CARDIO RUN 2025
17ème CONGRÈS DE PATHOLOGIE CARDIO-VASCULAIRE
17-18-19 SEPTEMBRE 2025
Hôtel Saint Alexis ILE DE LA RÉUNION France


# Resynchronisation cardiaque : stimulation de branche gauche ou bi ventriculaire ?

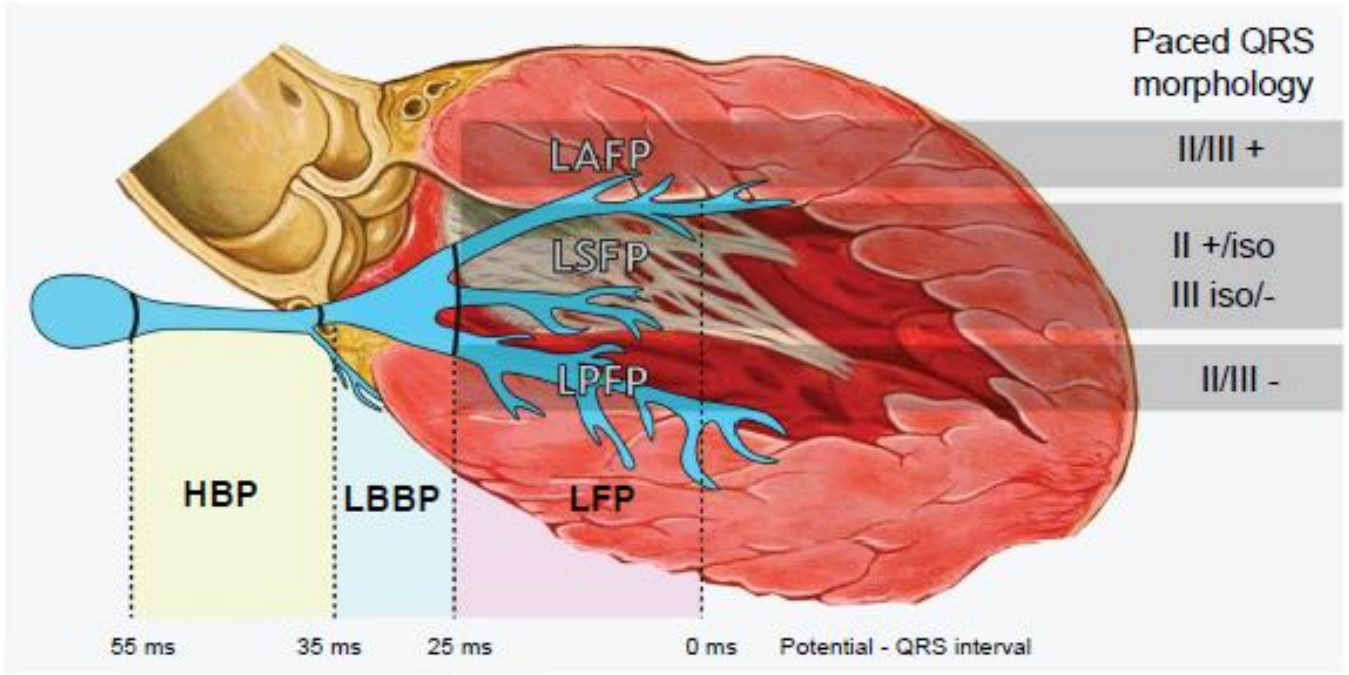
Frédéric Anselme
CHU de Rouen

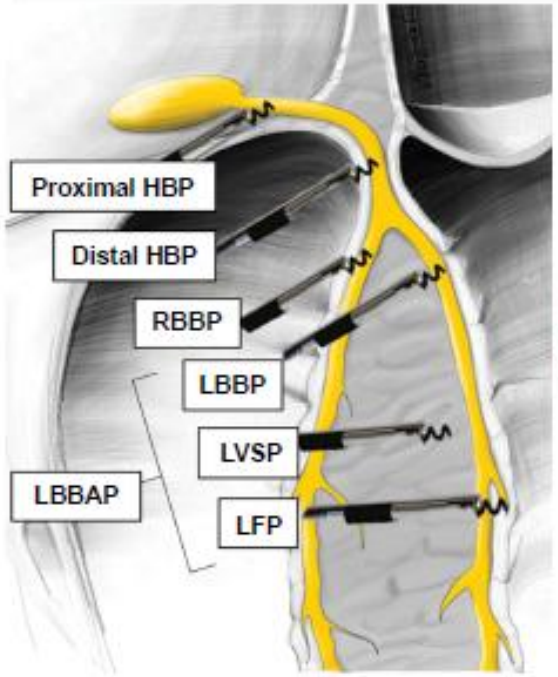
# Introduction

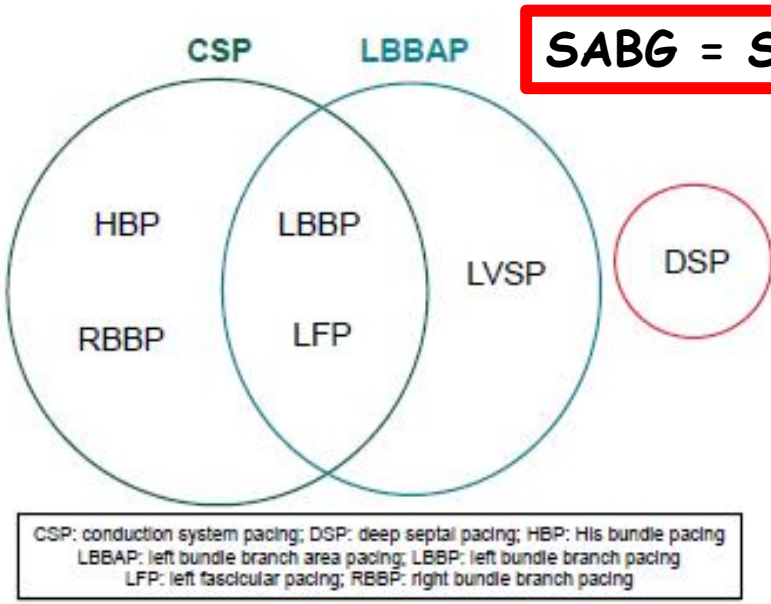
- *La stimulation de l'aire de la branche gauche submerge la stim BiV !*

  - Considérations théoriques
  - Considérations techniques
  - Analyse critique de la littérature

# Définitions



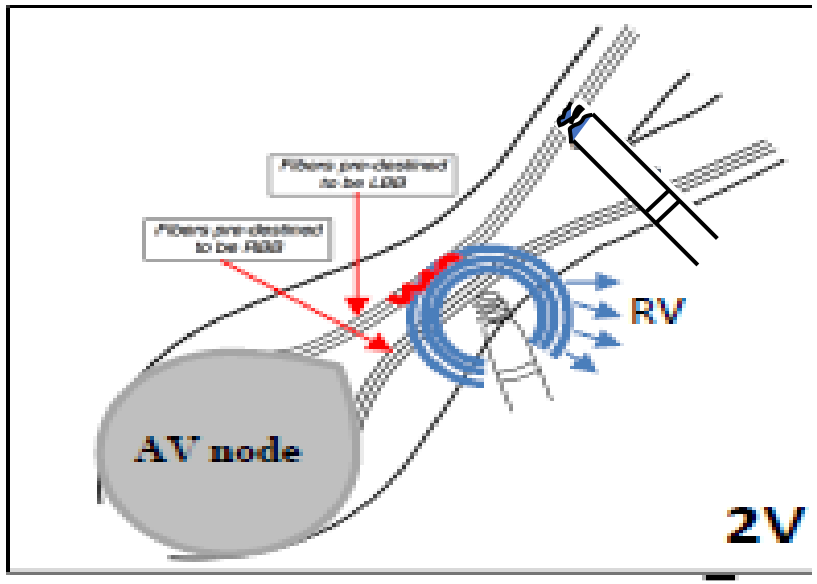




**SABG = SBG + SSG**

*H Burri et al.*
*Europace*
*2023;25:1237*

# Les écueils théoriques de la SABG dans la CRT

- Pour resynchronizer il faut corriger un BBG tronculaire




**La SABG ne bénéficiera pas aux patients avec des QRS larges en rapport avec:**

- Anomalies de la conduction:
  - Bloc situé en aval du site de stimulation
  - Conduction ralentie dans la BG
  - Combinaison des deux

- En présence de large(s) zone(s) de fibrose (IDM ou CMD)

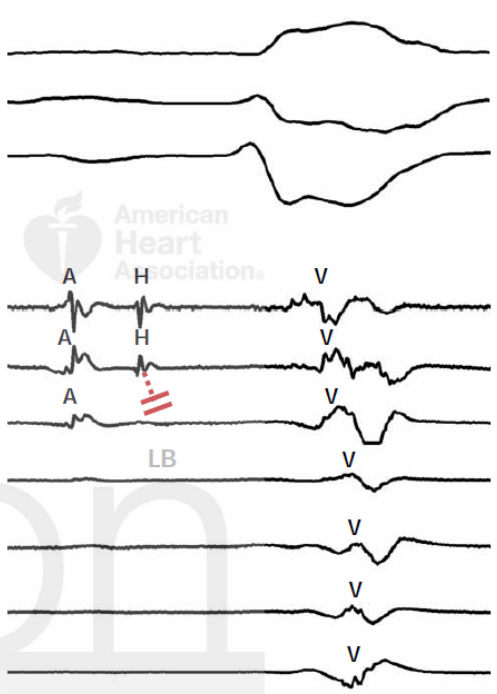
# Comment sélectionner les bons candidats pour SABG ?

## Cartographie endocavitaire VG chez des patients avec aspect de BBG

**64% de bloc gauche tronculaire**

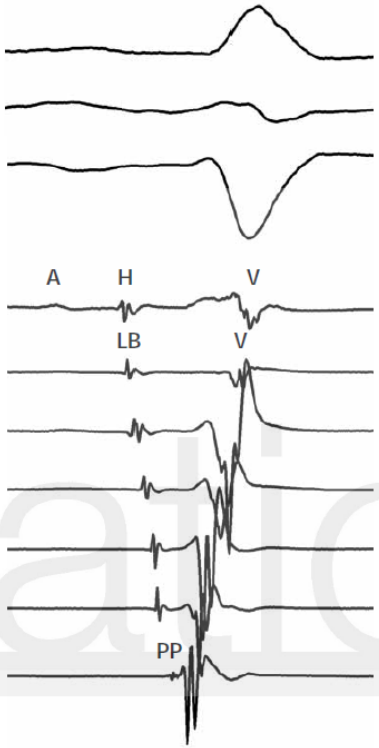
**Critères prédictifs de BBG tronculaire**

| Characteristic | IPA (n=26) | CCB (n=46) | p-value |
|---|---|---|---|
| Electrocardiographic characteristics | | | |
| *QRS duration (ms)—mean±SD* | *152±19* | *171±23* | *0.001* |
| *QRS duration > 140 msec (men) or >130 msec (women)—no. (%)* | *23 (88.5)* | *44 (95.7)* | *0.34* |
| R-wave amplitude in V1 (mV)—median(IQR) | 0.08 (0.00-0.13) | 0.07 (0.00-0.15) | 0.91 |
| R-wave in V1 < 0.1 mV—no. (%) | 15 (57.7) | 29 (63.0) | 0.65 |
| *Presence of QRS notching in V1, V2, V5, V6, I, or aVL—no. (%)* | *14 (53.9)* | *44 (95.7)* | *<0.0001* |
| *Overall Strauss criteria met—no. (%)* | *10 (38.5)* | *42 (91.3)* | *<0.0001* |




*"left intra-hisian" LBBB*

Wide QRS (190ms):
*Complete conduction block*




Wide QRS (135ms):
*Intact Purkinje activation*

***Upadhyay G, et al. Circulation 2019***

# Considérations techniques de la SABG dans la CRT

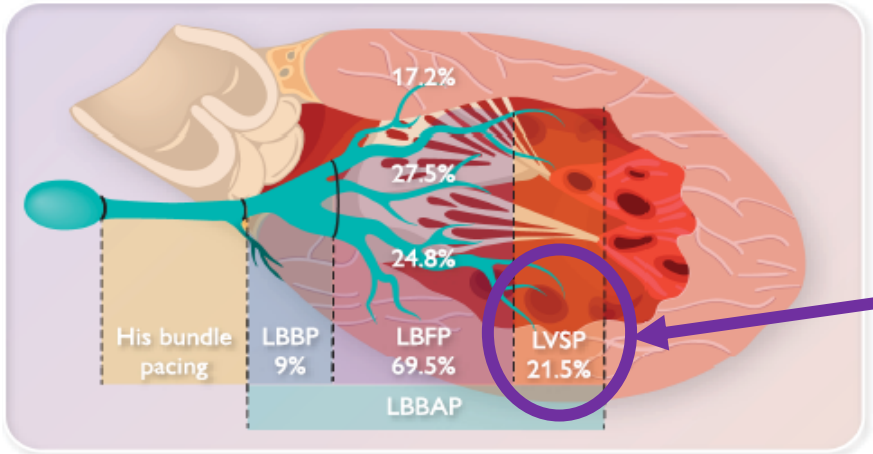
## Faisabilité ?

**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% |

| 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% |

| 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 |

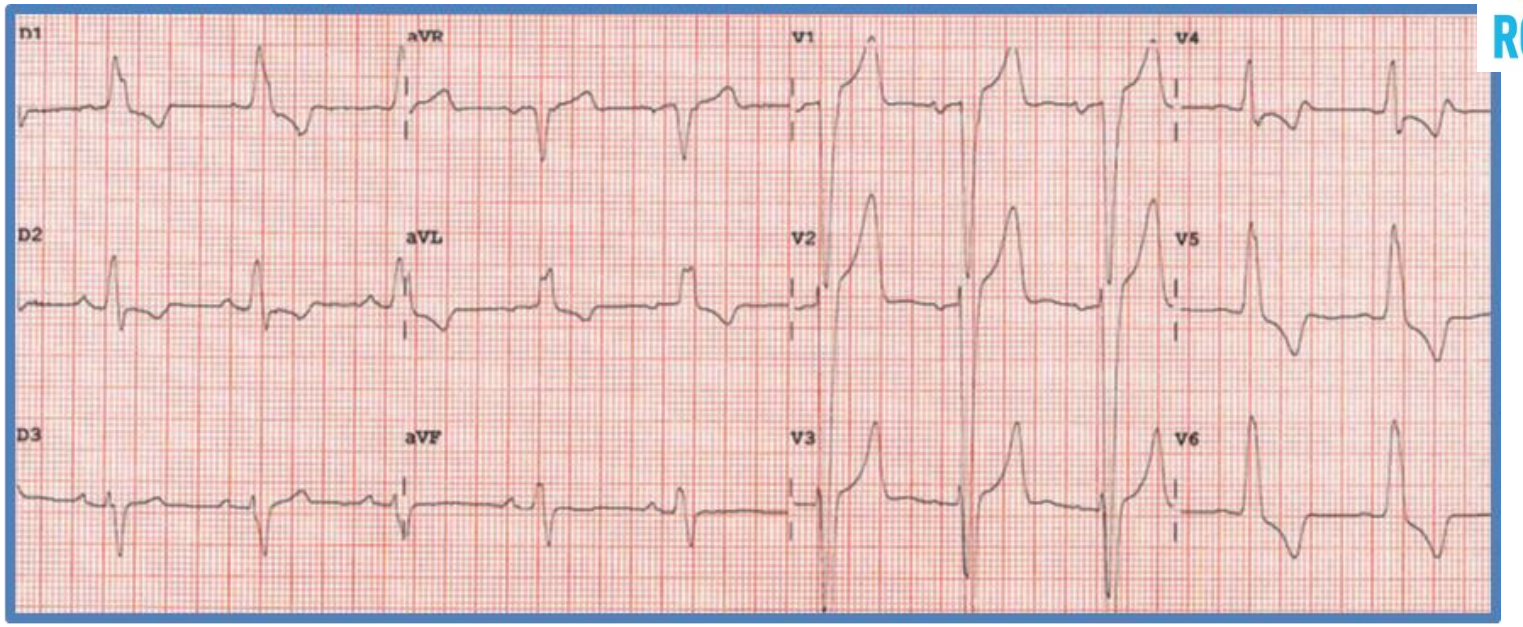
> 20% de Stim Septale Gauche

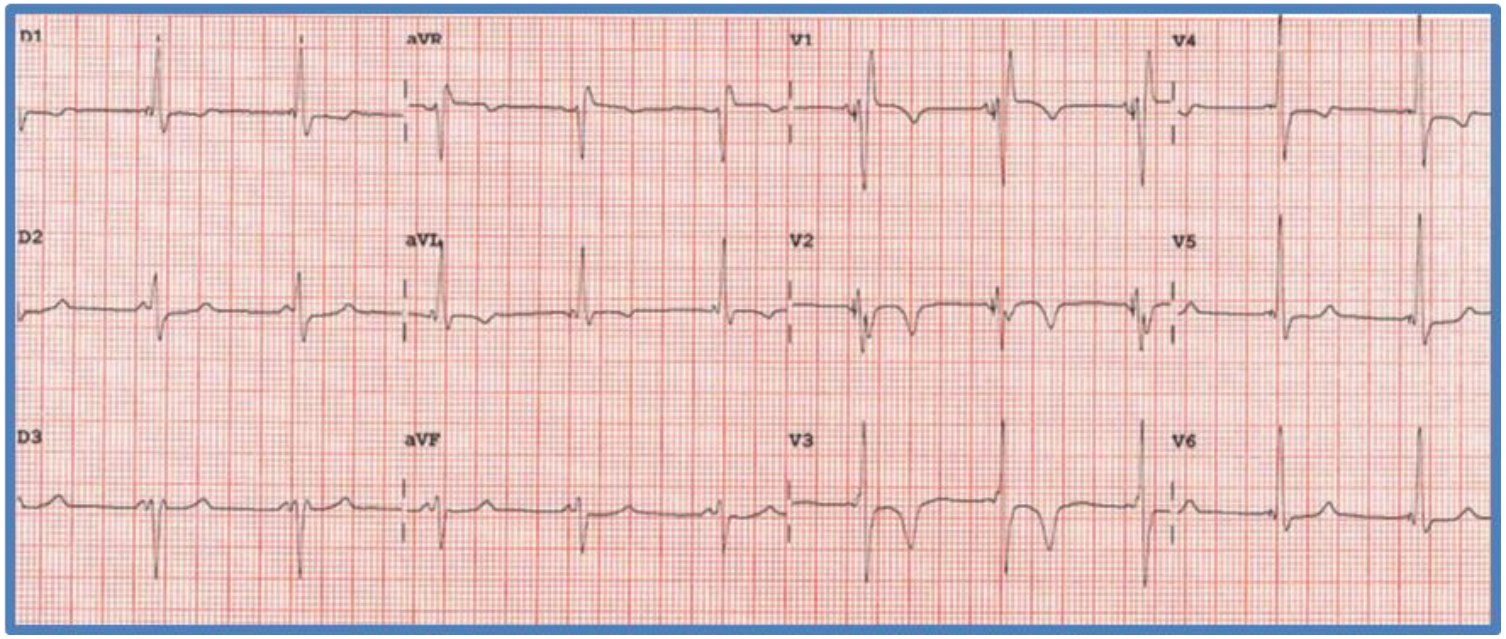
Un résultat optimal (SBG) que dans 60% des cas !

*Jastrzebski M, et al. EHJ 2022;43:4161-73*

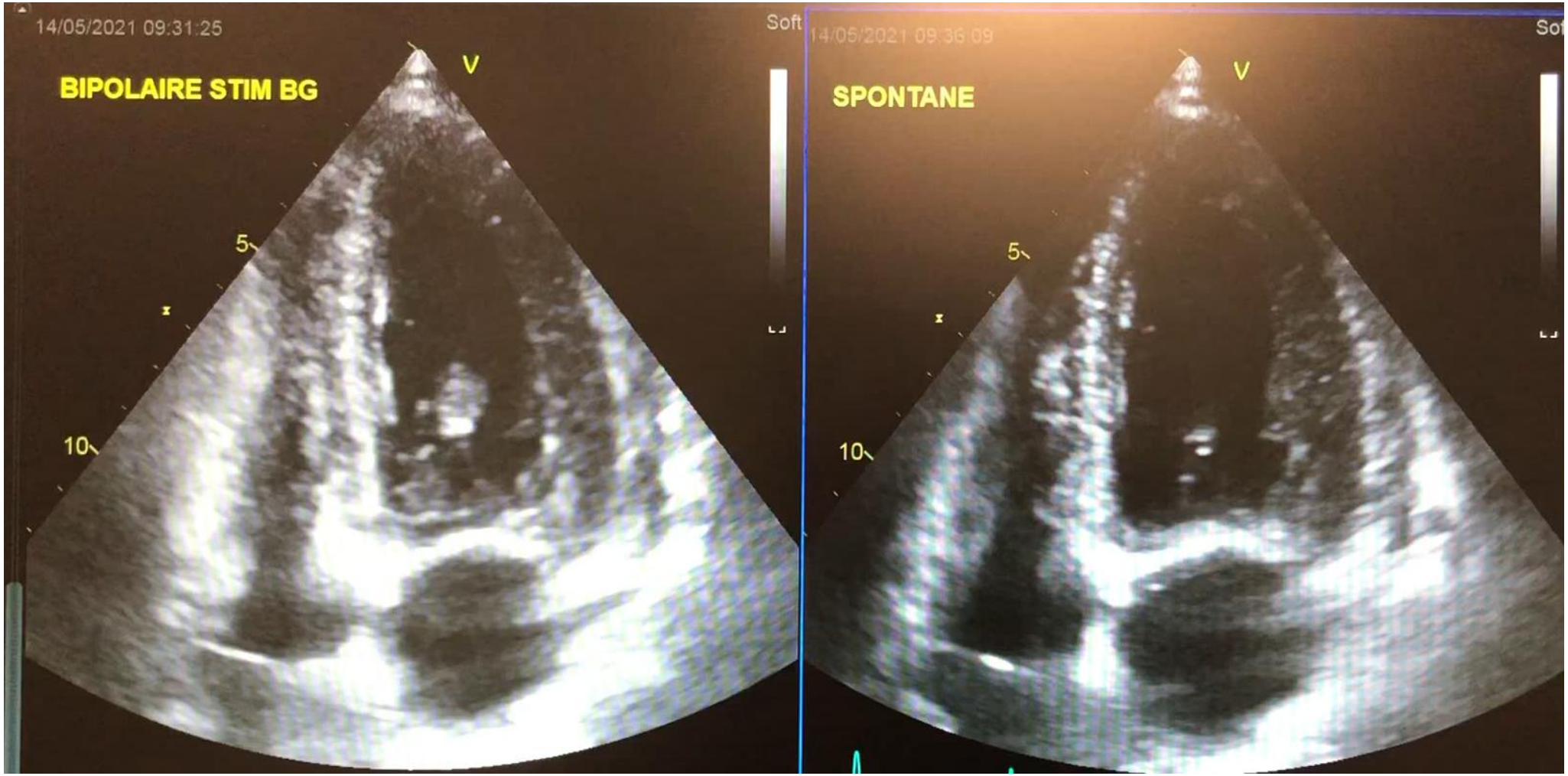
# Exemple

- LBBAP correcting LBBB



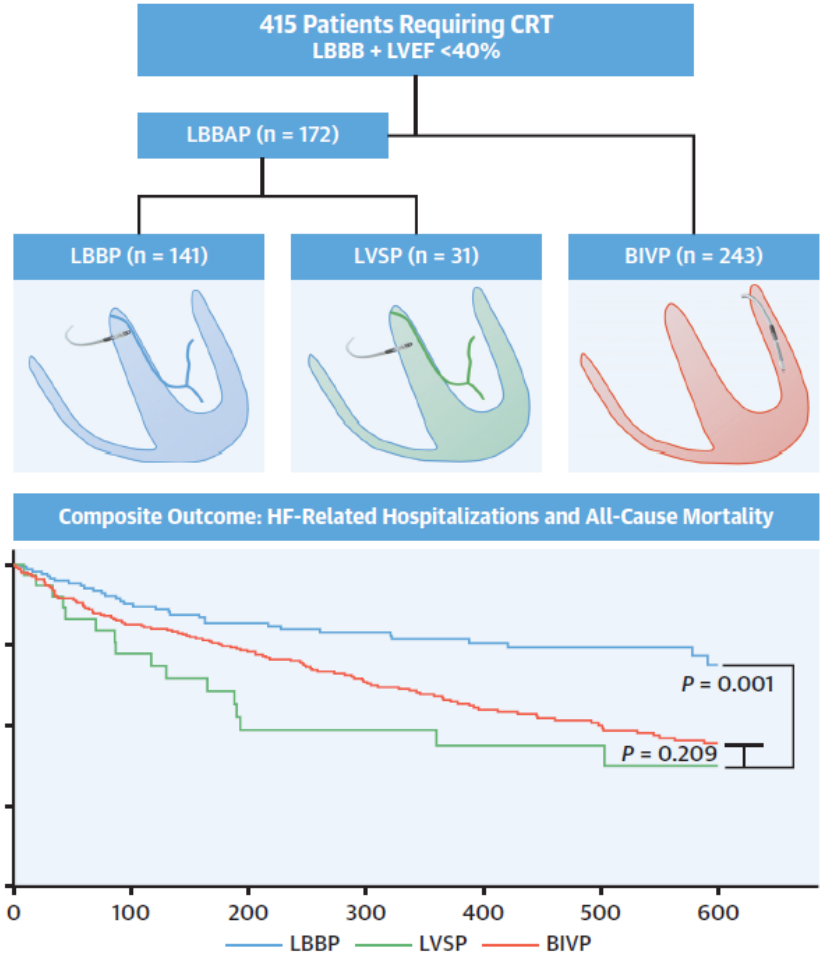



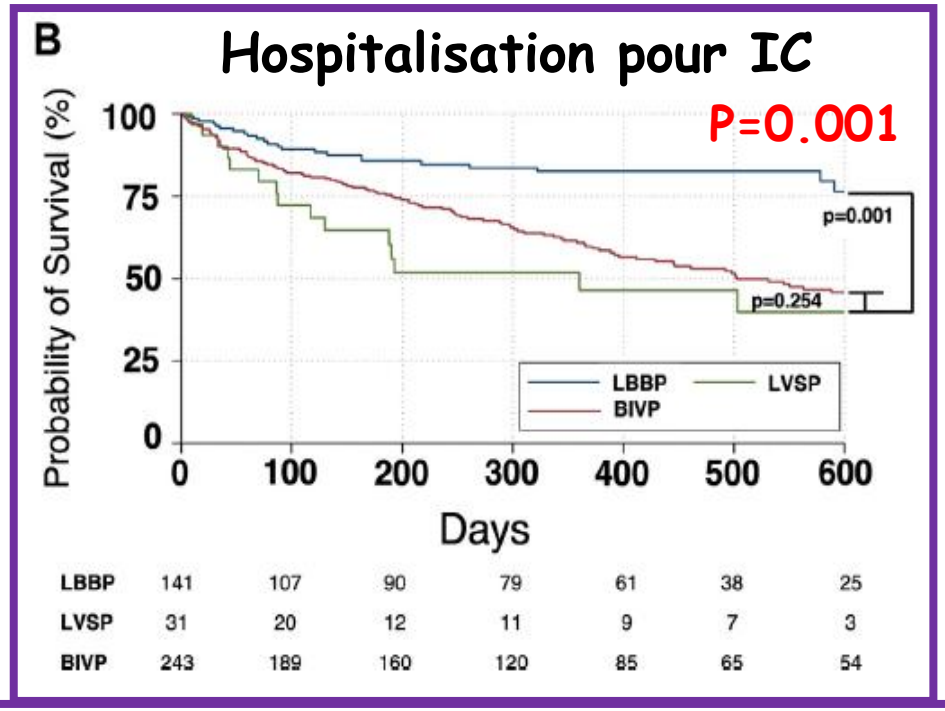
# Exemple (suite)



# Considérations techniques de la SABG dans la CRT

## SBG vs. SSG vs. BiV: Étude observationnelle prospective




### Mortalité toutes causes P=NS

| | Unadjusted HR (95% CI) | P Value | Adjusted HR (95% CI) | P Value |
|---|---|---|---|---|
| LBBP vs LVSP | 0.63 (0.25-1.61) | 0.33 | 0.63 (0.24-1.64) | 0.34 |
| LBBP vs BIVP | 0.89 (0.49-1.6) | 0.69 | 0.71 (0.39-1.3) | 0.26 |
| LVSP vs BIVP | 1.42 (0.6-3.37) | 0.43 | 1.14 (0.46-2.82) | 0.78 |

Diaz JC et al. JACC EP 2024;10:295-305

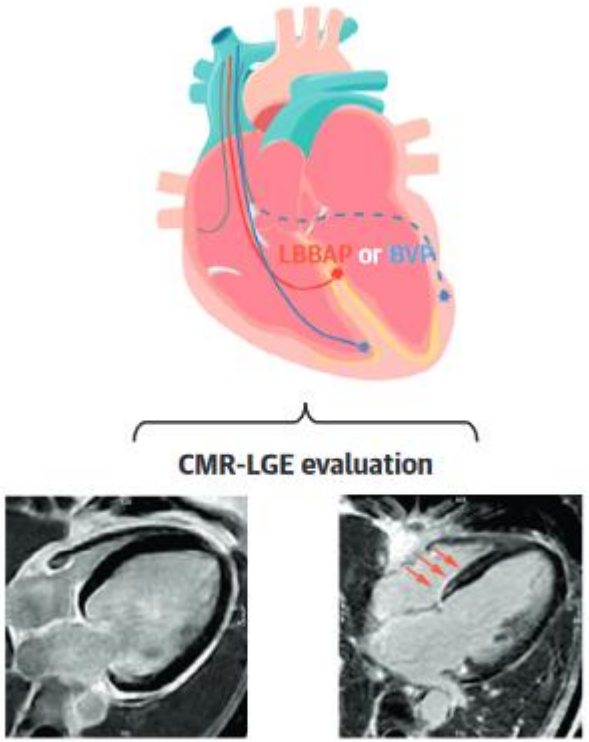
# Dilatation VG, facteur d'échec de SBG ?

| | All (n = 415) | LBBP (n = 141) | LVSP (n = 31) | BIVP (n = 243) | P Value LBBP vs LVSP | P Value LBBP vs BIVP | P Value LVSP vs BIVP |
|---|---|---|---|---|---|---|---|
| Age, y | 69.6 ± 11.3 | 69.2 ± 10.3 | 70.2 ± 11.9 | 68.8 ± 11.8 | 0.653 | 0.346 | 0.857 |
| Female | 125 (30.1) | 49 (34.8) | 5 (16.1) | 71 (29.2) | 0.054 | 0.304 | 0.141 |
| NICM | 253 (61) | 91 (64.5) | 19 (61.3) | 143 (58.8) | 0.837 | 0.28 | 0.848 |
| HTN | 311 (74.9) | 109 (77.3) | 21 (67.7) | 191 (74.5) | 0.258 | 0.623 | 0.515 |
| DM | 175 (42.2) | 66 (46.8) | 11 (35.5) | 98 (40.3) | 0.319 | 0.24 | 0.699 |
| AF | 206 (49.6) | 65 (46.1) | 19 (61.3) | 122 (50.2) | 0.165 | 0.46 | 0.259 |
| CAD | 173 (41.7) | 51 (36.2) | 11 (35.5) | 111 (45.7) | 1.0 | 0.086 | 0.339 |
| BB use | 369 (88.9) | 128 (90.8) | 26 (83.9) | 215 (88.5) | 0.327 | 0.607 | 0.555 |
| ACEI/ARB | 173 (41.7) | 59 (41.8) | 11 (35.5) | 103 (42.4) | 0.551 | 1.0 | 0.563 |
| ARNI | 131 (31.6) | 58 (41.1) | 8 (25.8) | 65 (26.7) | 0.153 | **0.005** | 1.0 |
| Spironolactone | 206 (49.6) | 77 (54.6) | 14 (45.2) | 115 (47.3) | 0.427 | 0.204 | 0.851 |
| Digoxin | 28 (6.7) | 5 (3.5) | 1 (3.2) | 22 (9.1) | 1.0 | 0.06 | 0.489 |
| LVEF, % | 26.2 ± 7.7 | 25.4 ± 8.4 | 25.4 ± 8.5 | 26.7 ± 7.8 | 0.937 | 0.151 | 0.329 |
| LVEDD, mm | 59 (54-65) | 60 (53-65) | 66 (54.5-74) | 59 (54-64) | **0.019** | 0.594 | **0.009** |
| Preprocedural NYHA functional class | 2.74 ± 0.6 | 2.9 ± 0.6 | 2.83 ± 0.8 | 2.6 ± 0.6 | 0.602 | **<0.001** | 0.165 |
| NYHA functional class ≥III | 286 (69.92) | 113 (80.1) | 20 (64.5) | 153 (63) | 0.060 | **<0.001** | 0.866 |
| Preprocedural QRS | 160 (146-180) | 160 (150-184) | 165 (130.5-199.3) | 160 (144-176) | 0.532 | 0.231 | 0.314 |

*Diaz JC et al. JACC EP 2024;10:295-305*

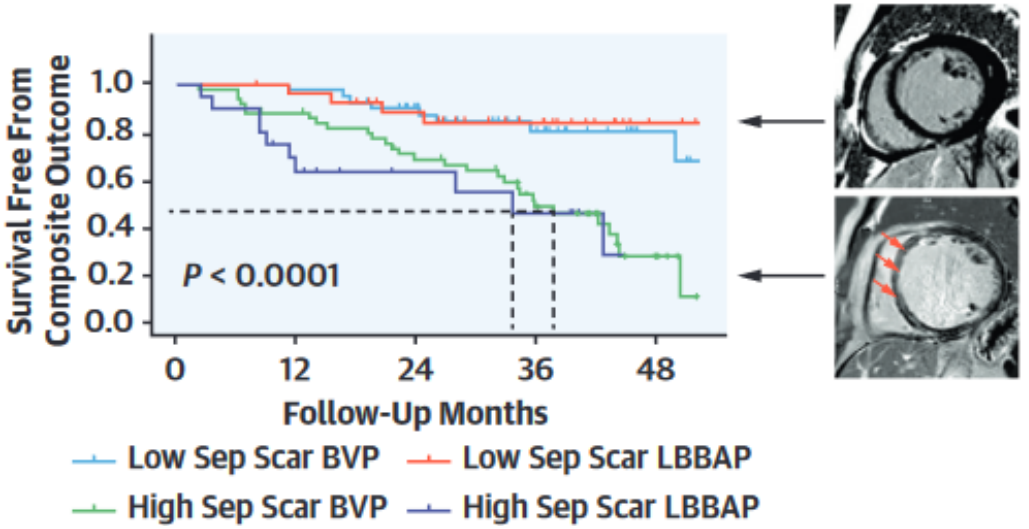
# Interaction entre stratégie de CRT et fibrose septale

- CMD non ischémique avec IRM pré-implantation
- Étude rétrospective : 51 SABG et 96 BiV



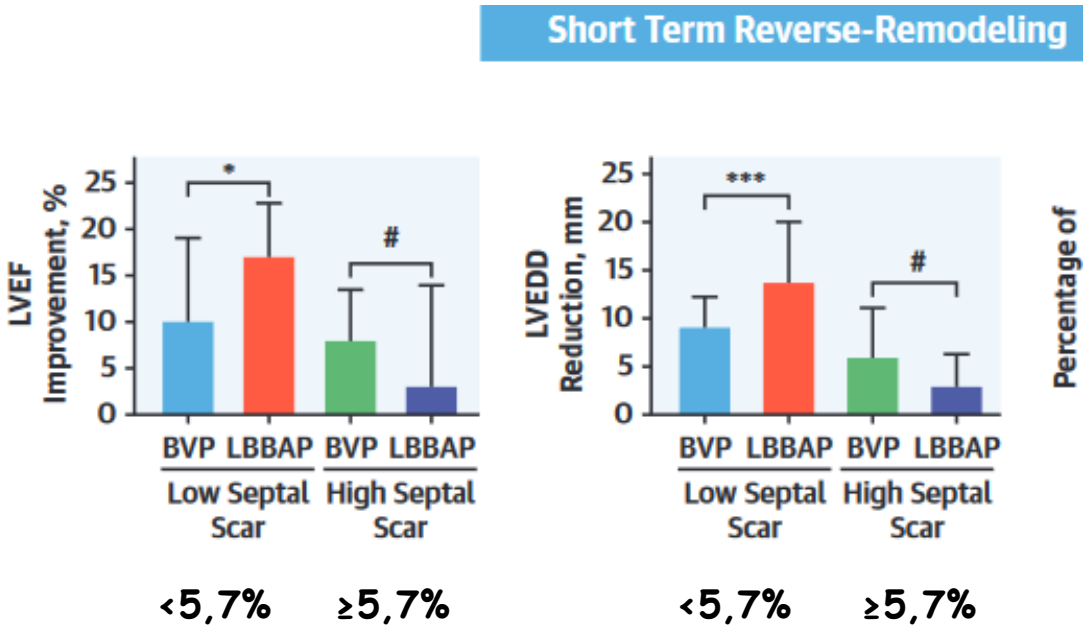

Long-Term Prognosis

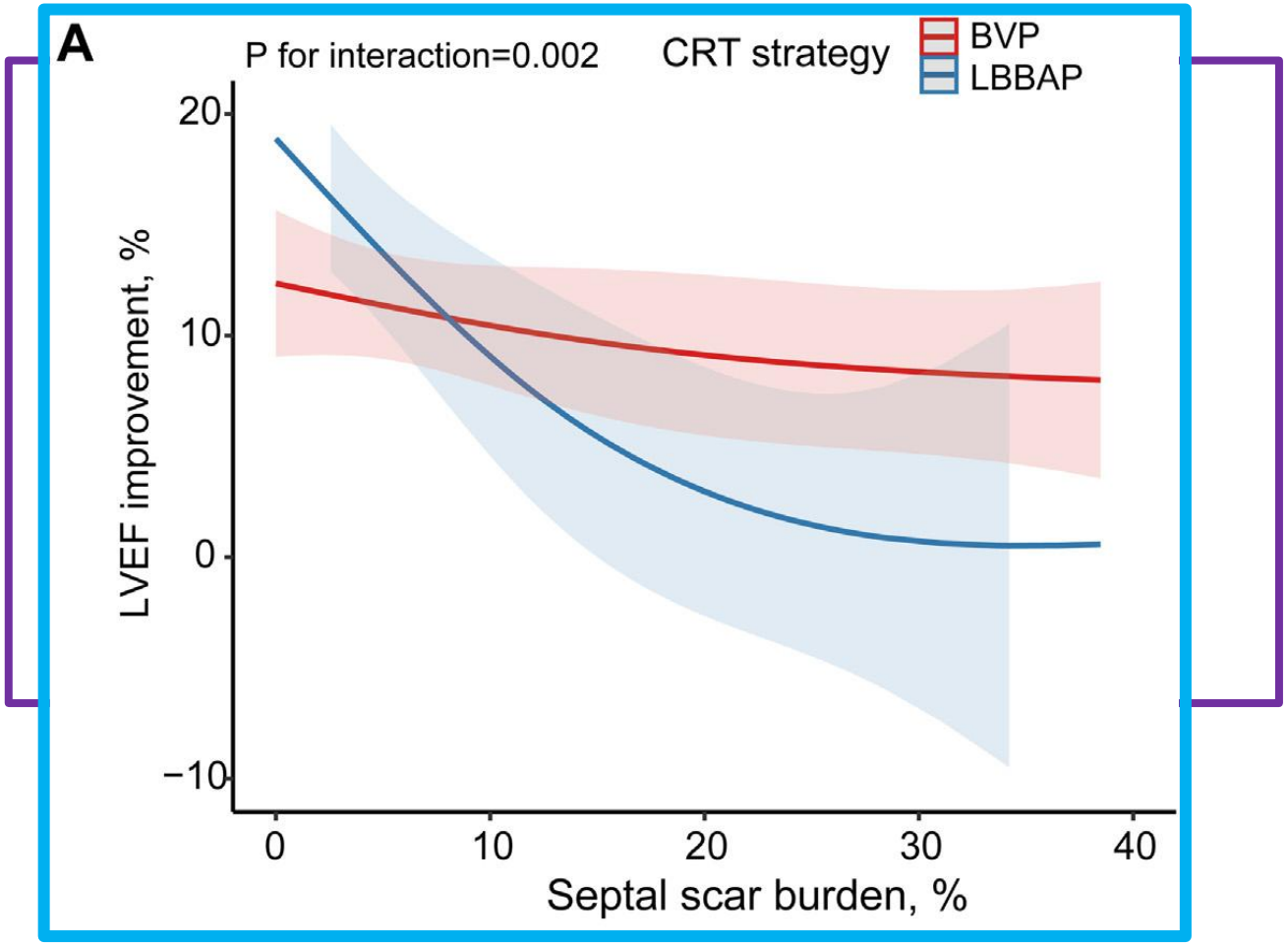
Mortalité totale
Hospitalisation pour IC
VT/FV




*Chen Z et al. JACC EP 2024*

# Interaction entre stratégie de CRT et fibrose septale



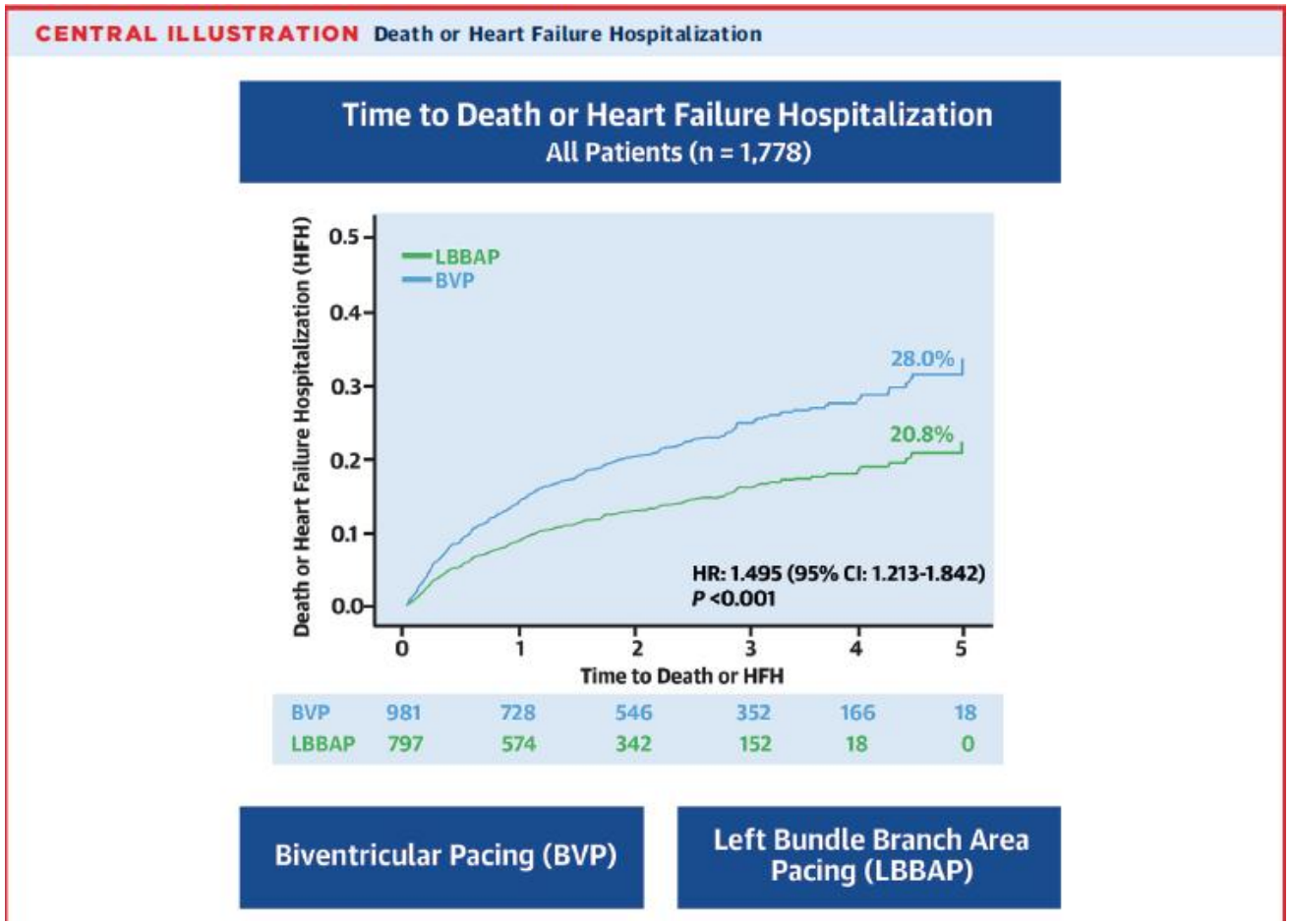



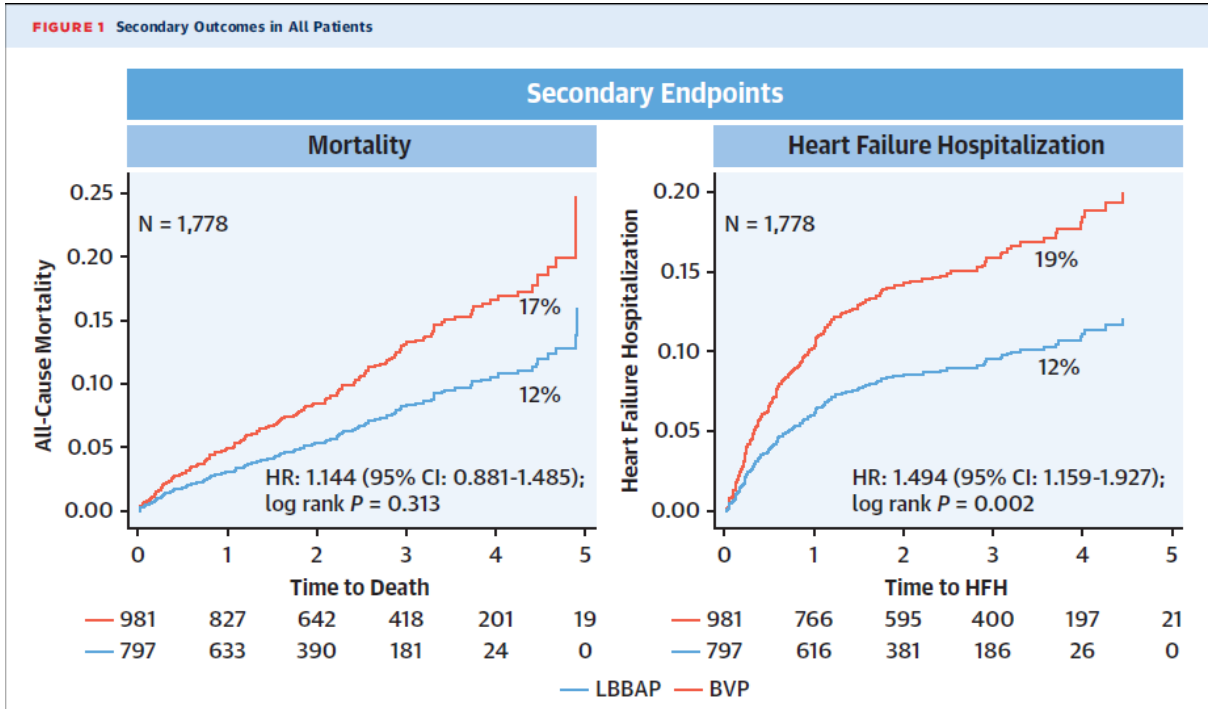

*Chen Z et al. JACC EP 2024*

# État de la littérature

## Comparison of Left Bundle Branch Area Pacing and Biventricular Pacing in Candidates for Resynchronization Therapy

- **Rétrospective**
- **Stratégie laissée au choix de l'opérateur**




*Vijayaraman P, et al. JACC 2023;82:228-241*

# Comparison of Left Bundle Branch Area Pacing and Biventricular Pacing in Candidates for Resynchronization Therapy

- Population identique ?
  - >FA et amiodarone
  - >Homme
  - > LVEDD
  - < FEVG

  dans le gr. BiV

- Pas de score de propension effectué

- Uniquement les patients avec succès de procédure !

Sonde G dans une veine lat

- RWPT<90 ms
- Critères de transition
- Onde R en V1

Gr BiV

Gr SABG

failed. Among patients with LBBAP, 144 (18%) received a coronary sinus (CS) lead in addition to LBBAP, 69 (8.6%) LOT-CRT, and 75 (9.4%) an LV lead as back-up. Overall, both groups were well matched,

*Vijayaraman P, et al. JACC 2023;82:228-241*

# Randomized studies on CSP for CRT

| Study | Year | Design | Initial Allocation (n) | Final allocation (n) | Mean FU (months) | Primary outcome | Results | P value | Secondary outcomes |
|---|---|---|---|---|---|---|---|---|---|
| Upadhyay et al. His-Sync | 2019 | prospective | BVP 20 HBP 21 | BVP 24 HBP 16 | 6 | QRS duration, ↑LVEF, time to CV hospitalization | BVP 152±30 ms HBP 144±30 ms | 0.42 | ↑LVEF |
| Vinther M. et al. His-Alternative | 2022 | prospective | BVP 25 HBP 25 | BVP 31 HBP 19 | 6 | % implant success rate | BVP 96% HBP 72% | - | ↑LVEF ↑NYHA |
| Huang W. et al. ALTERNATIVE-AF | 2022 | crossover | HBP + CS lead 50 | HBP + CS lead 38 | 9 | % change LVEF | BVP +16.7% HBP +21.3% | 0.015 | ↓LVEDD ↑NYHA ↓BNP |
| Whitnett ZI. et al. HOPE HF | 2022 | crossover | HBP 177 | HBP 167 | 6 | Peak $VO_2$ | +0.25 ml/kg/min | 0.3 | ↑QoL |
| Wang Y. et al. LBBP RESYNC | 2022 | prospective | BVP 20 LBBAP 20 | BVP 18 LBBAP 22 | 6 | difference LVEF improvement | 5.6% favouring LBBAP | 0.039 | ↓LVEDV ↓NT-proBNP |
| Pujol-López M. et al. LEVEL-AT | 2022 | prospective | BVP 35 CSP 35 | BVP 40 CSP 29 | 6 | change in LV activation time | BVP -28 ms CSP -21 ms | <0.001 for non-inferiority | ↓LVEDV |
| Vijayaraman P. et al. HOTCRT | 2023 | prospective | BVP 50 LBBAP 50 | BVP 43 LBBAP 54 | 6 | % change LVEF | BVP +8% HBP +12.4% | 0.02 | no difference in QRSd. LVEF, LVEDV, 6MWD, QoL |
| Pujol-López M. et al. CONSYST-CRT | 2025 | prospective, non-inferiorrity | BVP 67 HBP/LBBAP 67 | BVP 67 HBP/LBBAP 67 | 12 | Combined all-cause mortality, cardiac transplant, HFH, LVEF improvement < 5 points | BVP 29.8% HBP/LBBAP 23.9% | 0.02 | NI for echo response, NYHA class and QRS duration |
| Xen X. et al. HeartSync-LBBP | 2025 | prospective | BVP 100 LBBP 100 | BVP 100 LBBP 100 | 36 | All cause mortality and HF | BVP 32% LBBP 8% | <0.01 | ↑super-response rate for LBBP |
| Zizek. D. et al. CSP-SYNC | 2025 | prospective | BVP 31 LBBAP 31 | BVP 31 LBBAP 31 | 12 | Change in LVEF | BVP: ↑14% LBBAP: ↑8.5% | <0.001 for non inferiority | no difference in LVEF, LVESV, 6MWD, QoL, NT-proBNP |

# PHYSIO SYNC HF

- **Design:**

- étude randomisée multicentrique brésilienne

- Étude de non infériorité CSP vs BiV en intention de traiter sur des patients indiqués classe I pour la resynchronisation

- **Population:**

- 173 pts randomisés, âge moyen 62 ans, 50% femme, 2/3 cardiomyopathie dilatée, FE 26%, QRS 180 ms, ***BBG typique 97%***

- **Critères primaires**:

- DC, hospitalisation HF, Cs urgente HF, modification FEVG à M 12

- **Caractéristiques de la population SABG:**

- Procédures LBBAP 66%, stimulation hisienne 2%, ***septal profond 18%,*** LOT CRT 8%, 8-9% crossover dans les 2 groupes

***Zimmerman et Al, presented at the 2025 ESC congress***

# Trial design

Clinicaltrials.gov: NCT05572736

Symptomatic HF (NYHA II-III)
LVEF ≤35%
LBBB (QRS ≥130 ms)

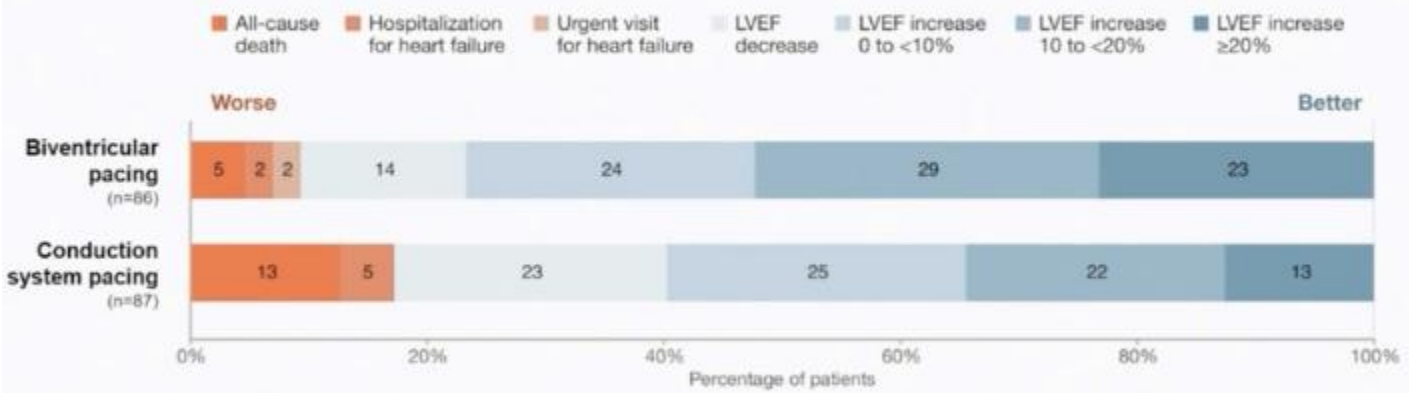
Key exclusion: plan to receive an ICD

1:1

- Conduction system pacing
  Left bundle → His bundle → deep septal → coronary sinus
- Biventricular pacing

Primary hierarchical endpoint:
- Death
- Hospitalization for HF
- Urgent visit for HF
- Change in LVEF at 12 months

# Primary endpoint




**Odds ratio, 2.36 (95% CI 1.37–4.06)**

p=0.99 for non-inferiority of conduction system pacing
p=0.002 for between-group difference favoring biventricular pacing

Assessed at 12 months.

**- BiV > SABG sur les critères décès, insuffisance cardiaque et remodelage ventriculaire.**

# Résumé

- **SABG**
  - technique la plus physiologique
  - Technique "simple" associée à peu de complications
  - Bénéfices potentiels en terme longévité de batterie et de coût
  - critères bien définis permet de basculer vers le BiV si nécessaire

- **BiV**
  - technique la plus solide sur le plan scientifique

- **Nous devons être compétents pour les deux techniques**
- **SABG en première intention avec le BiV pour la CRT**

# Merci de votre attention

# Les raisons du choix de la SABG dans la CRT

- Stimulation BiV non physiologique
- critères de succès bien définis
- La faisabilité technique et les complications moindre
- Technique simplifiée
- Coût

# Les raisons du choix du BiV dans la CRT

- Indications et bénéfices largement démontrés par des RCT
- Peu ou pas de grandes études comparatives avec la SABG
- Technique maitrisée et outils aboutis

# Overall current evidence on CRT