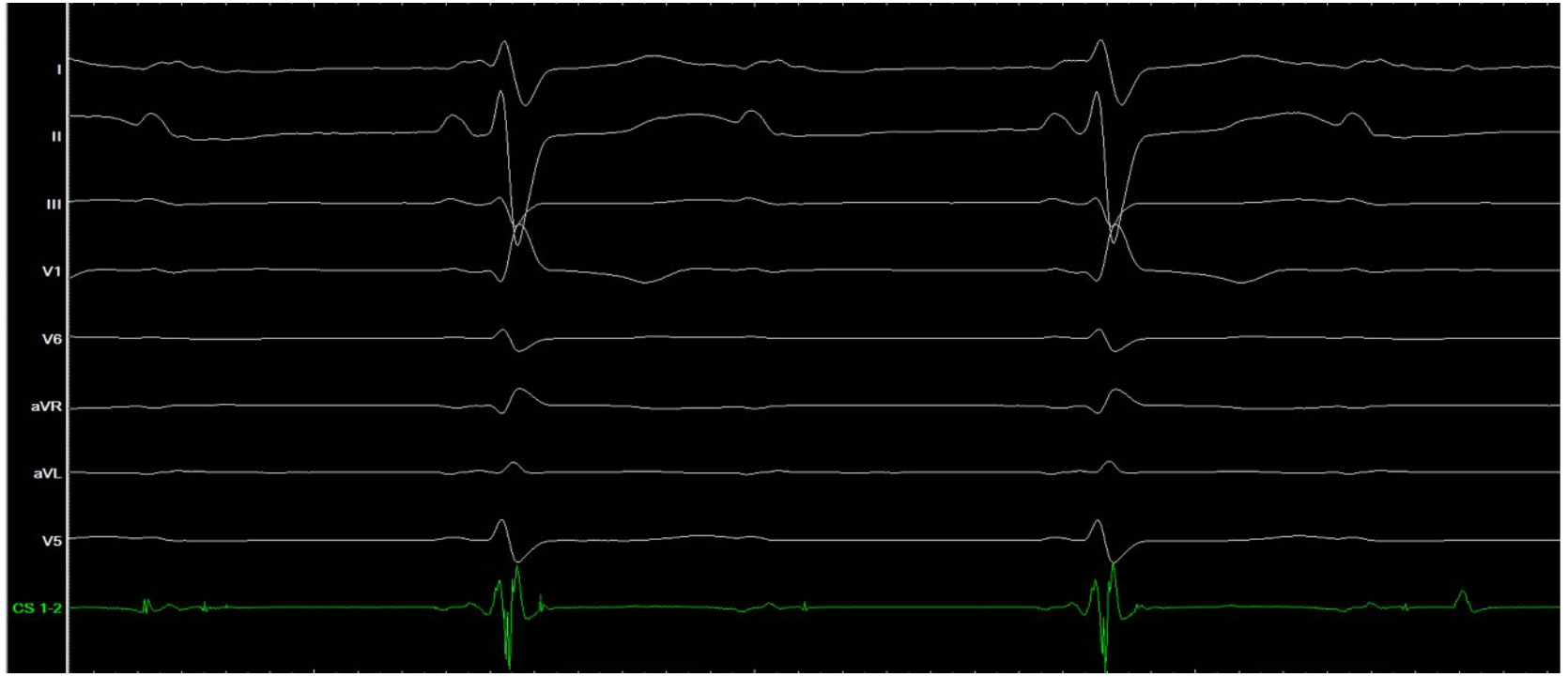

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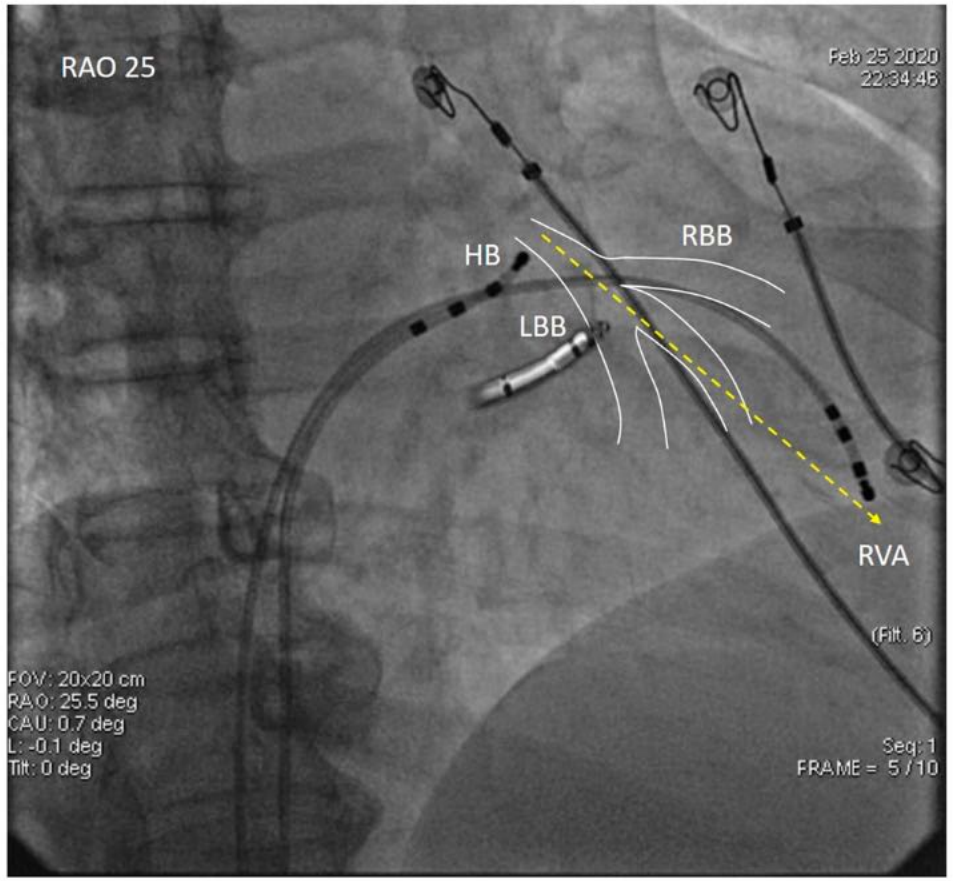
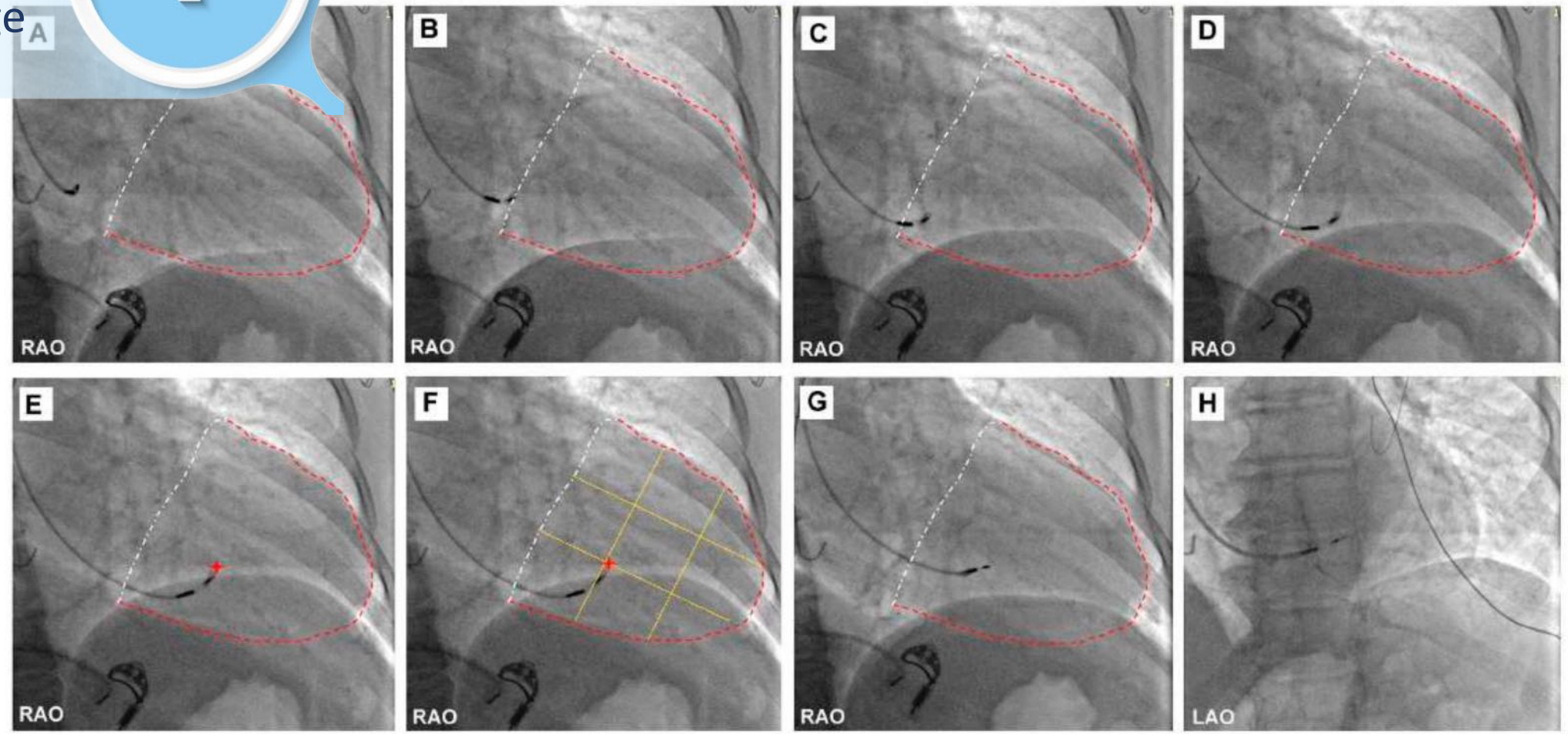


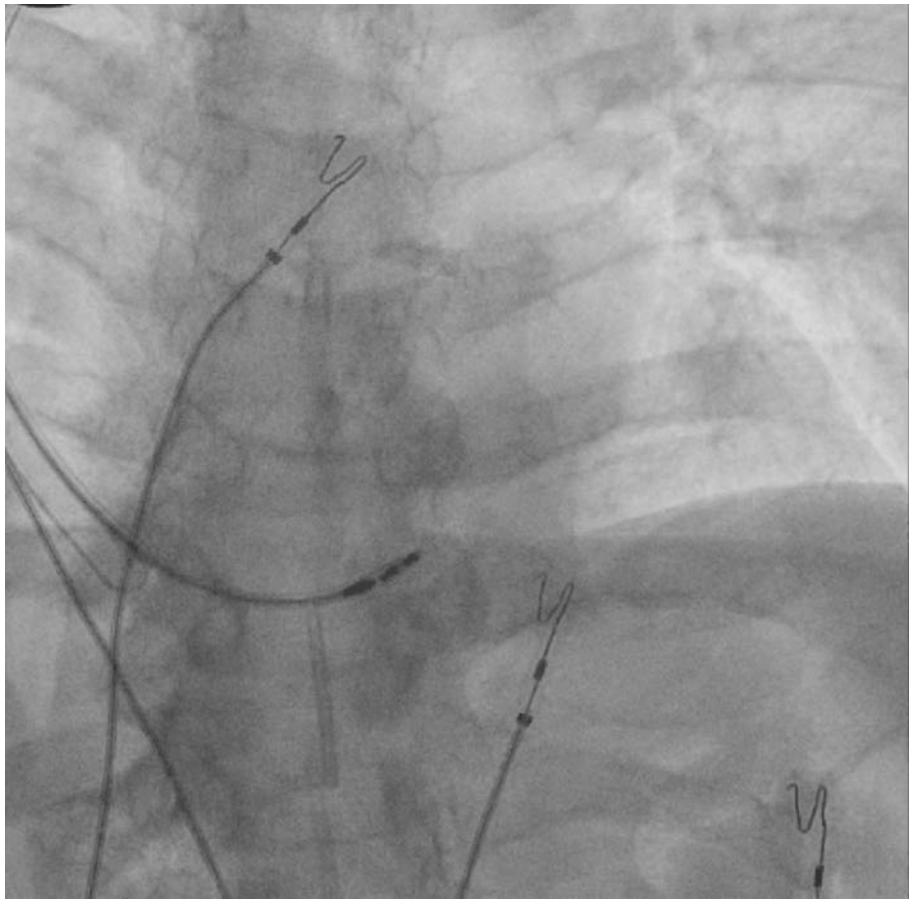
Ponnusamy, S. S. *et al.* Left bundle branch pacing: A comprehensive review. *J Cardiovasc Electrophysiol* **31**, 2462–2473 (2020).

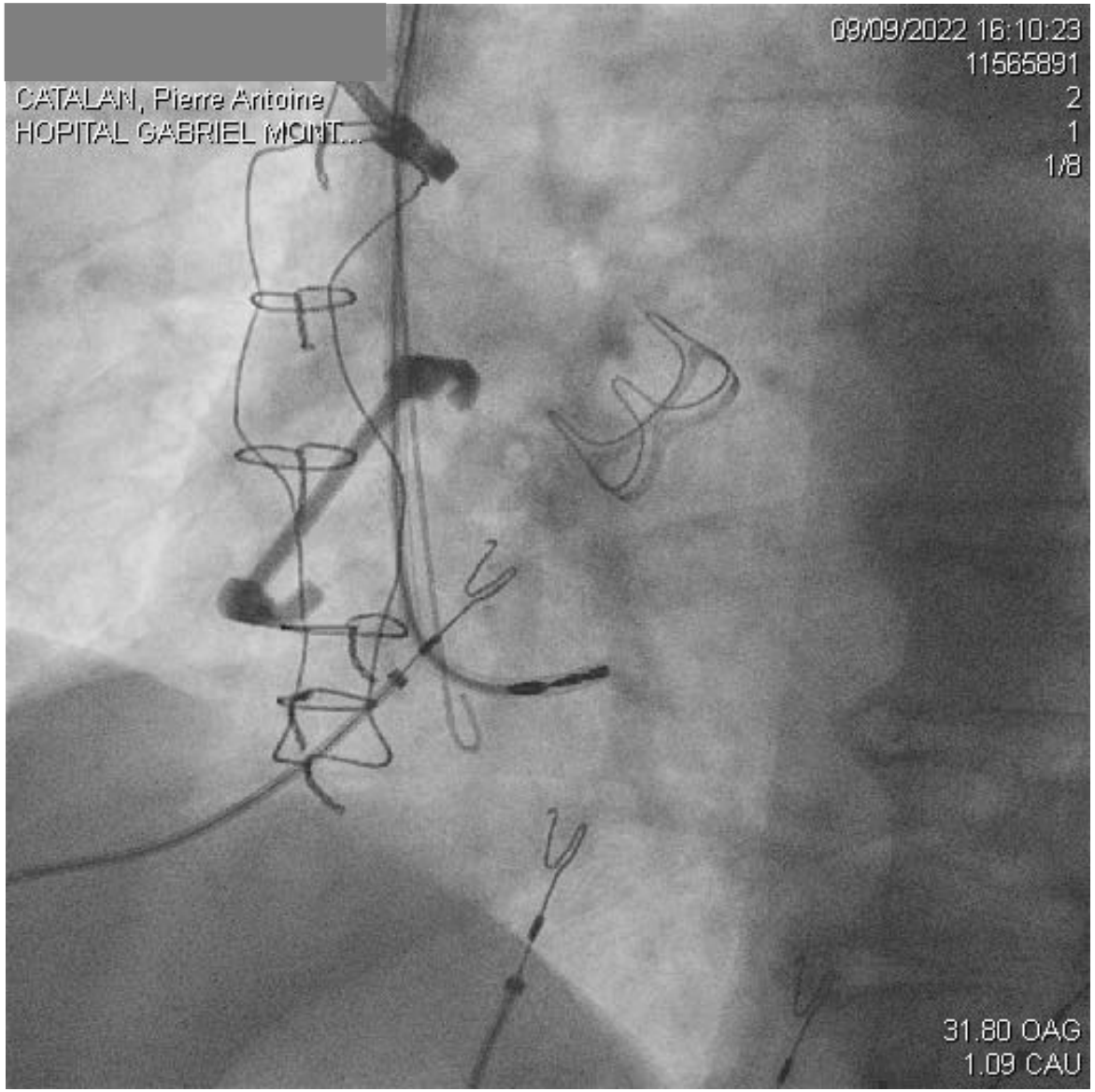
Localiser zone de vissage



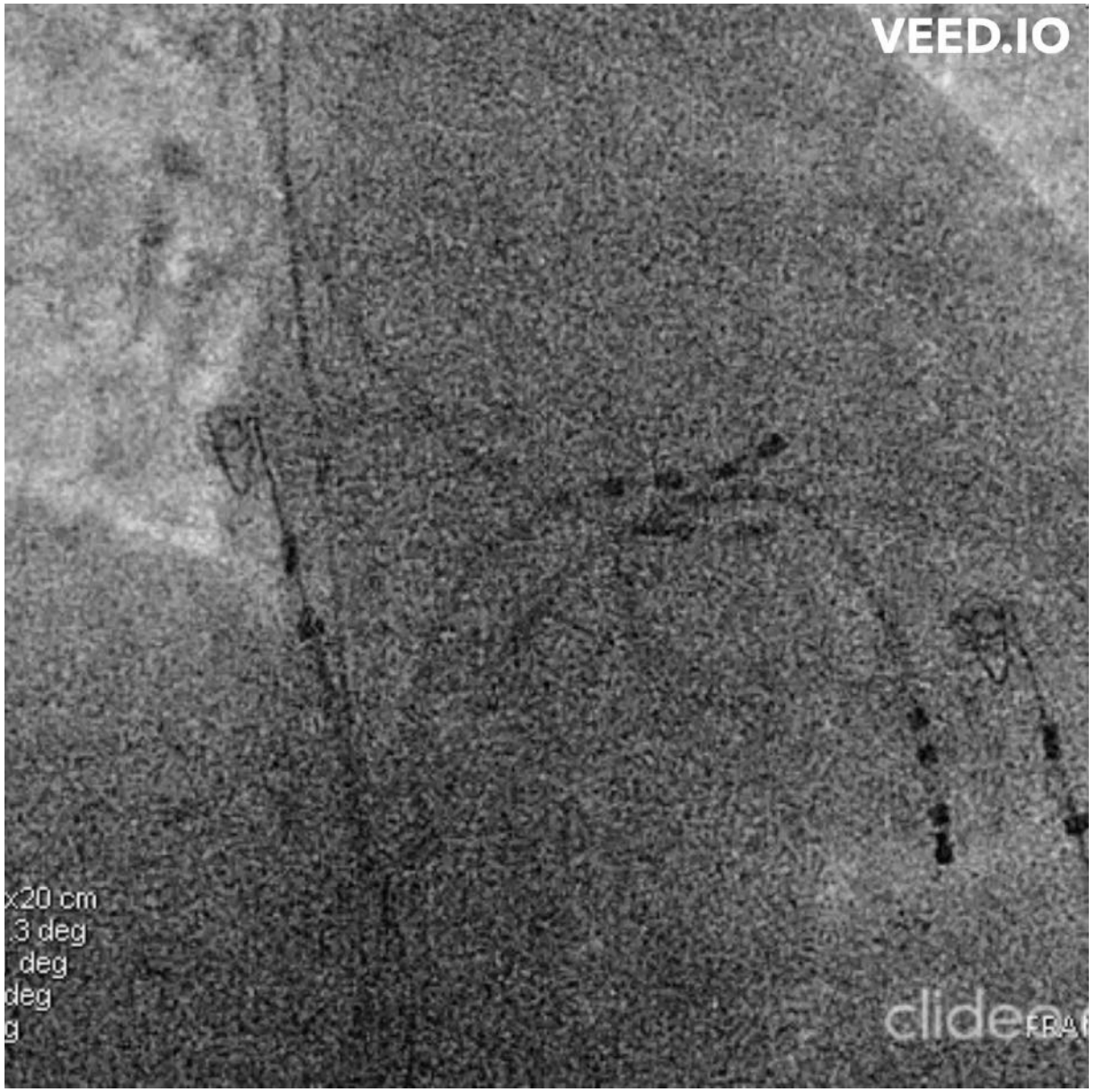
Zhang, J. *et al.* Simplifying Physiological Left Bundle Branch Area Pacing Using a New Nine-Partition Method. *Can J Cardiol* **37**, 329–338 (2021).

2 Visser jusqu'aux critères



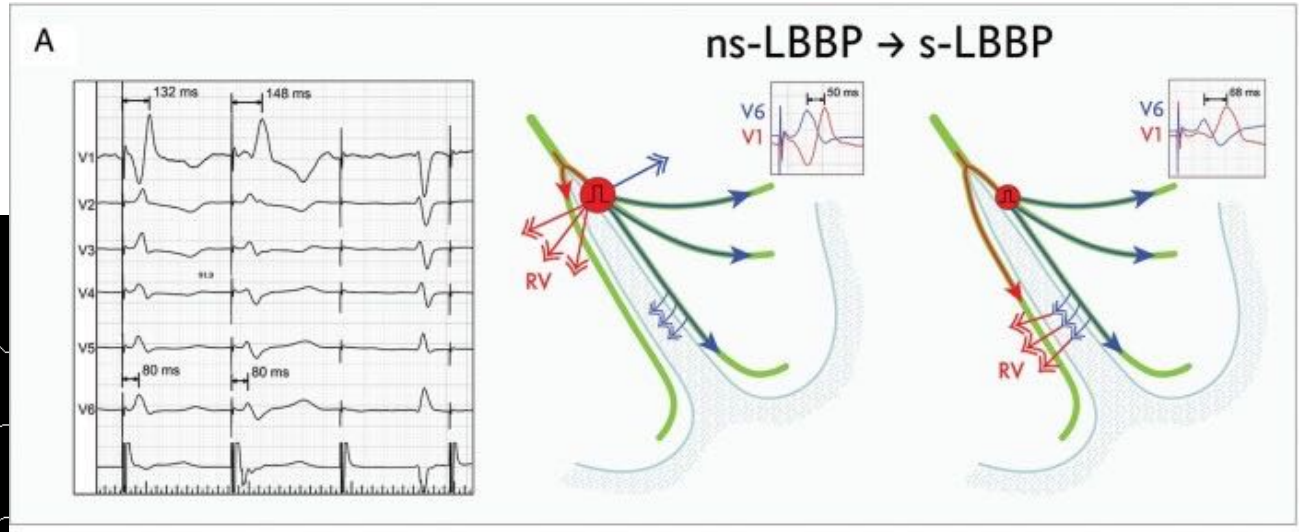


2 Visser jusqu'aux critères

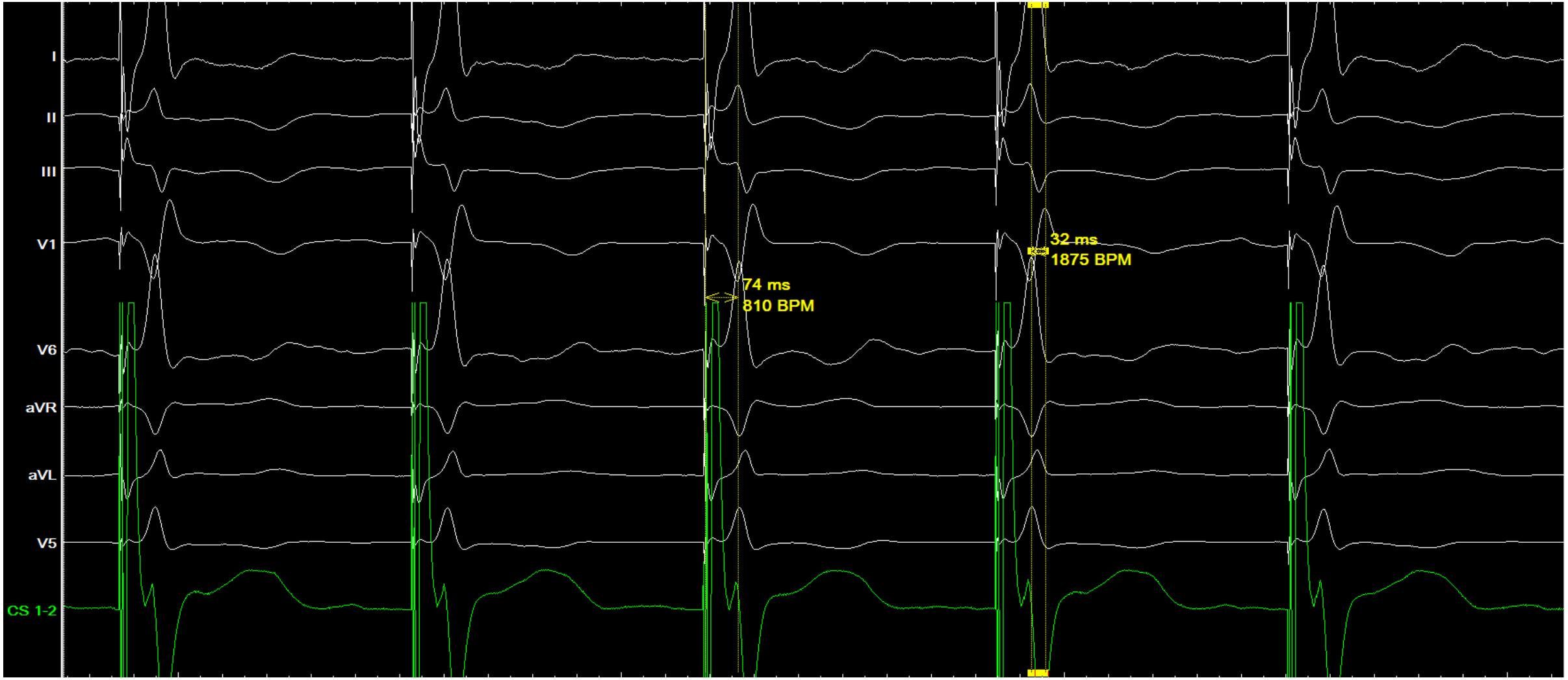


Ponnusamy, S. S. *et al.* Observations of interventricular septal behavior during left bundle branch pacing. *Cardiovasc electrophysiol* jce.16057 (2023) doi:10.1111/jce.16057.


I
II
III
V1
V6
aVR
aVL
V5
CS 1-2


A
ns-LBBP → s-LBBP
132 ms
148 ms
80 ms
80 ms
V1
V2
V3
V4
V5
V6
RV
V6
V1
50 ms
68 ms

I
II
III
V1
V6
aVR
aVL
V5
CS 1-2
38 ms
1578 BPM
86 ms
697 BPM
80 ms
750 BPM

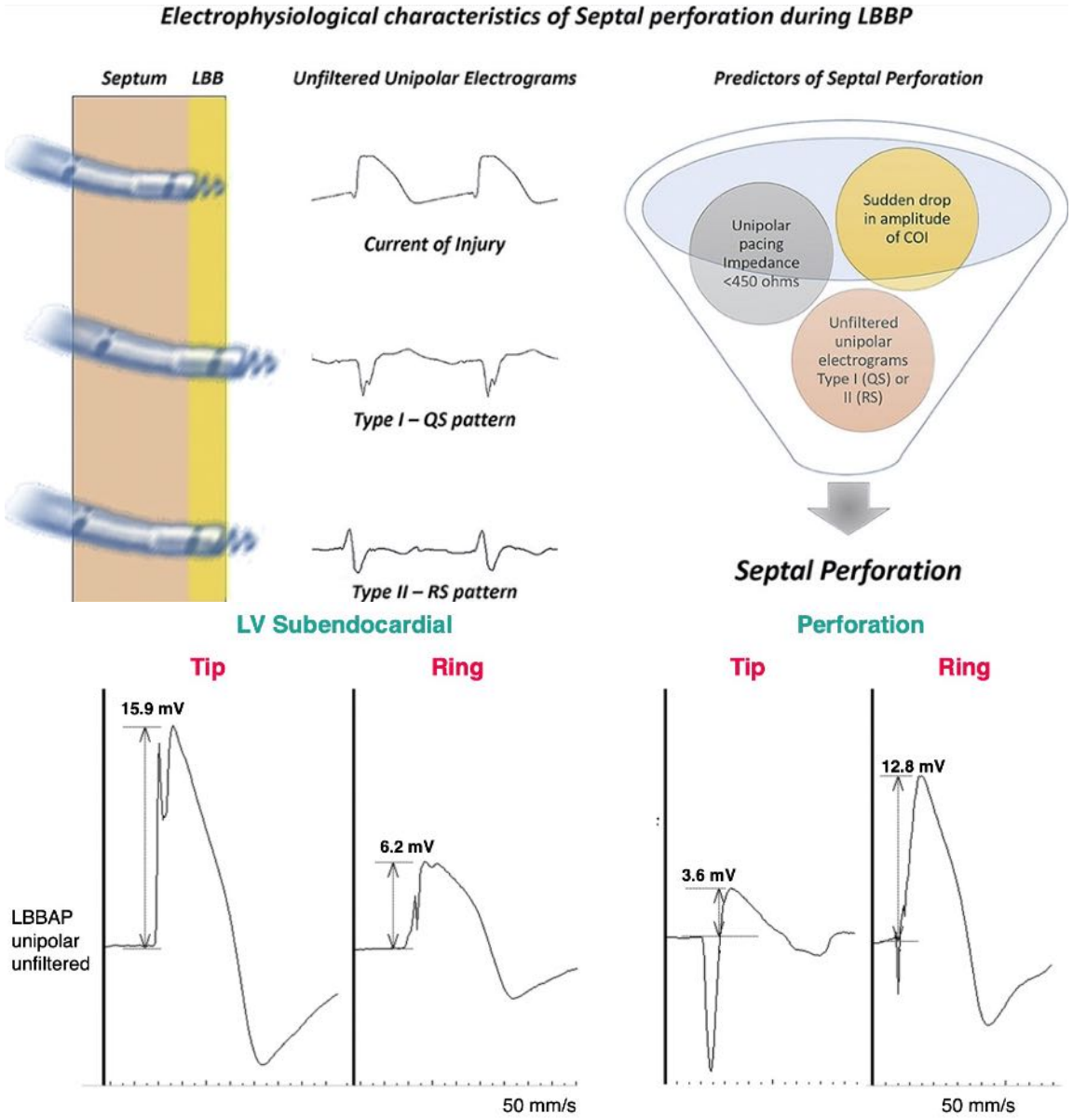

I
II
III
V1
V6
aVR
aVL
V5
CS 1-2
74 ms
810 BPM
32 ms
1875 BPM

Vérification critères sécurité

3

Table 4 Indicators of septal perforation with LBBAP

Myocardial COI amplitude
COI < 3–5 mV or absent
COI ring > tip[73]
COI < 25% of V amplitude[73]
Myocardial COI with QS or RS morphology[74]
Drop-in unipolar pacing impedance to <450 Ω[74] (or by >200 Ω)
Worsening of capture/sensing thresholds[24,73]
Loss of LBB/fascicular potential[23]
Contrast dye leakage into LV with injection via the delivery catheter[87]
Overt perforation visualized by lead position/motion on fluoroscopy



Shali, S. *et al.* Current of injury is an indicator of lead depth and performance during left bundle branch pacing lead implantation. *Heart Rhythm* **19**, 1281–1288 (2022).

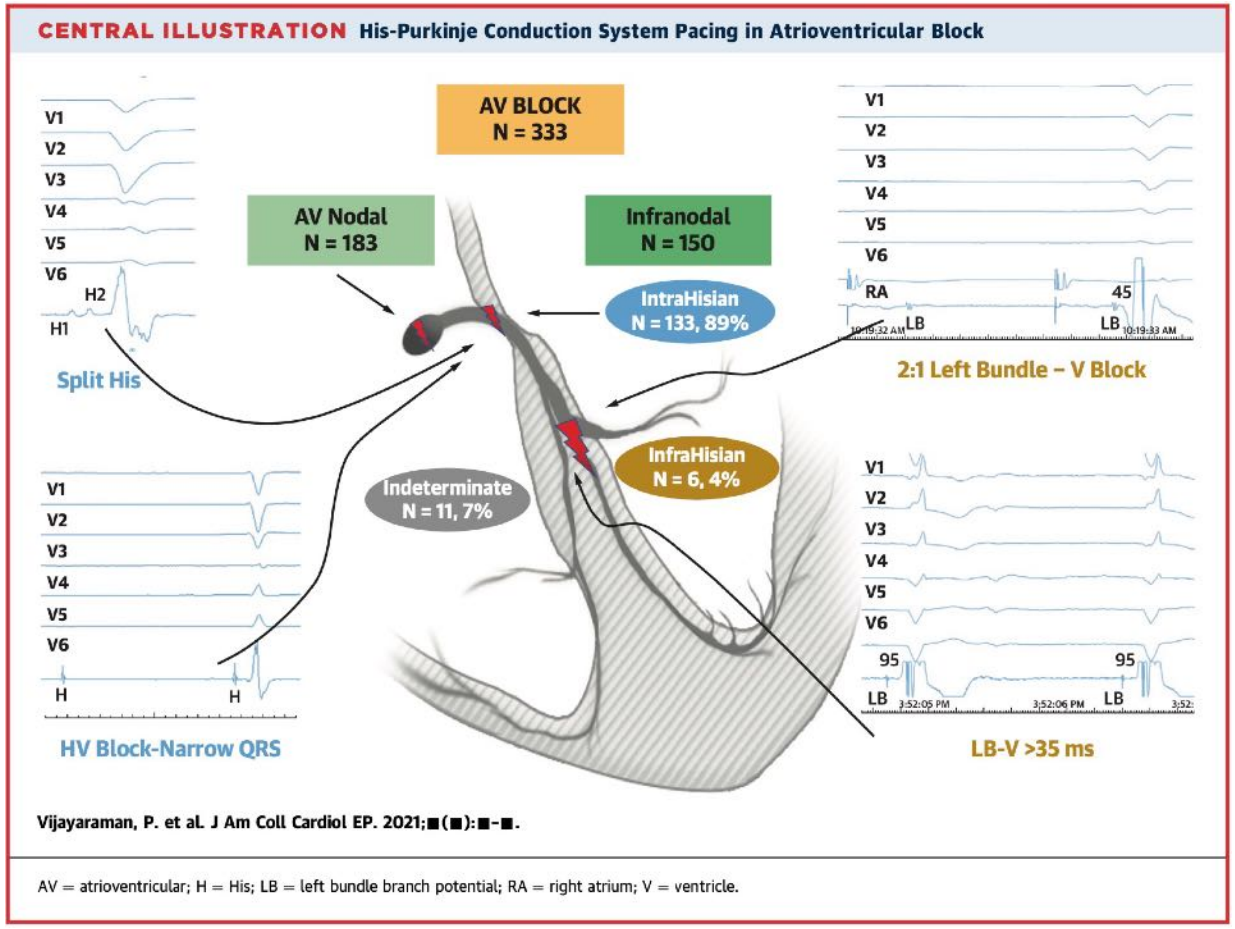
Ponnusamy, S. S., Basil, W. & Vijayaraman, P. Electrophysiological characteristics of septal perforation during left bundle branch pacing. *Heart Rhythm* **19**, 728–734 (2022).

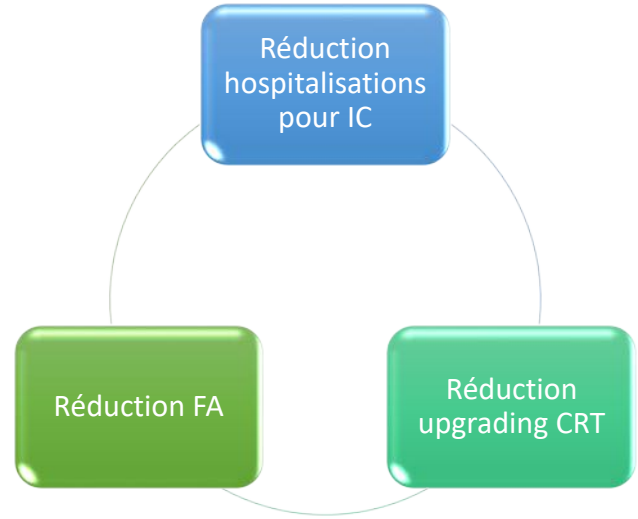
Burri, H. *et al.* EHRA clinical consensus statement on conduction system pacing implantation: endorsed by the Asia Pacific Heart Rhythm Society (APHRS), Canadian Heart Rhythm Society (CHRS), and Latin American Heart Rhythm Society (LAHRS). *EP Europace* **25**, 1208–1236 (2023).

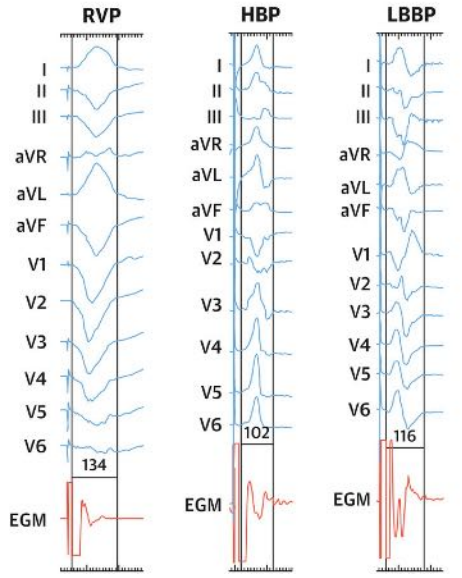
La stimulation de branche gauche

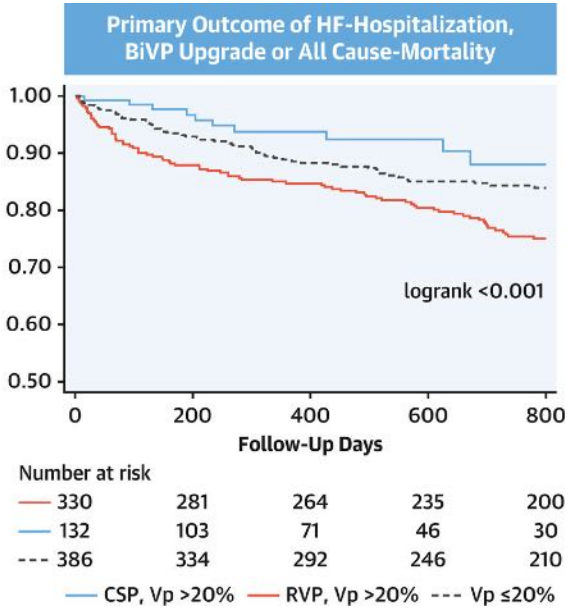
Nouvel Eldorado ?

BAV



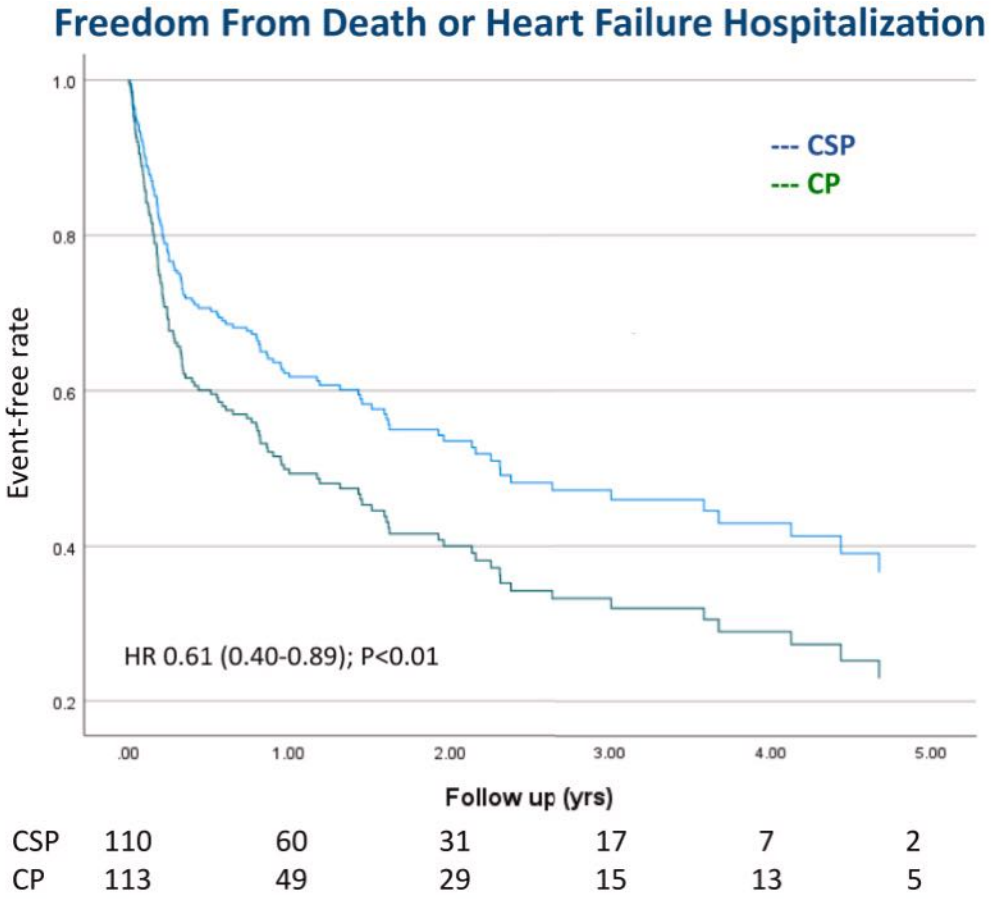


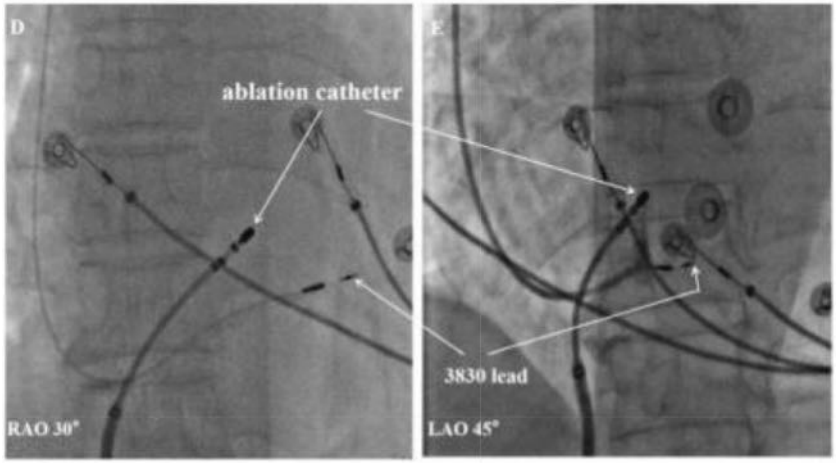


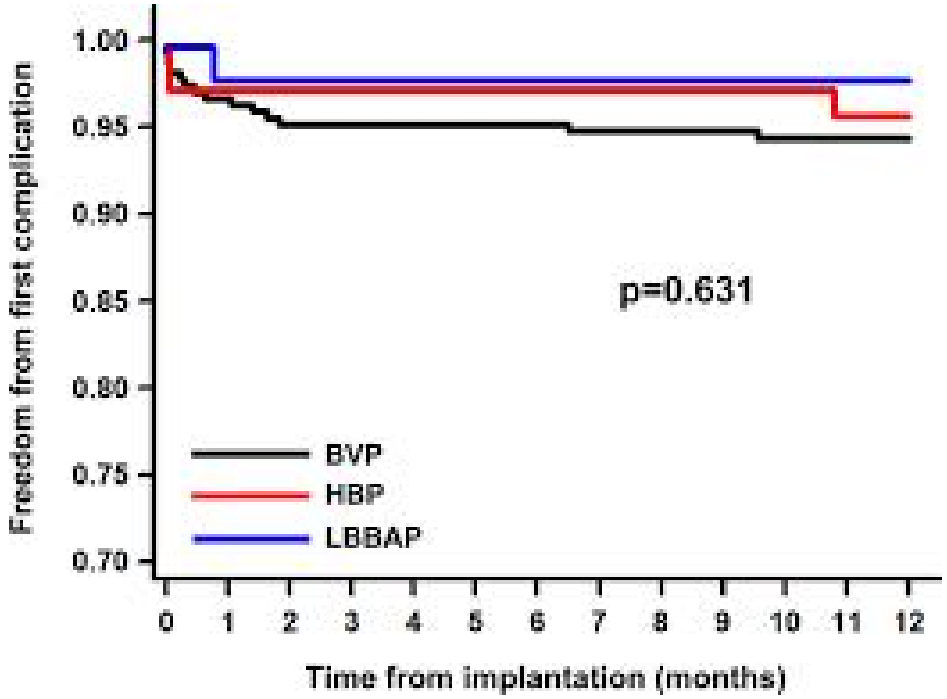


Vijayaraman, P. *et al.* His-Purkinje Conduction System Pacing in Atrioventricular Block: New Insights Into Site of Conduction Block. *JACC: Clinical Electrophysiology* **8**, 73–85 (2022).
Raymond-Paquin, A. *et al.* Left bundle branch area pacing in patients with atrioventricular conduction disease: A prospective multicenter study. *Heart Rhythm* **19**, 1484–1490 (2022).
Tan, E. S. J. et al. Clinical Outcomes in Conduction System Pacing Compared to Right Ventricular Pacing in Bradycardia. JACC: Clinical Electrophysiology S2405500X2200929X (2022) doi:10.1016/j.jacep.2022.10.016.

Ablate and Pace



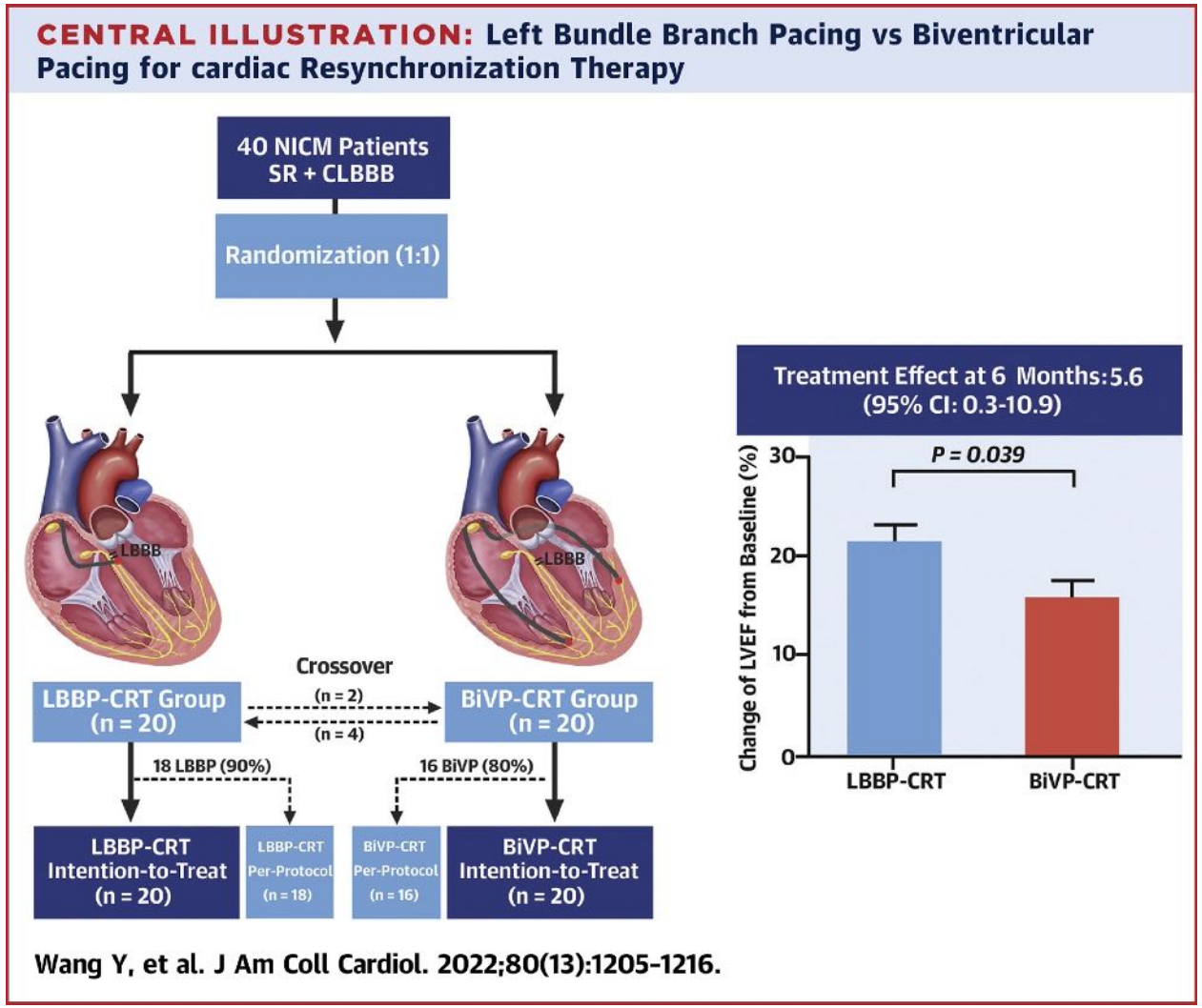


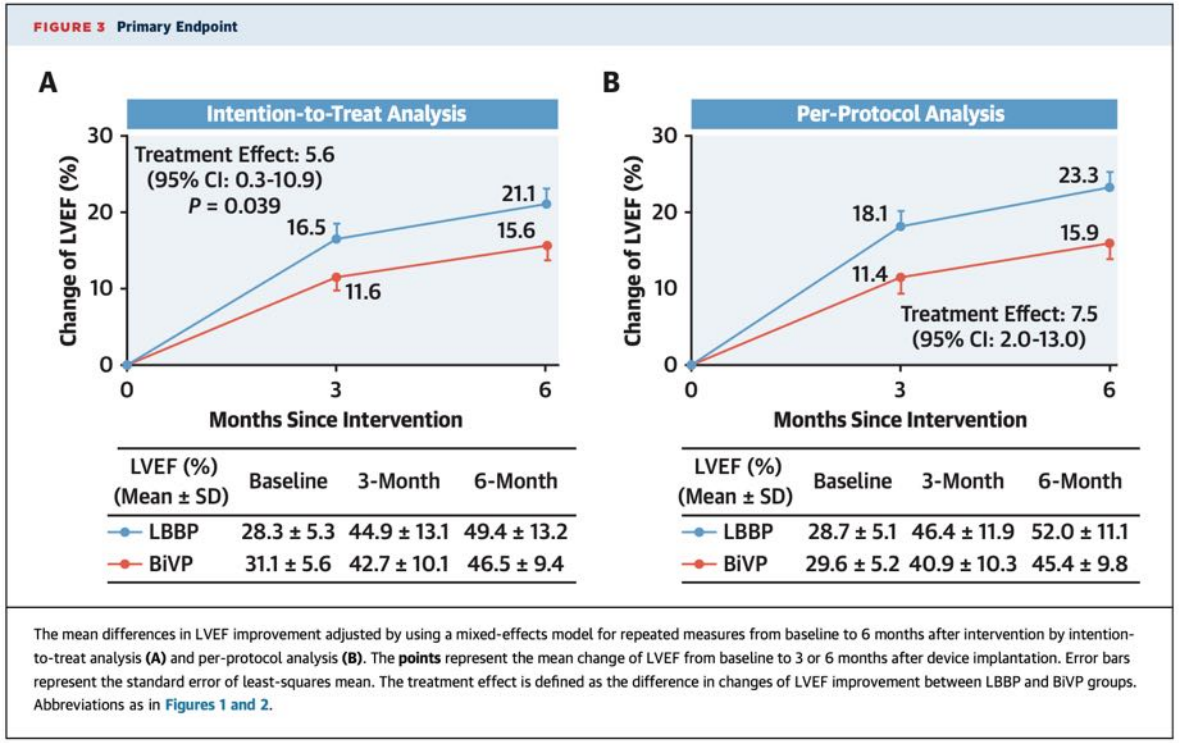


Palmisano, P. *et al.* Ablate and pace: Comparison of outcomes between conduction system pacing and biventricular pacing. *Pacing Clinical Electrophis* **46**, 1258–1268 (2023).

Vijayaraman, P. *et al.* Conduction system pacing versus conventional pacing in patients undergoing atrioventricular node ablation: Nonrandomized, on-treatment comparison. *Heart Rhythm O2* **3**, 368–376 (2022).

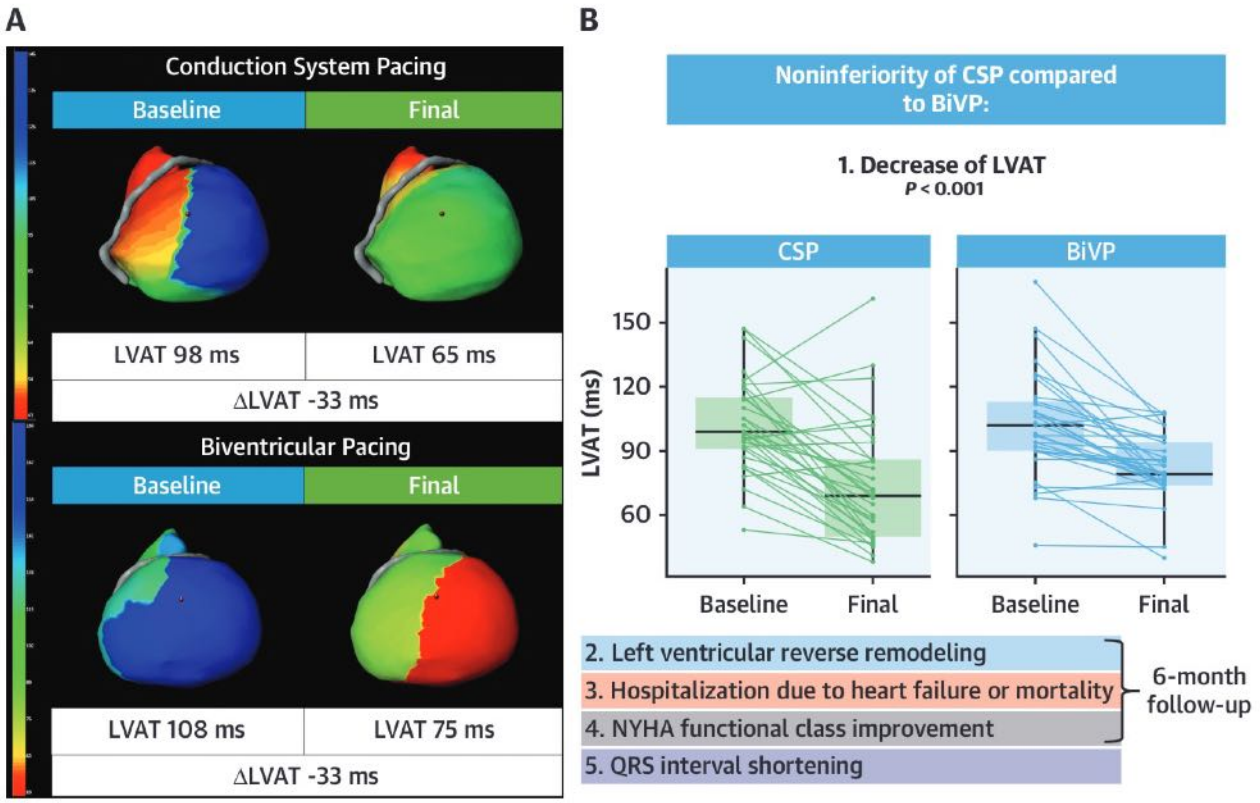
CRT





Wang, Y. *et al.* Randomized Trial of Left Bundle Branch vs Biventricular Pacing for Cardiac Resynchronization Therapy. *Journal of the American College of Cardiology* **80**, 1205–1216 (2022).

CENTRAL ILLUSTRATION CSP and BiVP Obtained Similar Degree of Cardiac Resynchronization

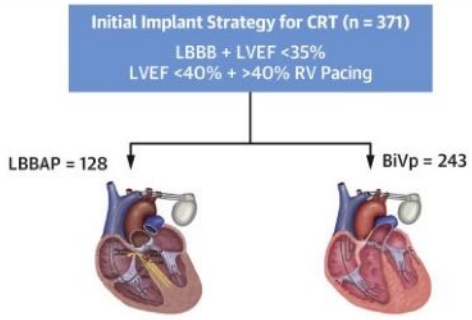


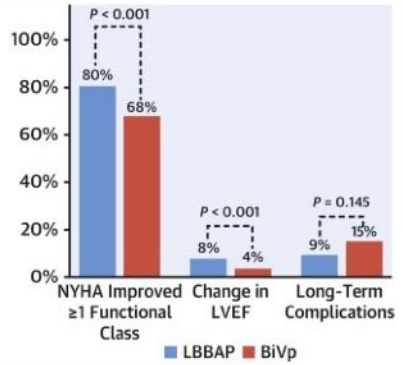
Pujol-Lopez M, et al. J Am Coll Cardiol EP. 2022;8(11):1431-1445.

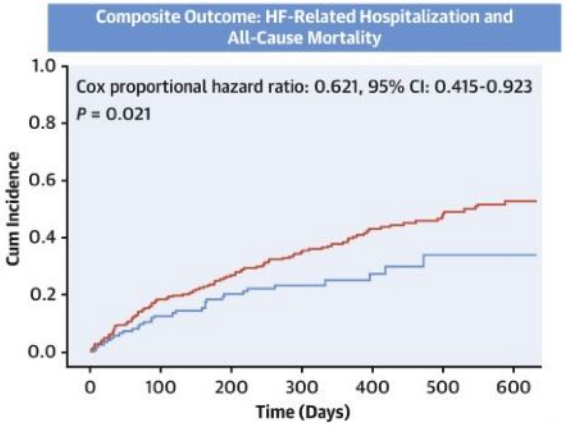
(A) Example of left ventricular (LV) activation time (LVAT) shortening with conduction system pacing (CSP) **(top)** and with biventricular pacing (BiVP) **(bottom)**. Both cases show long LVAT baseline with delayed activation of the left ventricle **(blue)**. Both CSP and BiVP showed a similar decrease in LVAT measured with electrocardiographic imaging and faster activation of the left ventricle **(green and red)**. **(B)** Both CSP and BiVP resulted in similar (noninferior) decrease of LVAT, LV reverse remodeling, heart failure hospitalizations or mortality, improvement in New York Heart Association (NYHA) functional class at 6 months, and QRS shortening. ΔLVAT = (final LVAT − baseline LVAT).

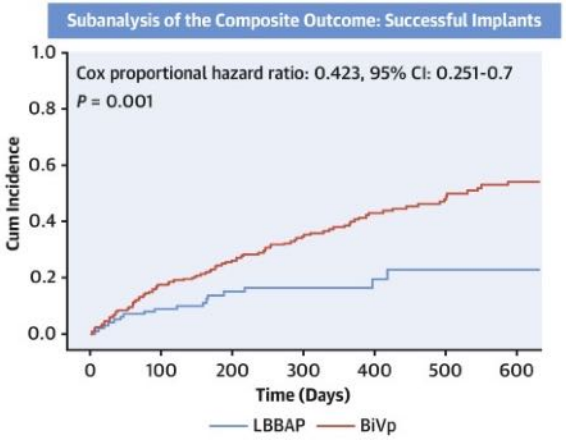
Pujol-Lopez, M. *et al.* Conduction System Pacing vs Biventricular Pacing in Heart Failure and Wide QRS Patients. *JACC: Clinical Electrophysiology* **8**, 1431–1445 (2022).

CENTRAL ILLUSTRATION: LBBAP for the Treatment of Heart Failure



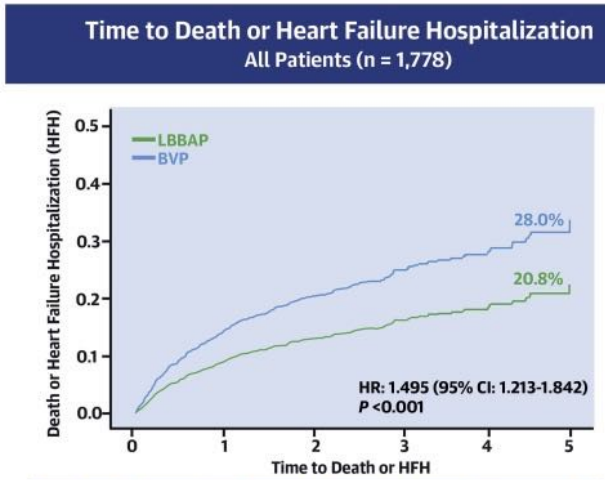


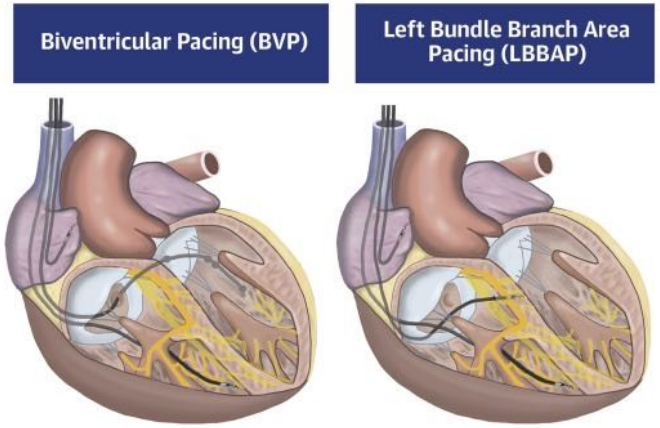




Diaz JC, et al. J Am Coll Cardiol EP. 2023;9(8):1568-1581.

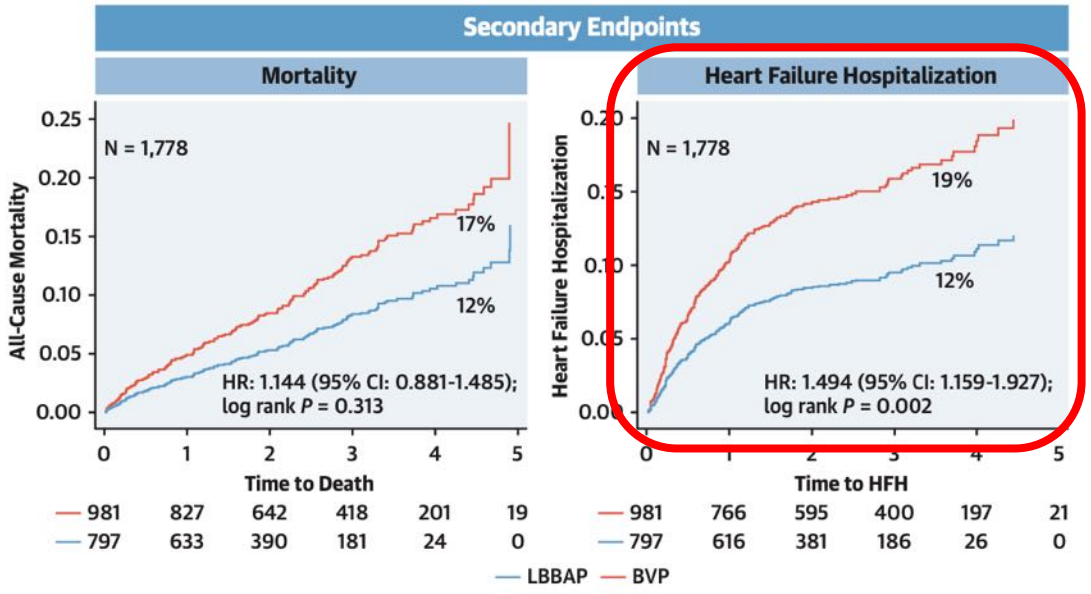
CENTRAL ILLUSTRATION: Death or Heart Failure Hospitalization





Vijayaraman P, et al. J Am Coll Cardiol. 2023;82(3):228-241.

FIGURE 1 Secondary Outcomes in All Patients



(Left) Mortality: Cox proportional hazard survival curves and analysis did not show a significant difference in all-cause mortality. **(Right)** Heart failure hospitalization: figure and analysis show a statistically significant reduction in heart failure hospitalization with left bundle branch area pacing (LBBAP) compared with biventricular pacing (BVP) among all patients.

TABLE 6 Comparison of Echocardiographic Response and Hyper-Response Between BVP and LBBAP

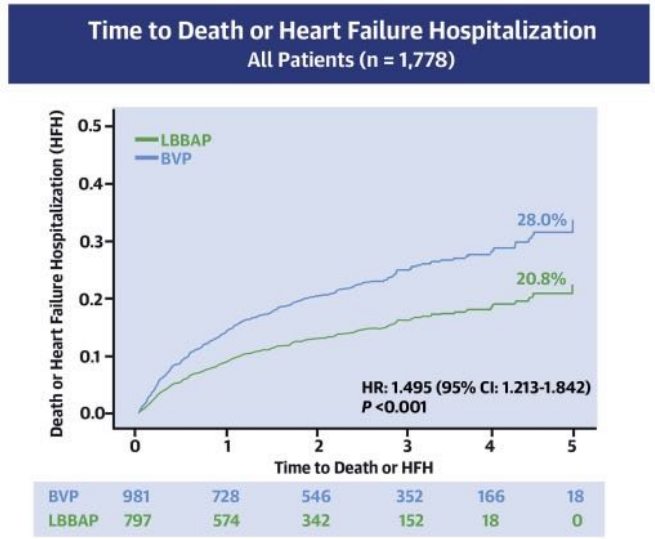
				Univariate Analysis		Multivariate Analysis	
	BVP	LBBAP	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
All patients (N = 1,424)	757	667					
Echocardiographic response	495 (65.4)	492 (73.9)	<0.001	1.727 (1.306-2.285)	<0.001	1.604 (1.247-2.063)	<0.001
Hyper-response	190 (25.1)	226 (33.9)	<0.001	1.638 (1.248-2.149)	<0.001	1.678 (1.291-2.181)	<0.001
LBBB (n = 874)	492	382					
Echocardiographic response	335 (68.2)	312 (81.7)	<0.001	2.197 (1.487-3.248)	<0.001	1.932 (1.352-2.760)	<0.001
Hyper-response	140 (28.5)	161 (42.1)	<0.001	1.619 (1.156-2.267)	0.005	1.771 (1.305-2.402)	<0.001

Values are n or n (%), unless otherwise indicated. On regression analysis, echocardiographic response and hyper-response rates were significantly higher in patients with LBBAP in all patients and in those with LBBB.

Abbreviations as in Table 1.

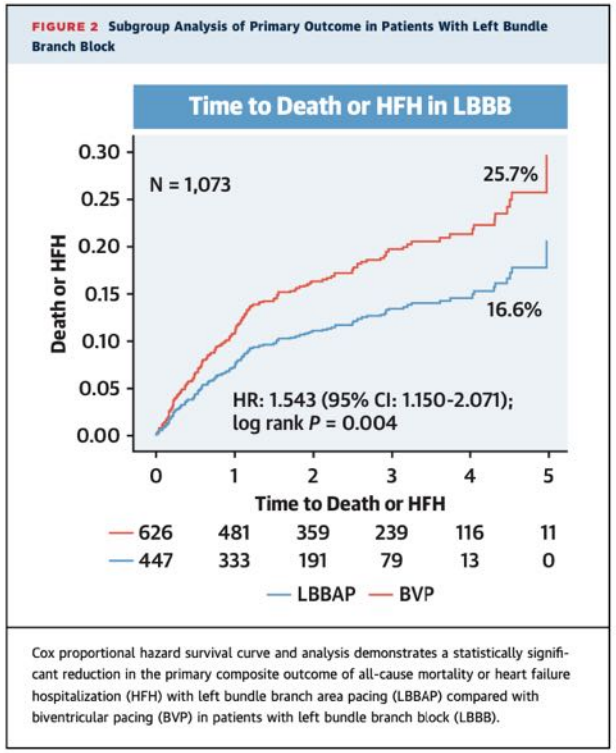
Vijayaraman, P. *et al.* Comparison of Left Bundle Branch Area Pacing and Biventricular Pacing in Candidates for Resynchronization Therapy. *Journal of the American College of Cardiology* **82**, 228–241 (2023)
Subzposh, F. A. *et al.* Sex-Specific Outcomes of LBBAP Versus Biventricular Pacing. *JACC: Clinical Electrophysiology* S2405500X23006783 (2023) doi:10.1016/j.jacep.2023.08.026.

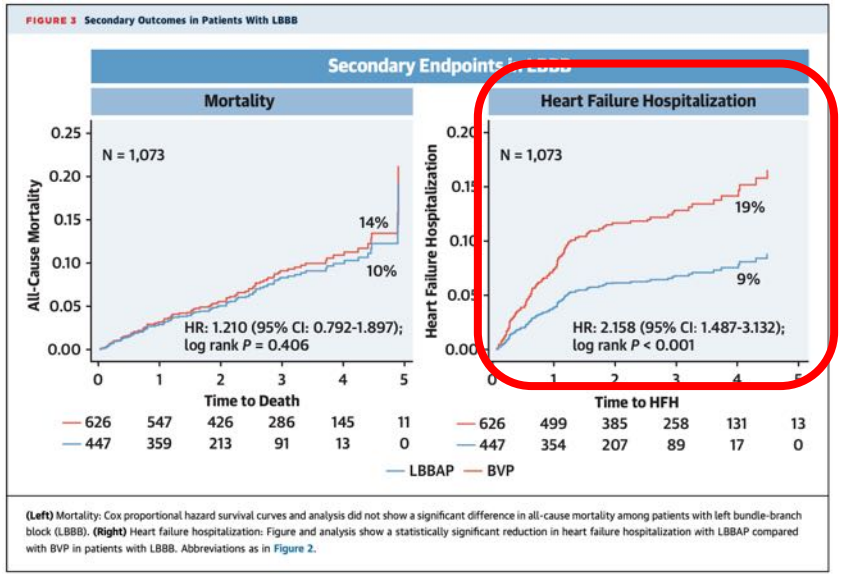
CENTRAL ILLUSTRATION: Death or Heart Failure Hospitalization



Vijayaraman P, et al. J Am Coll Cardiol. 2023;82(3):228-241.

Pour LBBB





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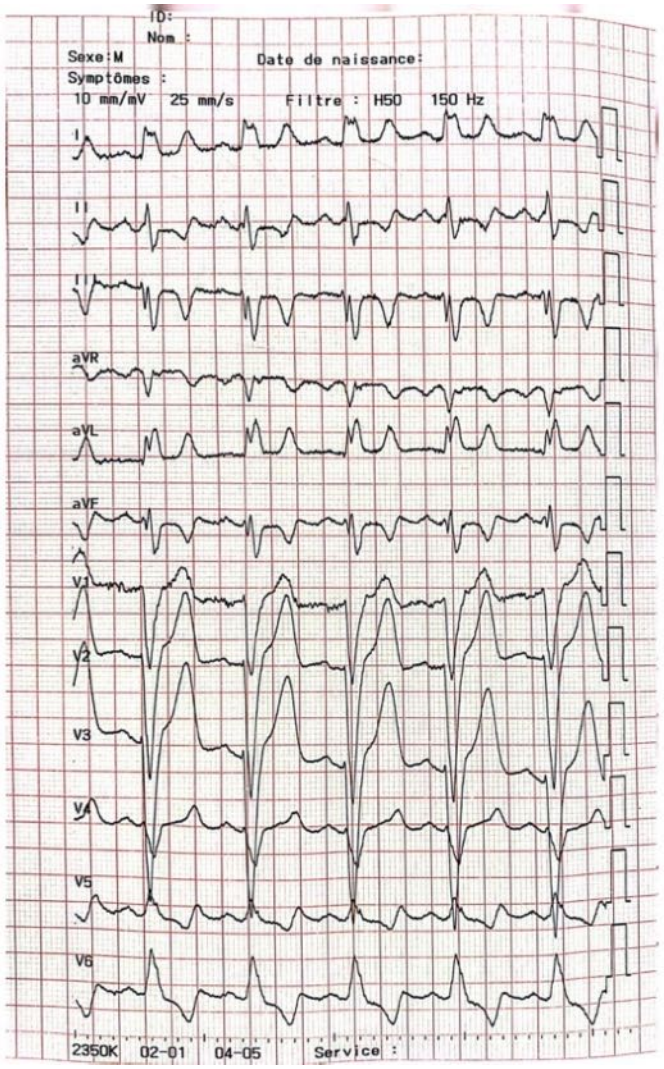
Subzposh, F. A. *et al.* Sex-Specific Outcomes of LBBAP Versus Biventricular Pacing. *JACC: Clinical Electrophysiology* S2405500X23006783 (2023) doi:10.1016/j.jacep.2023.08.026.


ID:
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Service :

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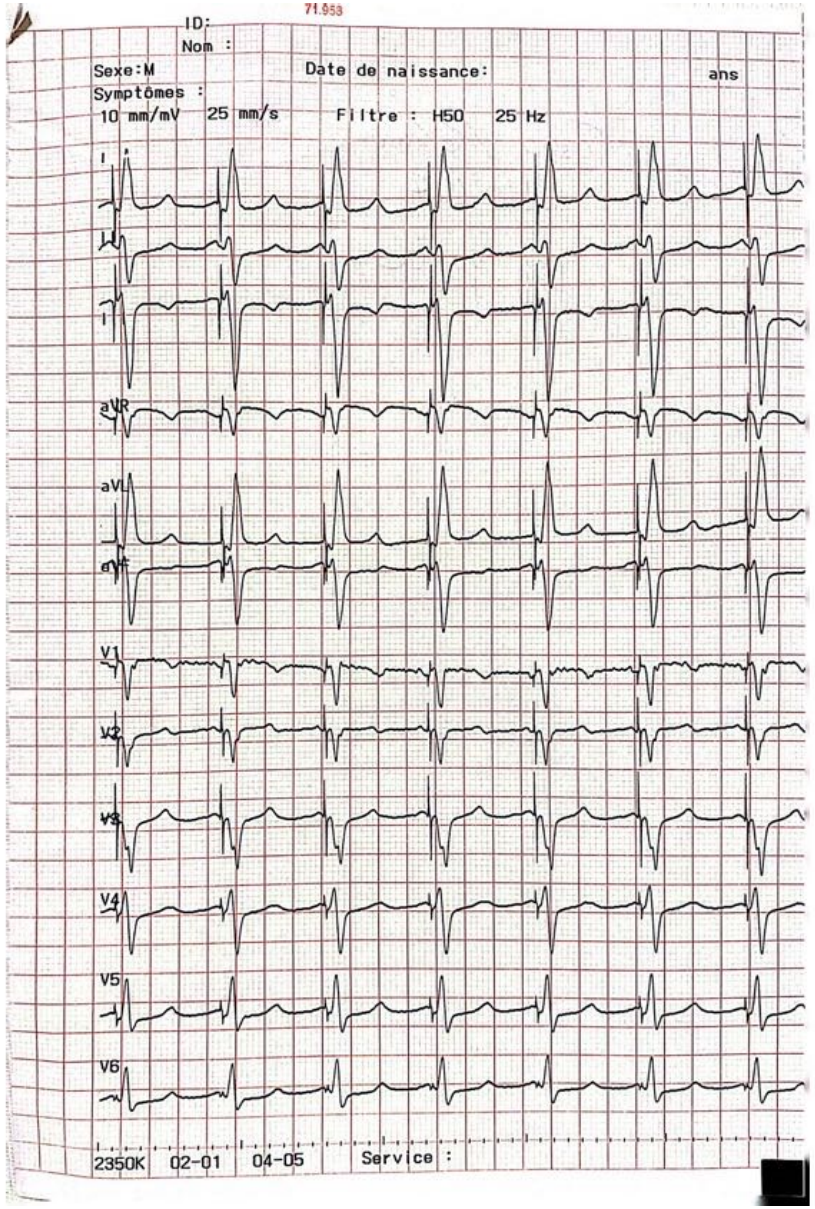
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2350K 02-01 04-05
Service :

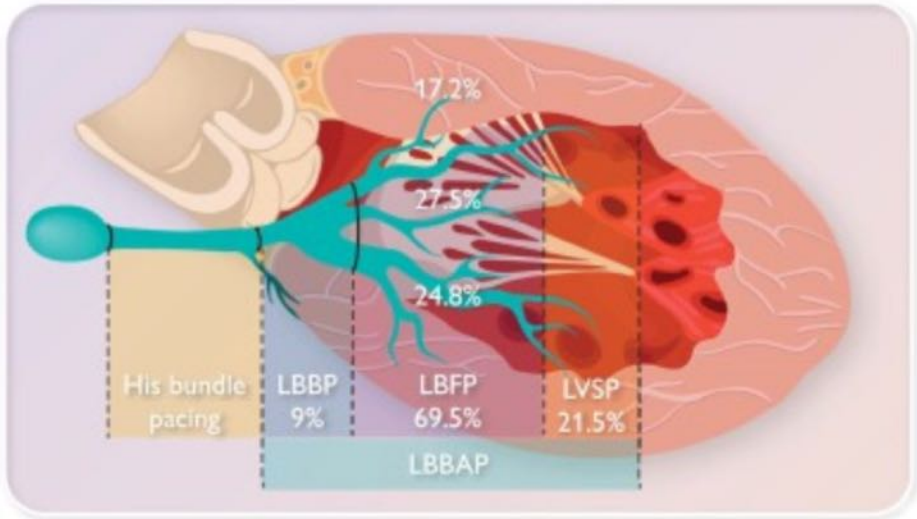
- **Excellent indication :**
  - AV block, VP > 20% and LVEF < 50%
  - Ablate and pace with LVEF < 50%
  - Upgrading of PICM if extraction of previous lead is feasible
  - CRT for LBBB
  - Non-responders for biV pacing
- **Bad indication :**
  - Paroxysmal AV block, VP < 20% and LVEF > 50%
  - Sinus node dysfunction
- **Good indication :**
  - AV block, VP > 20% and LVEF > 50%
  - AV block, VP < 20% and LVEF < 50%, mostly if LBBB !
  - Ablate and pace with LVEF > 50%
  - Painful LBBB
  - Upgrading of PICM
- **? :**
  - CRT with RBBB
  - CRT with NICD

MELOS — MULTICENTER EUROPEAN LEFT BUNDLE BRANCH AREA PACING OUTCOMES STUDY

Prospective, multicenter, registry-based observational study

2533 Participants

14 European centres



LBBAP implantation success

Bradycardia indication success	92.4%
Heart failure indication success	82.2%

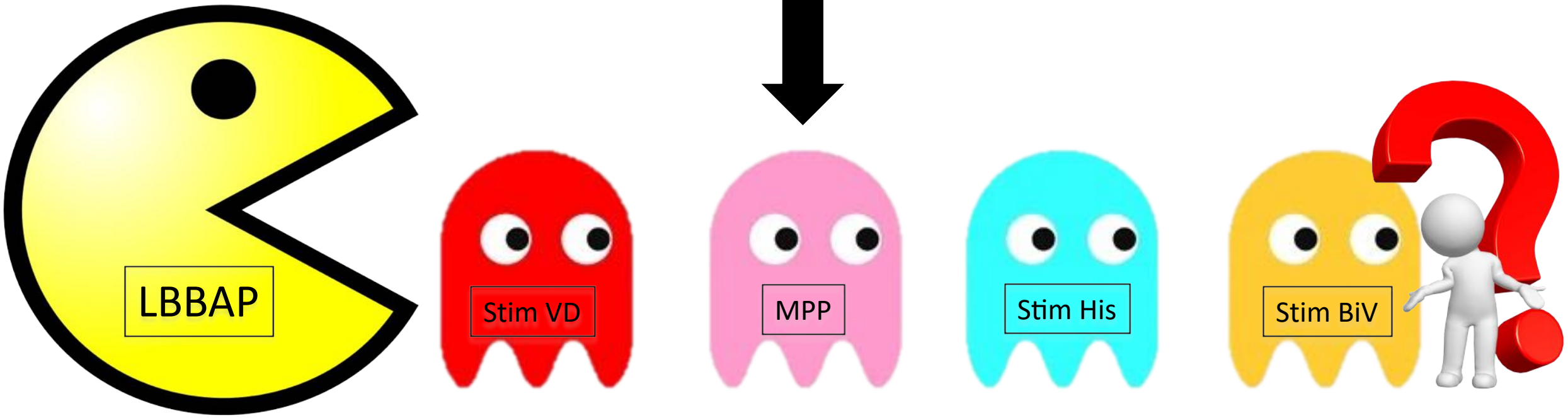
Independent predictors of LBBAP lead implantation failure

Heart failure indication	OR 1.49, 95% CI 1.01–2.21
Baseline QRS duration, per 10 ms	OR 1.08, 95% CI 1.03–1.14
LVEDD, per 10 mm increase	OR 1.53, 95% CI 1.26–1.86

LBBAP lead complications	**8.3%**
• Acute perforation to LV	3.7%
• Lead dislodgement	1.5%
• Acute chest pain	1.0%
• Capture threshold rise	0.7%
• Acute coronary syndrome	0.4%
• Trapped/damaged helix	0.4%
• Delayed perforation to LV	0.1%
• Other	0.7%

Jastrzębski, M. *et al.* Left bundle branch area pacing outcomes: the multicentre European MELOS study. *Eur Heart J* **43**, 4161–4173 (2022).

- Cardiopathie de stimulation
- Non répondeurs à la CRT
- Risque à multiplier le nombre de sondes



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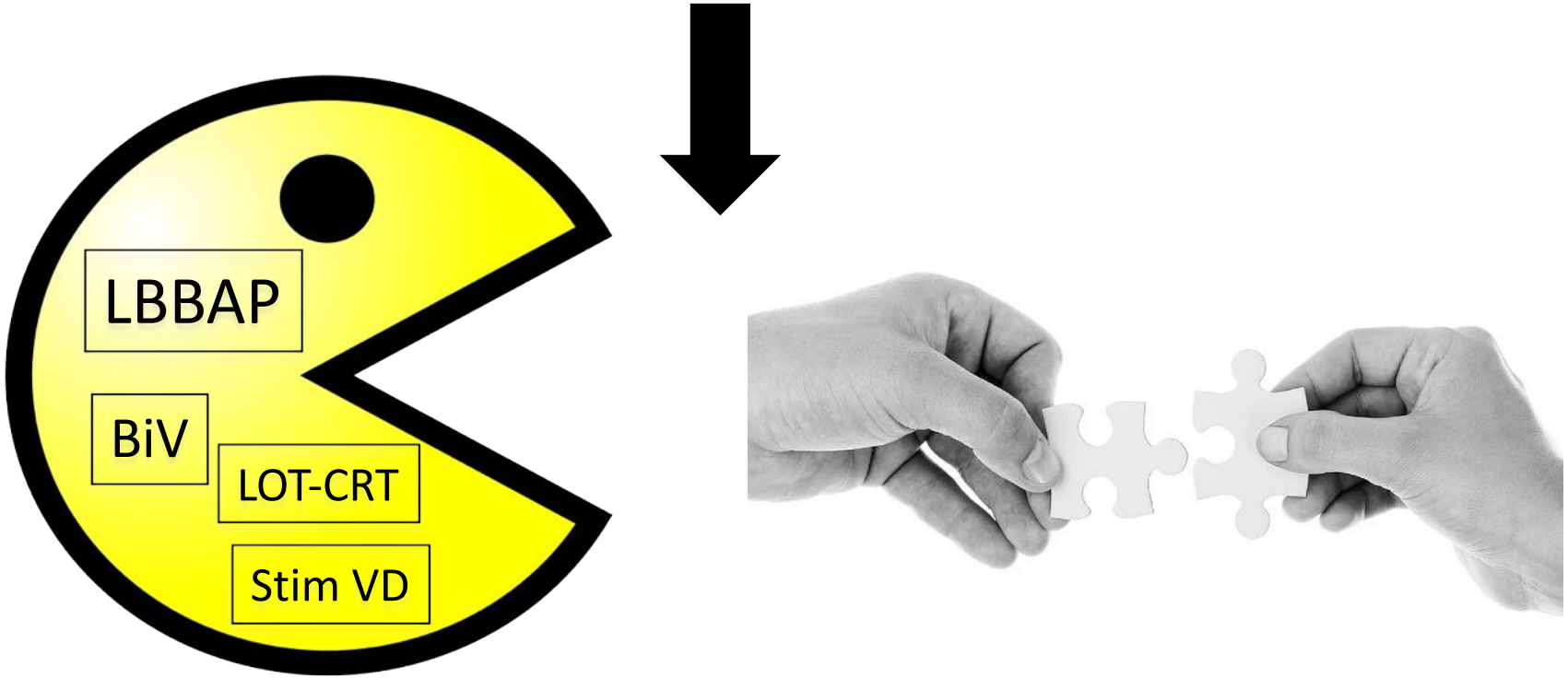

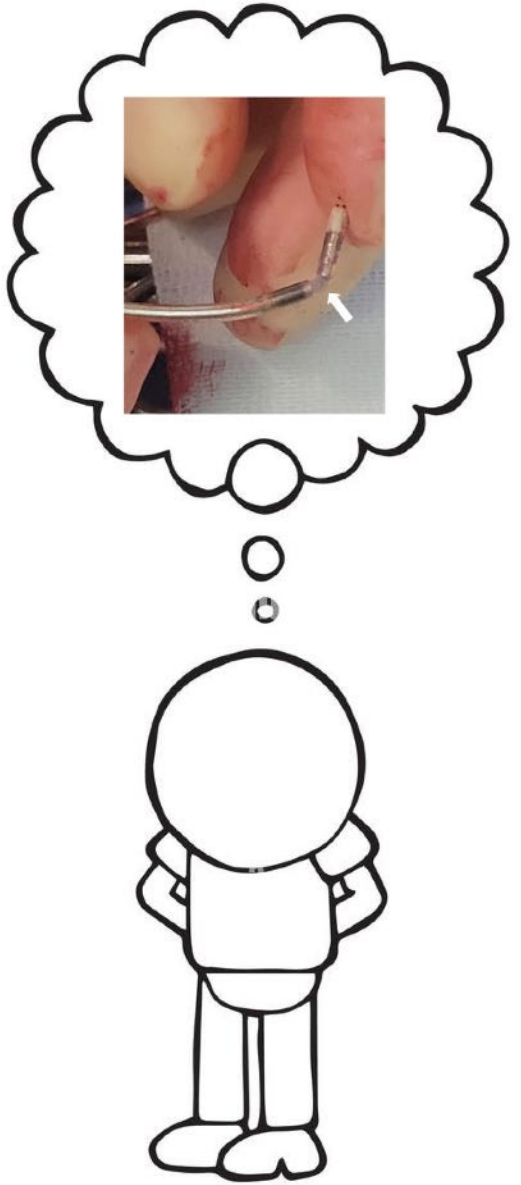

Merci

Dr Pierre-Antoine Catalan

Rythmologie et Cardio-Génétique

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