

Sessione: LA CARDIONEUROABLAZIONE



I risultati della CNA bi-atriale

Andrea Saglietto, MD PhD

A.O.U. Città della Salute e della Scienza, Turin, Italy

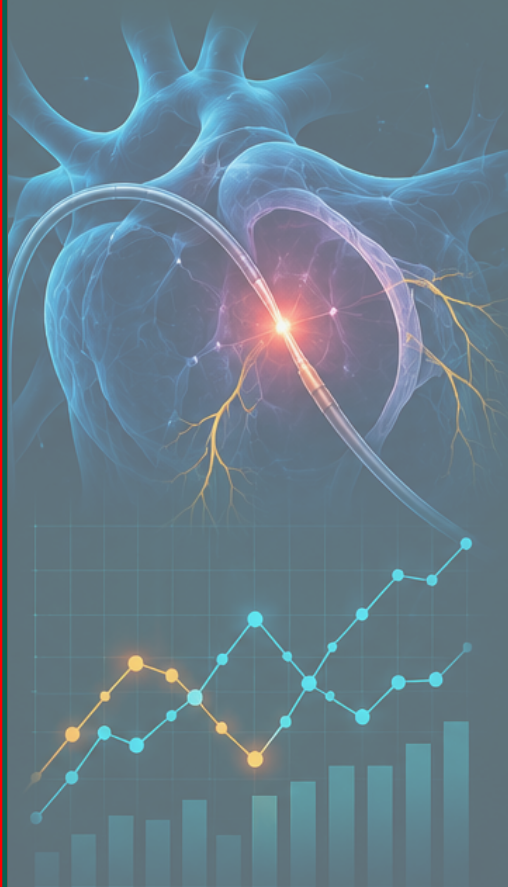




The Foundations



The Evidence



The Unanswered Questions

Optimal Targets?

Patient Selection?

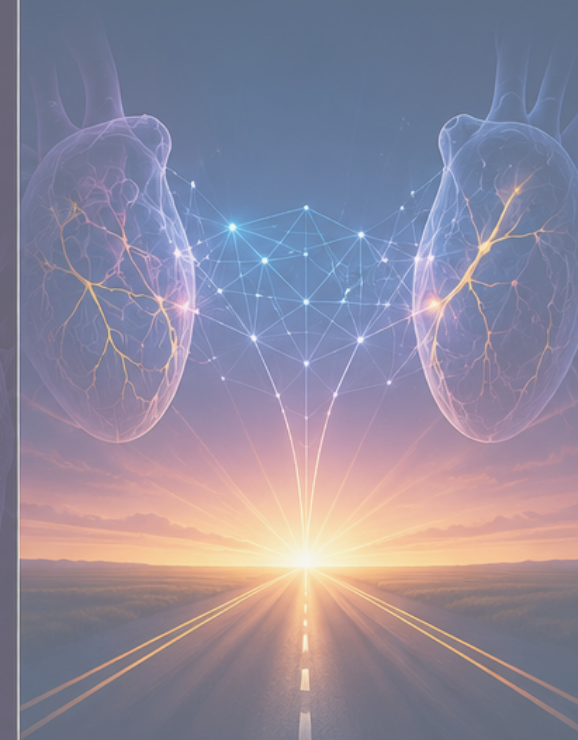


Durability?

Standardization?



The Future Directions



Personalization



Precision



Technology Integration

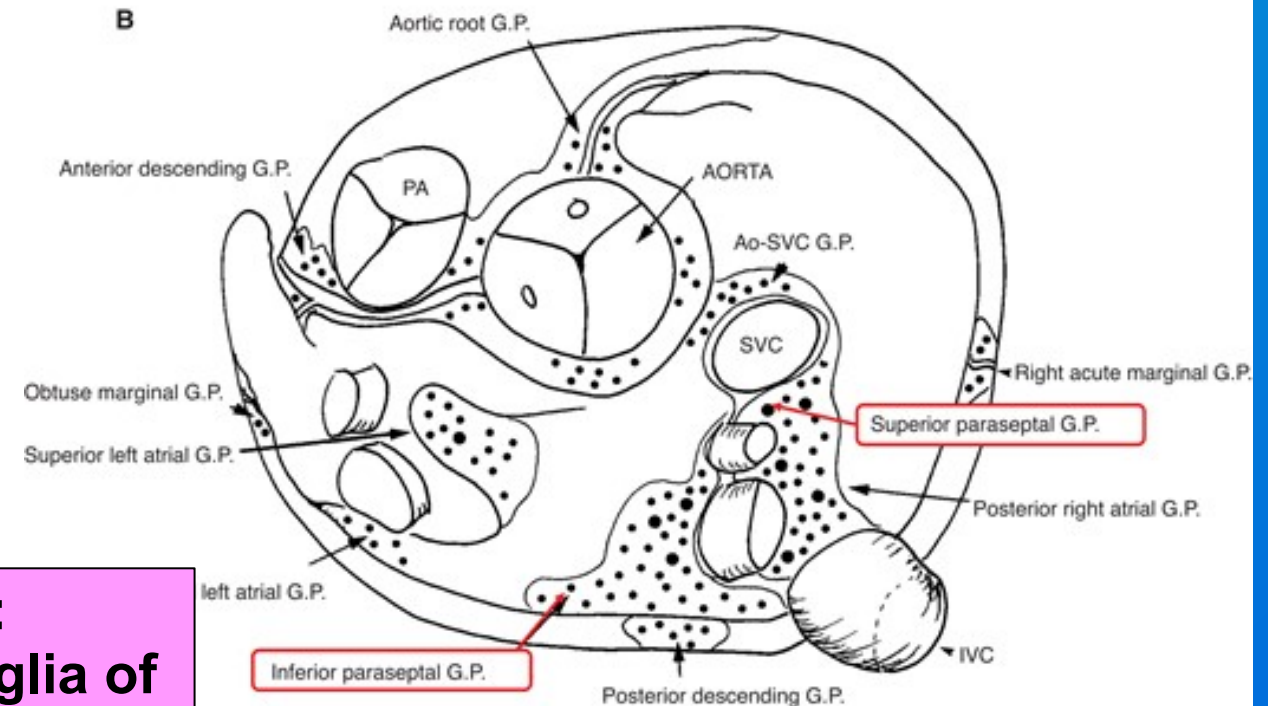
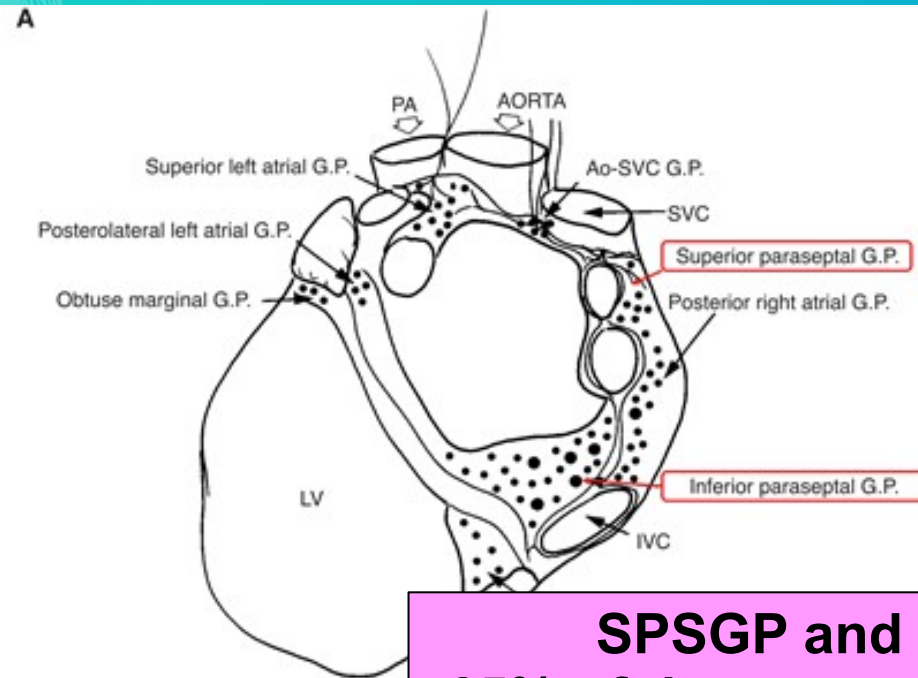


Better Outcomes

Human intrinsic cardiac nervous system

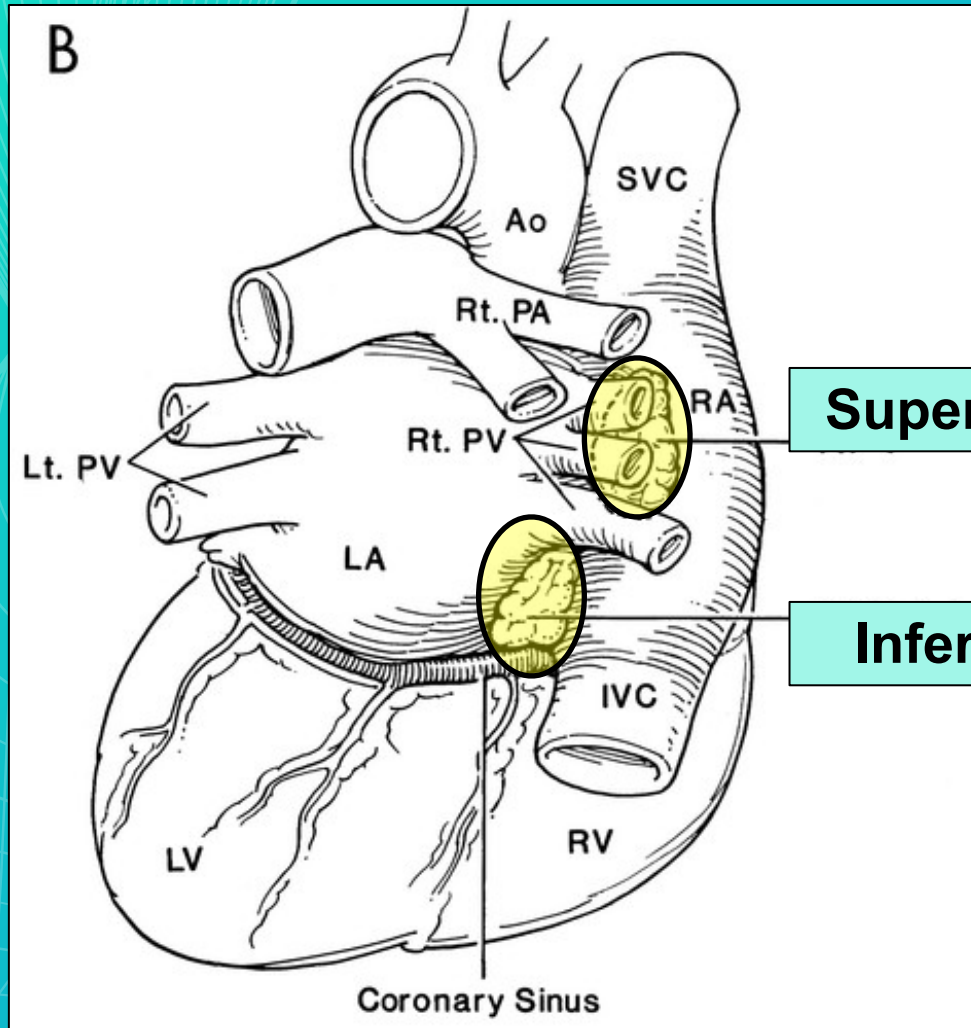
10 ganglionated plexuses:

- 5 atrial: 84% of neurons
- 5 ventricular: 16% of neurons



SPSGP and IPSGP:
65% of the neuronal ganglia of
human heart!

The two “main players”



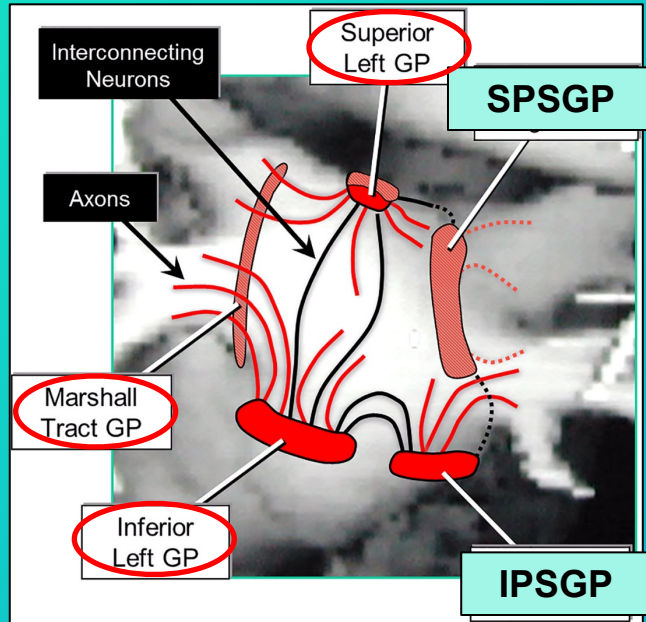
Superior paraseptal GP (SPSGP)

Inferior paraseptal GP (IPSGP)

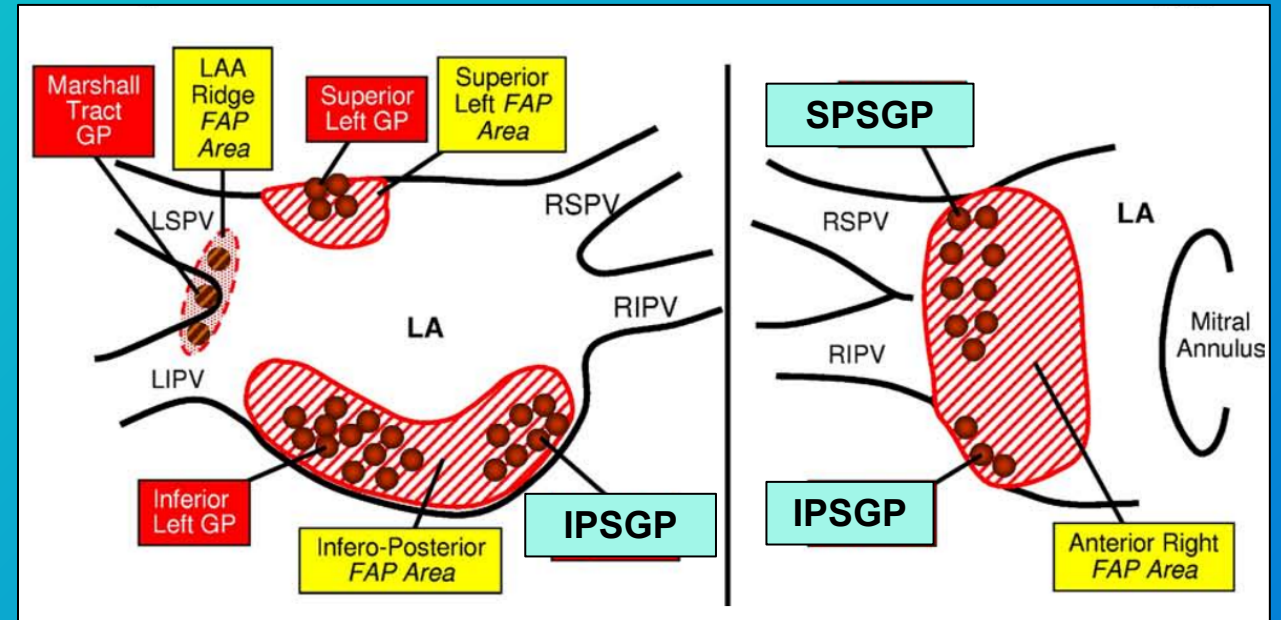
**Sinoatrial node
(SAN)**

**Atrioventricular
node
(AVN)**

The other GPs

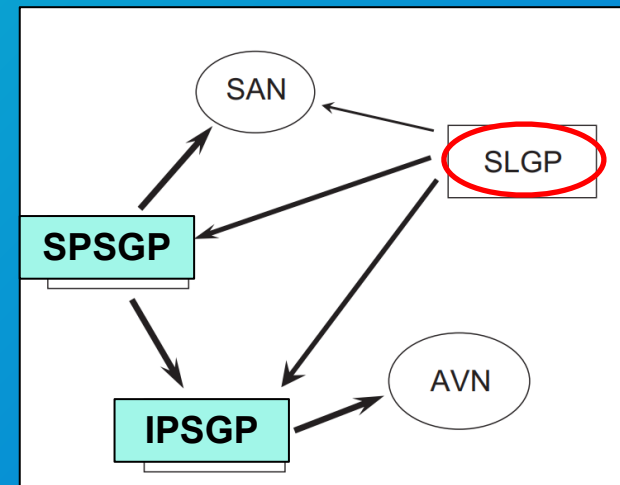


Nakagawa et al. Heart Rhythm 2009 (modified)



Nakagawa et al. Heart Rhythm 2009 (modified)

Complex interplay between the different GPs!



Hou et al. Heart Rhythm 2007 (modified)

Cardioneuroablation: the indications

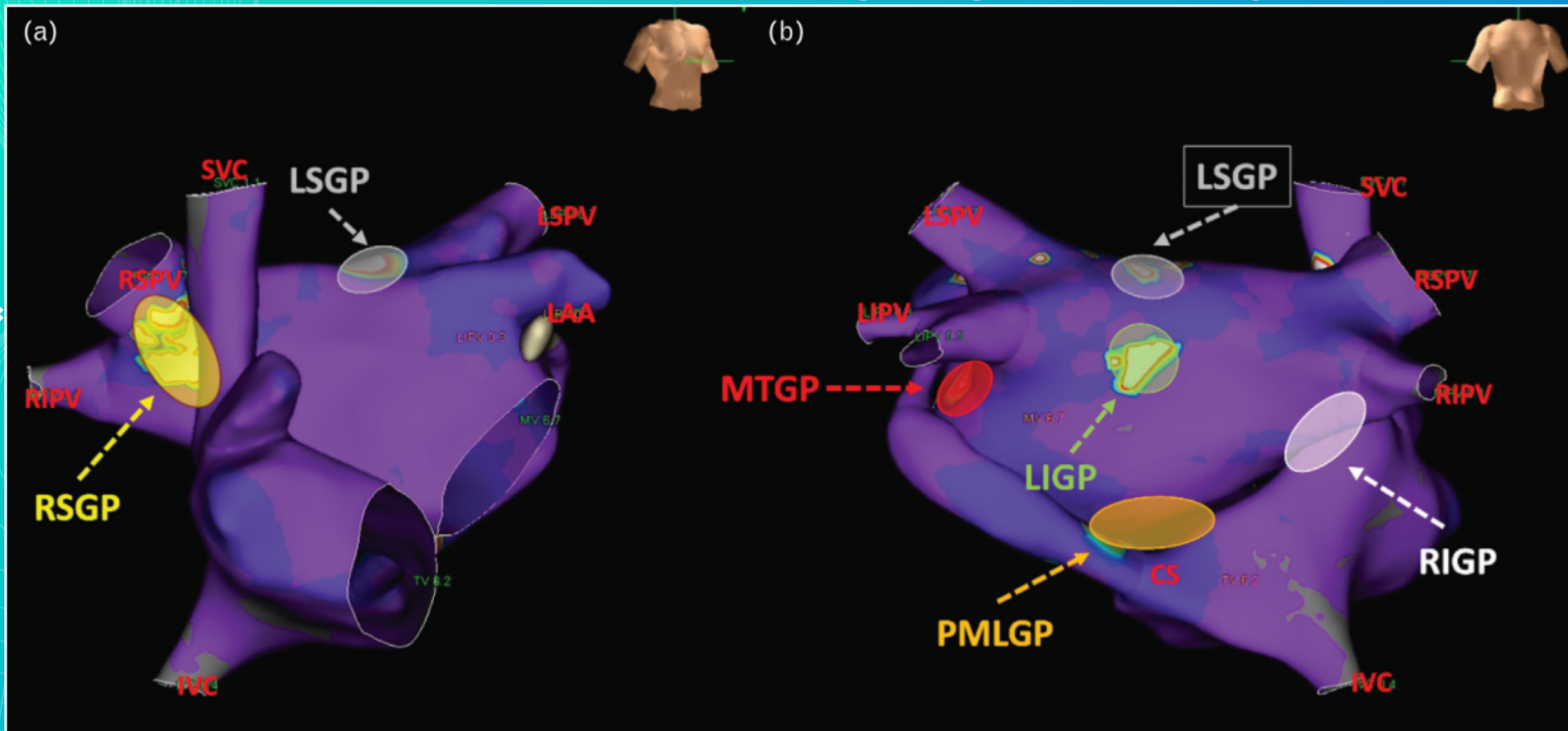
Enhanced parasympathetic phasic/tonic activity

**Cardioinhibitory
Vasovagal Syncope
(VVS)**

**Functional sinus
bradycardia**

**Functional
AV block**

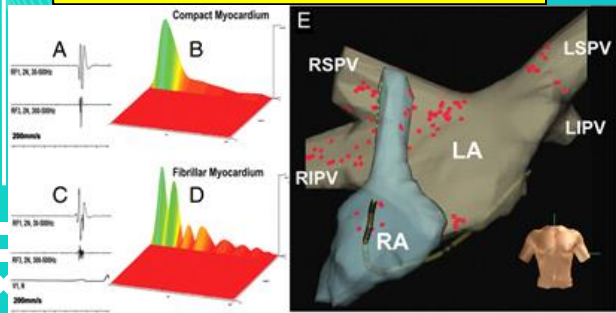
First dilemma: which ganglia to target?



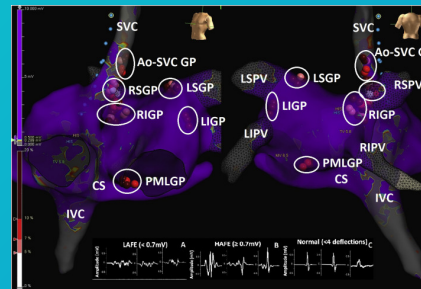
Second (related) dilemma: biatrial vs unilateral

Bilateral approaches

Historical multisite approach

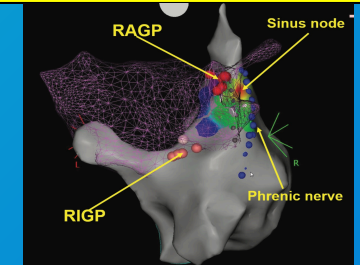


Other multisite approach



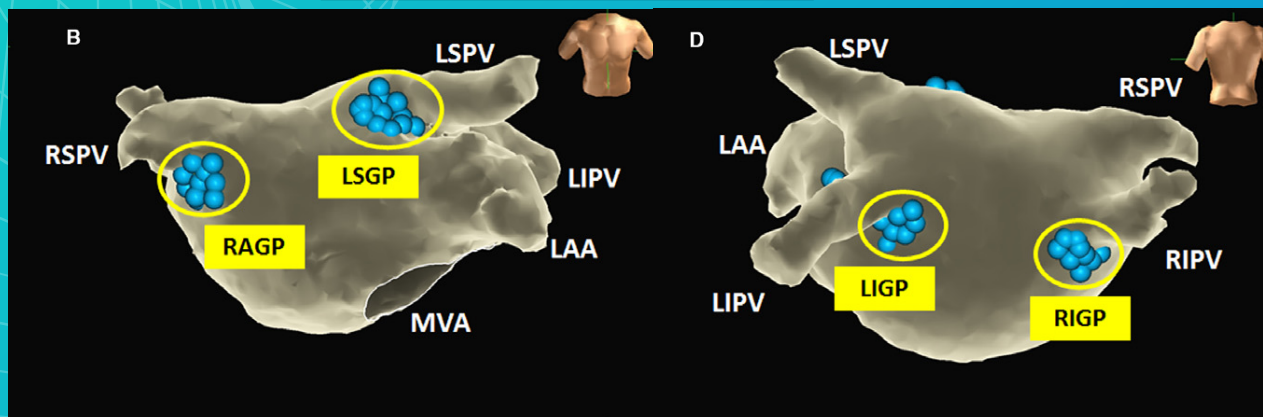
Aksu et al.
Int J Cardiol 2020

Approach targeting two sites



Unilateral approaches

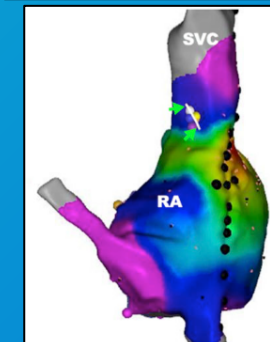
Left-sided



Sun et al. JAHA 2016

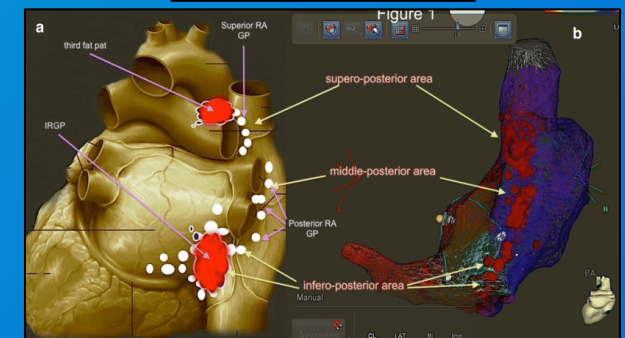
Right-sided

Unifocal



Debruyne et al. Circ EP 2018

Multifocal



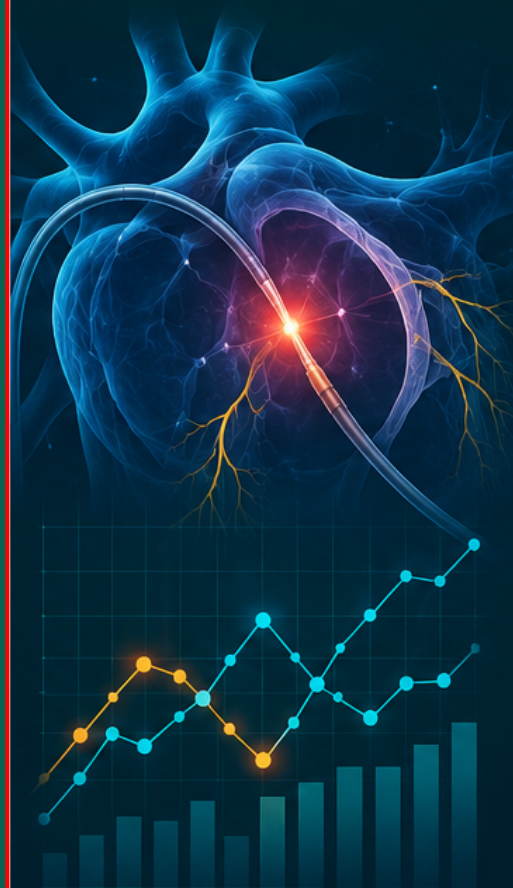
Calò et al. J Int Cardi EP 2021



The Foundations



The Evidence



The Unanswered Questions

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Patient Selection?

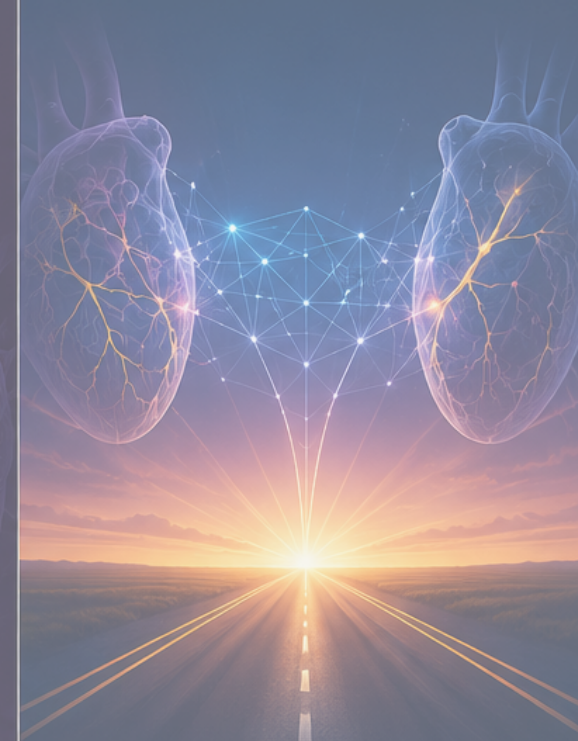


Durability?

Standardization?



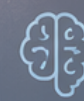
The Future Directions



Personalization



Precision



Technology Integration



Better Outcomes

Rationale of biatrial ablation

Enables the targeting of **more** GPs

Right side-only

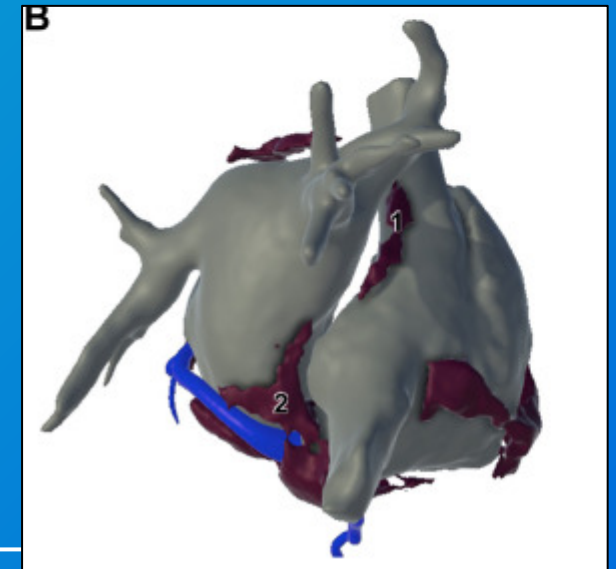
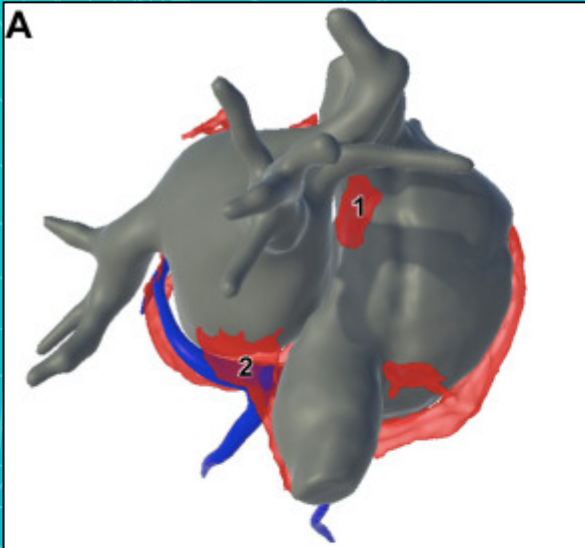
- SPSGP
- IPSGP

Biatrial

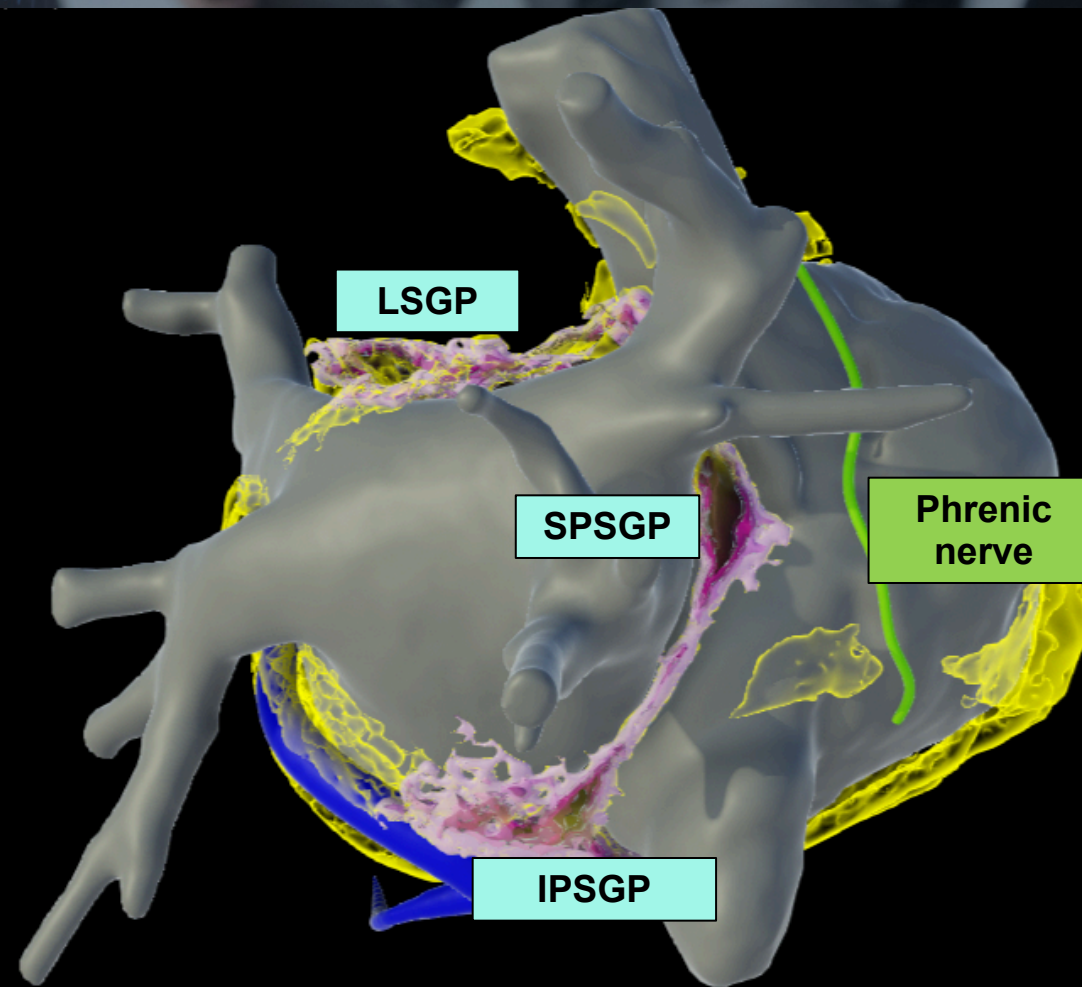
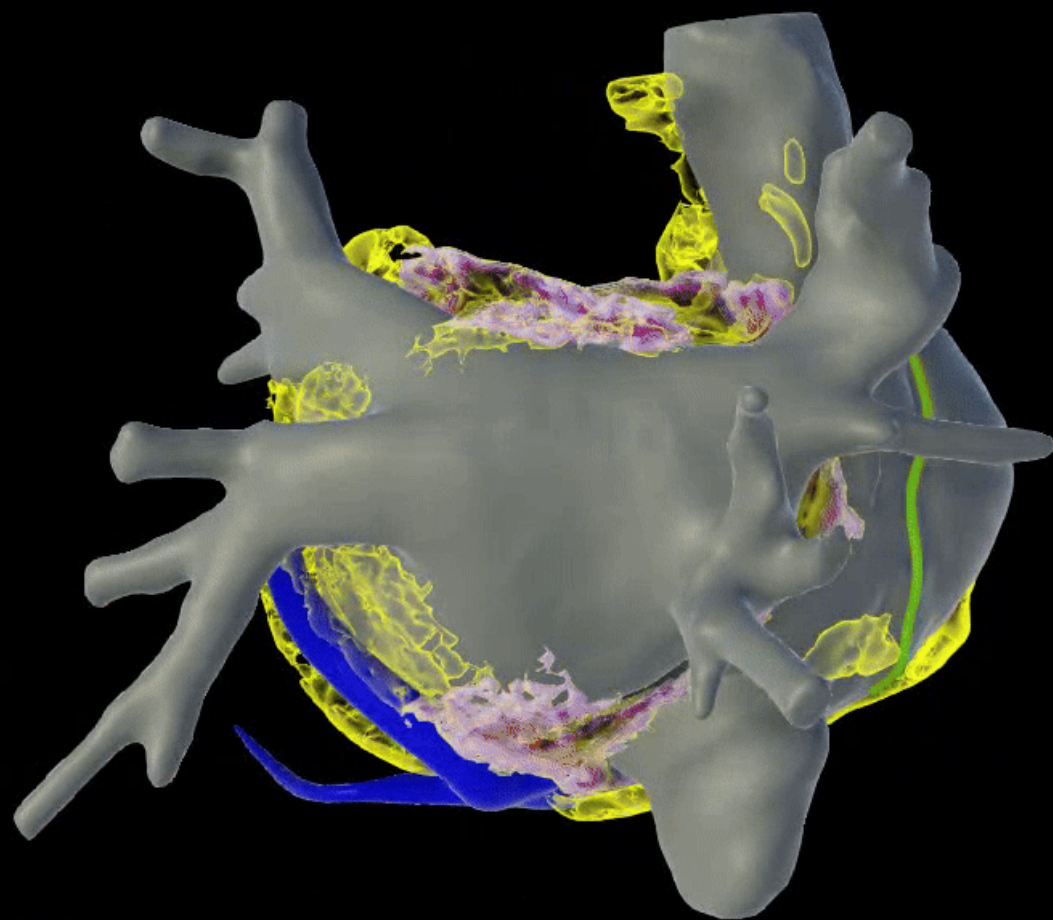
- SPSGP
- IPSGP
- **LSGP**
- **MTGP**

«Sandwich» ablation of
paraseptal GPs

High interpatient variability!



Cardiac CT identification of putative GP sites



Biatrial CNA for reflex syncope

HeartRhythm

The Official Journal of the Heart Rhythm Society, The Cardiac Electrophysiology Society,
and The Pediatric & Congenital Electrophysiology Society



Check for updates

Cardioneuroablation in patients with vasovagal syncope: An updated systematic review and meta-analysis

Alonzo Armani Prata,^{1,7} Eric Katsuyama, MD,² Pedro Scardini,^{3,7} Vanio Antunes,^{4,7} João Granja,^{5,7}
Ana Carolina Coan,^{1,7} Christian Fukunaga,^{2,7} Juan Carlos Pachón Mateos, MD, PhD⁶

28 studies (1 RCT)

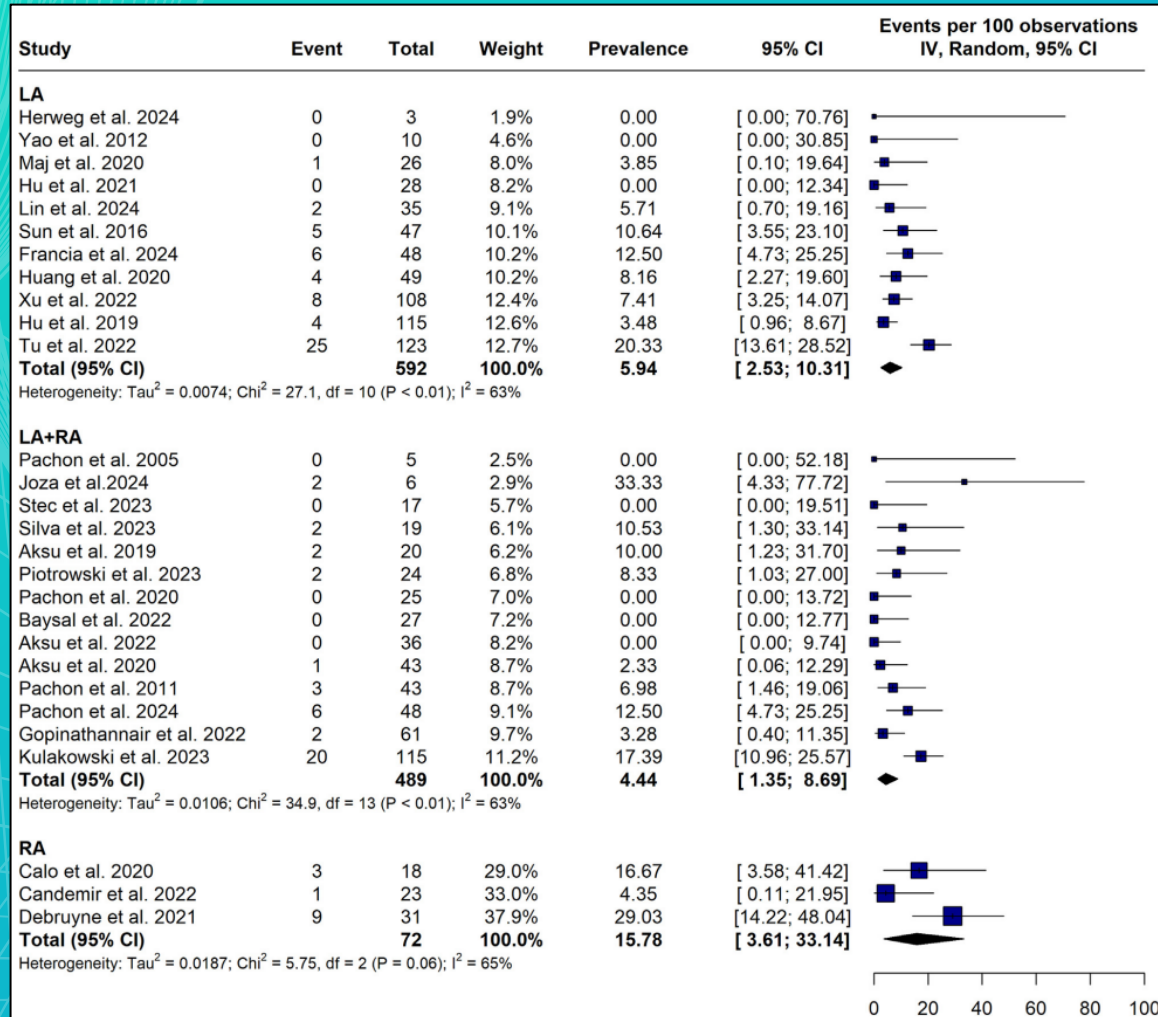
1153 pts with vasovagal syncope

Median f-up: 21 months

Table 1 Baseline patient and study characteristics

Study and year	Study design	Sample size, n	Location of ablation	Method of ablation	Age (y)	Sex: female	Syncope episodes in the previous year	HR preprocedure (beats/min)	Follow-up (mo)
Aksu et al (2019) ^{15*}	RC	12	Biatrial	EAM + fEGM	36 ± 12.8	12 (50)	NA	65 (38–82)	24
		8		EAM + HFS					
Aksu et al (2020) ^{16*†}	PC	43	Biatrial	EAM + fEGM	35.5 ± 12.2	19 (29.2)	5.5 ± 2.9	NA	15
Aksu et al (2022) ¹⁷	RC	36	Biatrial	EAM + fEGM	35.1 ± 14	19 (41.5)	6.7 ± 4	NA	8
Baysal et al (2022) ⁷	PC	27	Biatrial	EAM + fEGM	34.1 ± 14	13 (49.2)	4 (1–8.5)	74 ± 15	12
Calo et al (2021) ¹⁸	PC	18	RA	EAM + fEGM	36.9 ± 11.2	10 (55.6)	5.2 ± 1.4	59.4 ± 6.3	34.1
Candemir et al (2022) ¹⁹	PC	23	RA	Only EAM	40.7 ± 13.2	10 (43.5)	3.3 ± 1.3	66.4 ± 10.7	10
Debruyne et al (2021) ²⁰	PC	31	RA	EAM + CT	39.6 ± 19	16 (52)	13.3 ± 22.3	69.9 ± 9	12
Francia et al (2024) ²¹	PC	48	LA	EAM + CT	53.96 (NA)	23 (38.33)	NA	64.7 ± 11.4	8
Gopinathannair et al (2022) ²²	PC	61	Biatrial	EAM + fEGM	35 ± 11	25 (40.9)	6.5 ± 4	NA	12
Herweg et al (2024) ²³	RC	3	LA	Only EAM	48 ± 14.7	1 (33.3)	2.6 ± 0.6	83.3 ± 4.2	5.9
Hu et al (2019) ²⁴	RC	115	LA	EAM + HFS	42.9 ± 17.9	69 (60.3)	3.5 ± 4.4	61.3 ± 12.2	21.4
Hu et al (2021) ⁶	PC	28	LA	EAM + HFS	39.5 (NA)	20 (71.4)	4.3 ± 1.5	59.15 ± 9.6	16
Huang et al (2020) ²⁵	PC	49	LA	Only EAM	42.4 ± 16.1	27 (55.1)	NA	65.4 ± 7.3	16.4
Joza et al (2024) ²⁶	PC	6	Biatrial	EAM + fEGM + HFS	29 ± 4	4 (67)	14 ± 7.2	63.2 ± 15	13.4
Kulakowski et al (2023) ²⁷	PC	115	Biatrial	EAM + fEGM + ICE	39 ± 13	67 (58)	5 (3–5)	60 ± 14	28
Lin et al (2023) ²⁸	CC	35	LA	Only EAM	53.9 ± 13.6	21 (60)	9.6 ± 15.4	NA	12
Maj et al (2020) ²⁹	RC	26	LA	EAM + CT + ICE	37.5 ± 9	6 (23.1)	2.6 ± 0.8	57.2 (NA)	20.1
Pachon et al (2005) ³⁰	PC	5	Biatrial	EAM + SA	NA	NA	NA	NA	9.2
Pachon et al (2011) ³¹	PC	43	Biatrial	EAM + SA	32.9 ± 15	18 (41.8)	4.7 ± 2	73.6 (NA)	45.1
Pachon et al (2020) ³²	PC	25	Biatrial	EAM + SA	36.3 ± 19	12 (48)	3.8 ± 2	NA	40
Pachon et al (2024) ³³	RC	48	Biatrial	EAM + fEGM	36.4 ± 16	27 (56.2)	5 ± 2.6	59.8 ± 11.2	29.9
Piotrowski et al (2023) ⁵	RCT	24	Biatrial	EAM + fEGM + ICE	38 ± 10	13 (54.1)	3 ± 3	67 ± 10	24
Silva et al (2023) ³⁴	PC	19	Biatrial	EAM + ICE	37.8 ± 12.9	6 (32)	2.8 (NA)	NA	21
Stec et al (2023) ³⁵	PC	17	Biatrial	Only EAM	37.7 ± 1.47	8 (40)	0	NA	18
Sun et al (2016) ^{36‡}	PC	47	LA	Only EAM	43.2 ± 13/4	28 (59.6)	3 (2–5)	NA	26.4
Tu et al (2022) ³⁷	RC	123	LA	EAM + HFS	42.2 ± 17.7	69 (56.1)	3 (2–3)	69 ± 11	48
Xu et al (2022) ³⁸	RC	108	LA	EAM + HFS	51.3 ± 15.2	48 (44.4)	2.6 ± 1.8	73.7 ± 12.5	8
				Only EAM					
Yao et al (2012) ^{39‡}	PC	10	LA	EAM + HFS	50.4 ± 6.4	7 (70)	3.5 (2–20)	70.9 ± 5.4	30

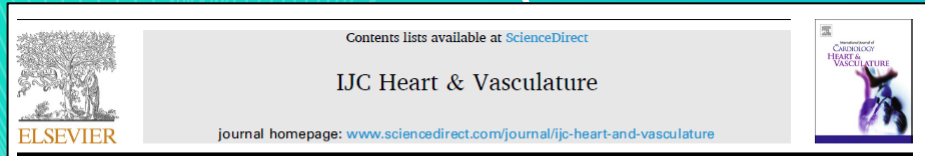
Batrial CNA for reflex syncope



Pooled efficacy:

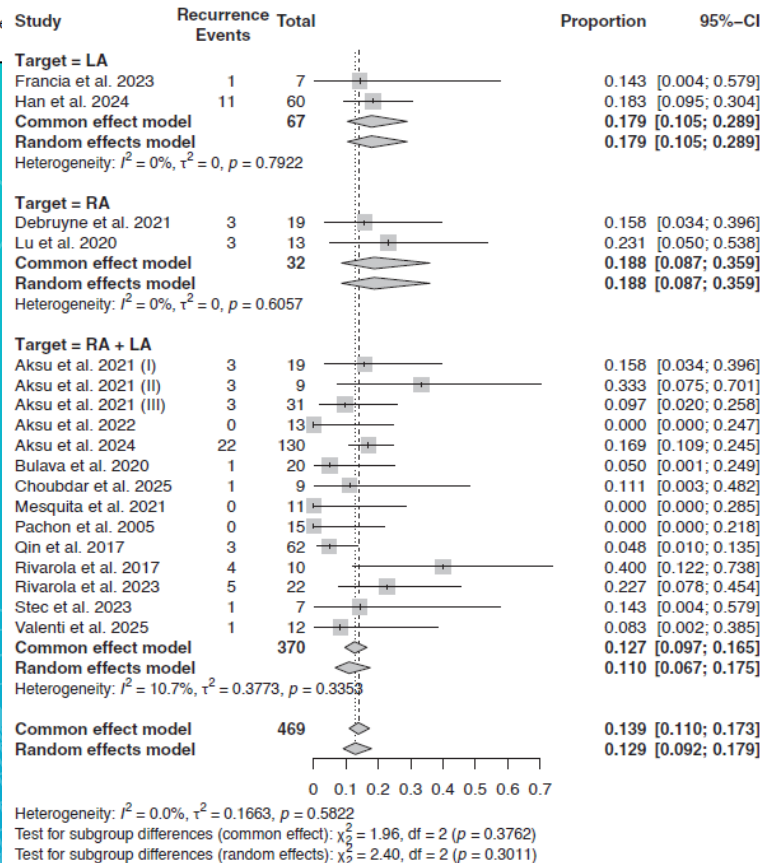
- **Batrial: 96%**
- **LA: 94%**
- **Right: 84%**

Biatrial CNA for functional bradyarrhythmias (sinus bradycardia or/AV block)



Efficacy and safety of cardioneuroablation as a treatment for patients with functional bradyarrhythmia: a systematic review and meta-analysis

Aiyue Chen^{a,1}, Tao Zhang^{a,1}, Huanling Sun^b, Bin Tu^c, Paki Lihui Zheng^{a,1}



19 studies (no RCT!)

482 pts with functional bradyarrhythmias

Mean f-up: 16 months

Pooled efficacy:

- **Biatrial: 89%**

- **LA: 82%**

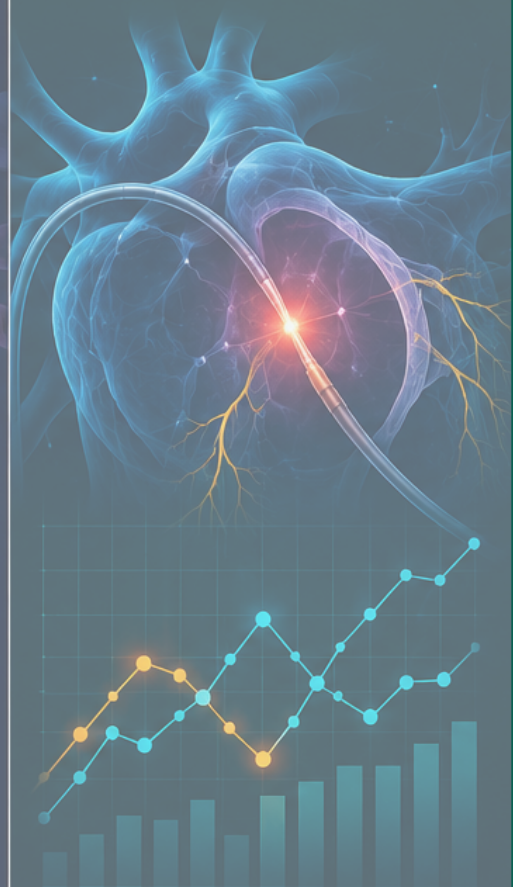
- **Right: 81%**



The Foundations



The Evidence



The Unanswered Questions

Optimal
Targets?

Patient
Selection?



Durability?

Standardization?



The Future Directions



Personalization



Precision



Technology
Integration

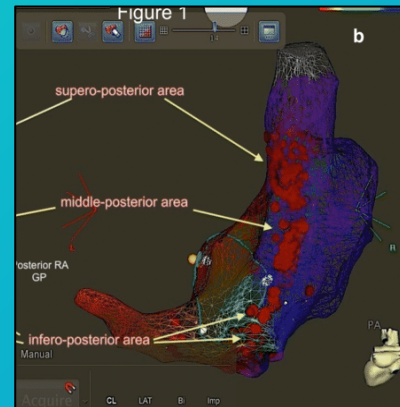
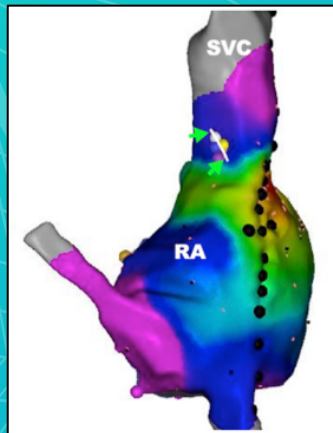


Better
Outcomes

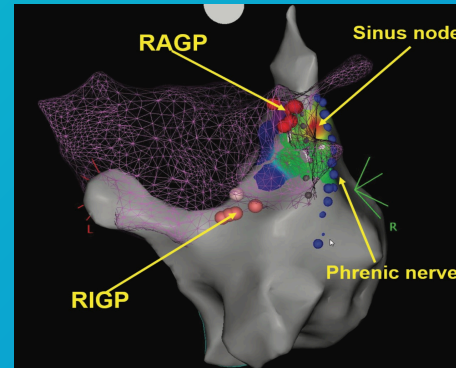
Should “biatrial” necessarily be more “extensive”?

Paraseptal GPs

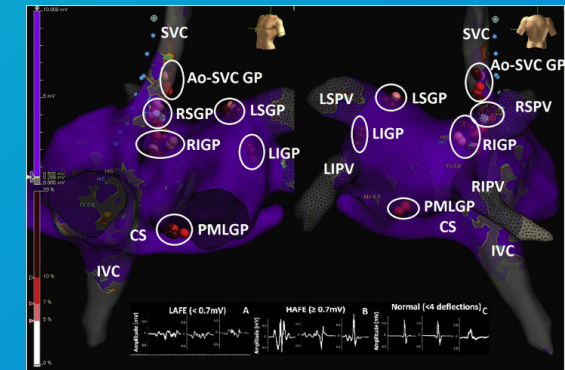
SPSGP only



Paraseptal GPs



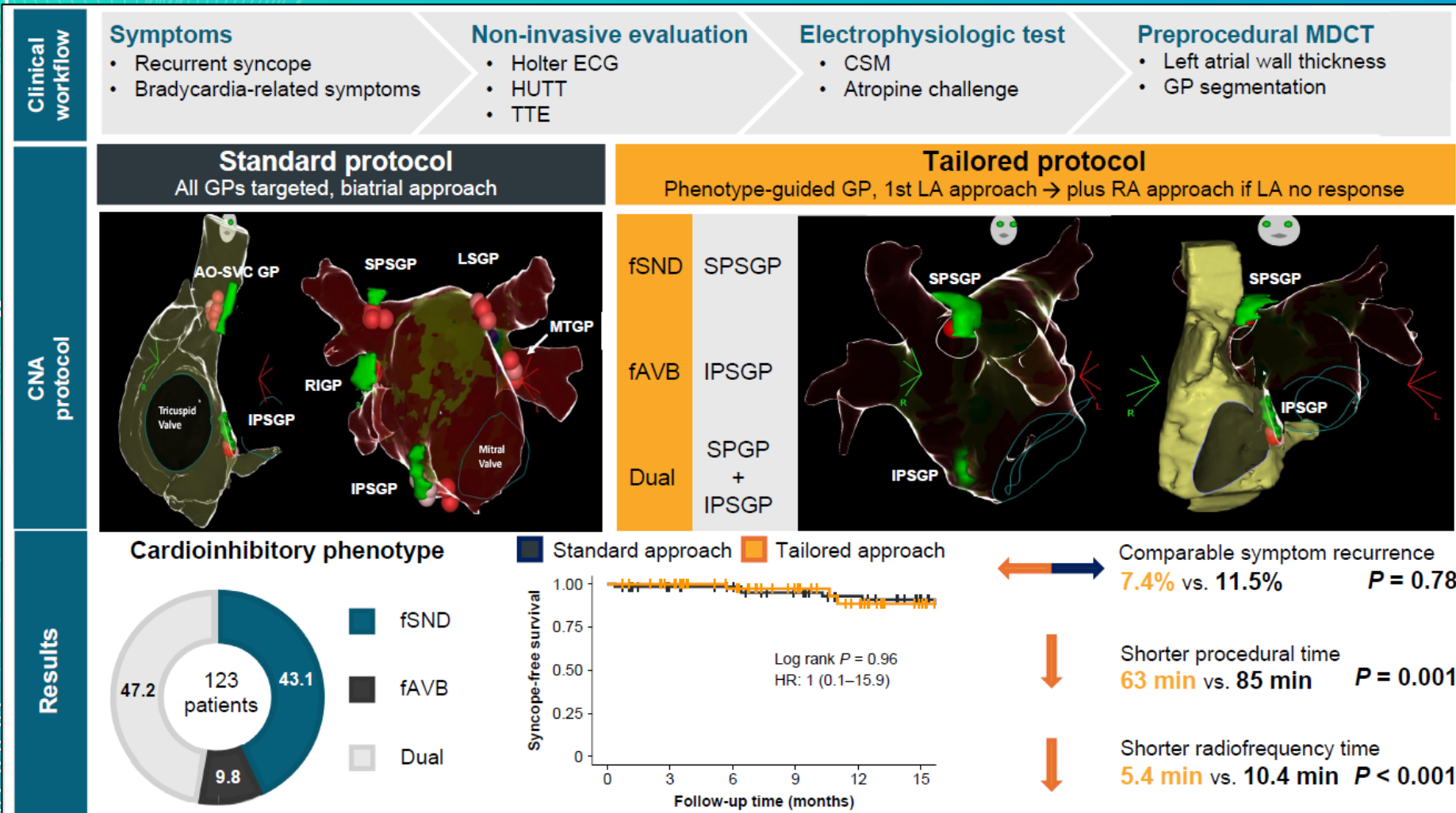
Complete set of GPs



Right atrial ablation only

Biatrial ablation

Lessons from a “tailored” approach



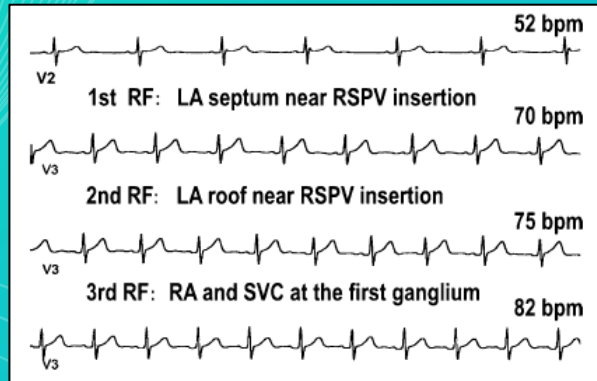
In the «tailored» group:

Necessity of biatrial ablation: **63%**

Adjunctive GP targeting: **13%**

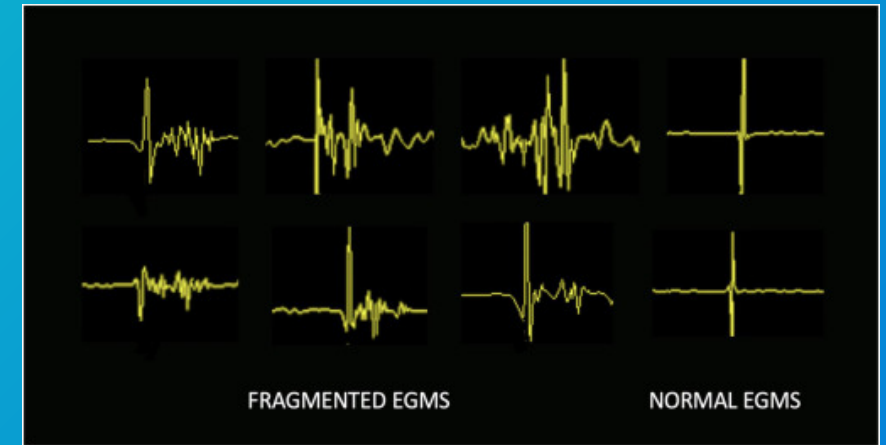
How can we define acute procedural success?

HR and AVN response



Pachon 2025

Elimination of fEGM



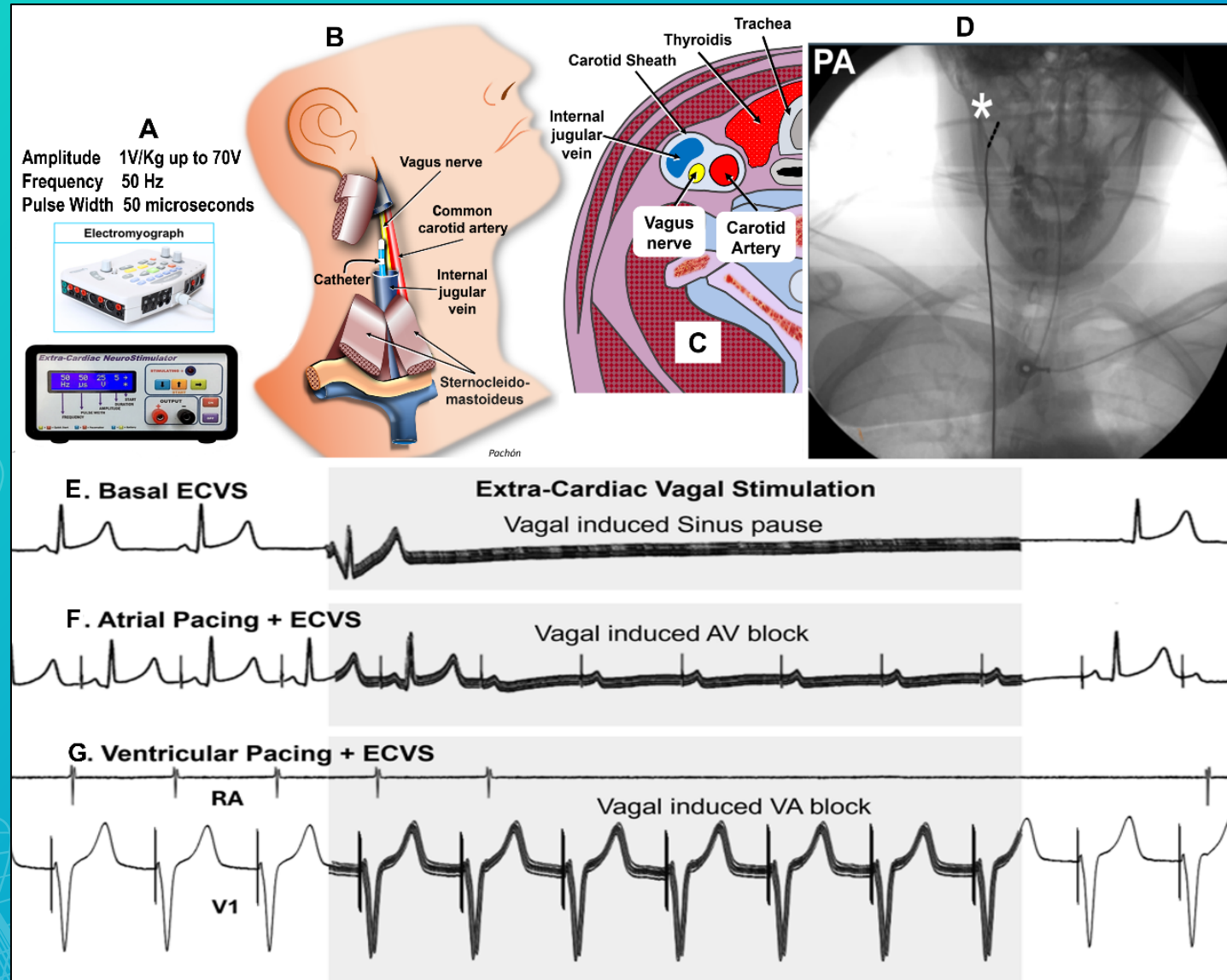
Aksu 2024

Absence of vagal response

-
-
-

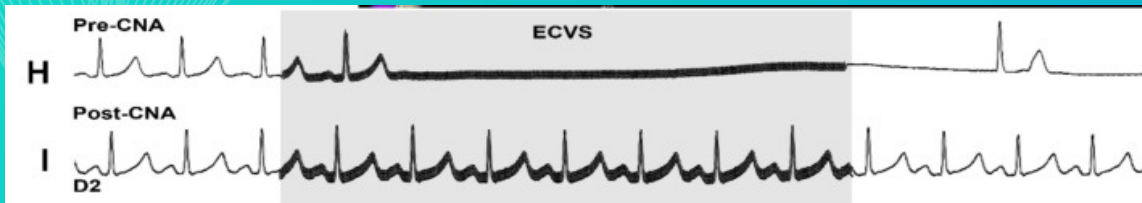
Post atropine
Post-HFS
Post-ECVS

Extracardiac vagal stimulation



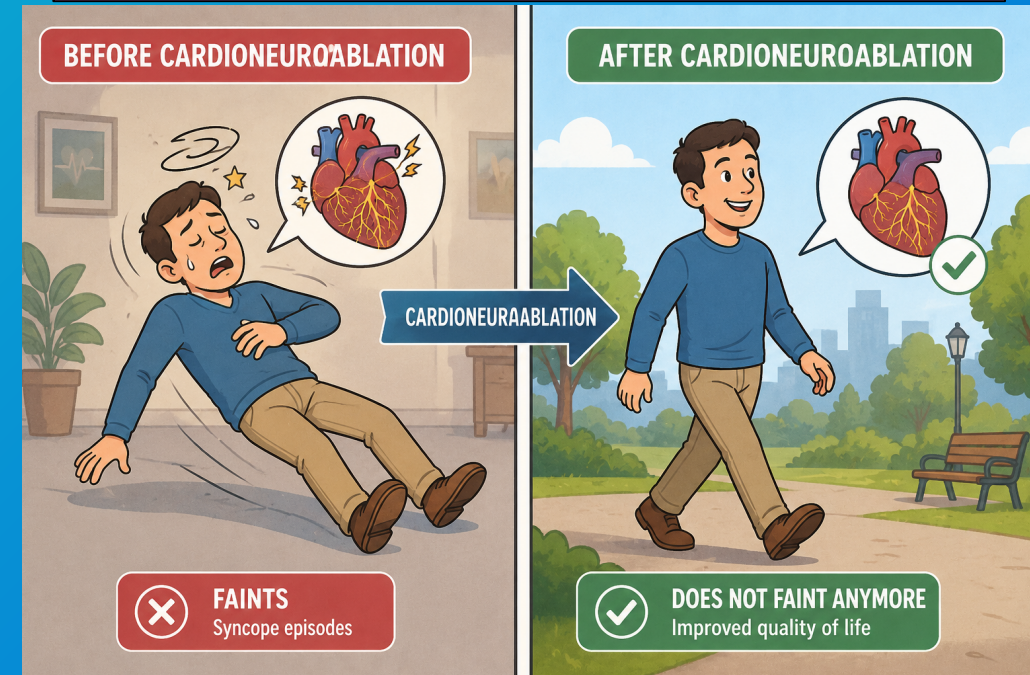
What's our final aim?

Complete vagal denervation



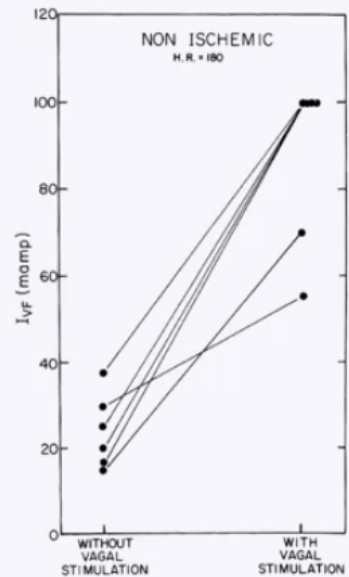
OR

Elimination of syncopal episodes



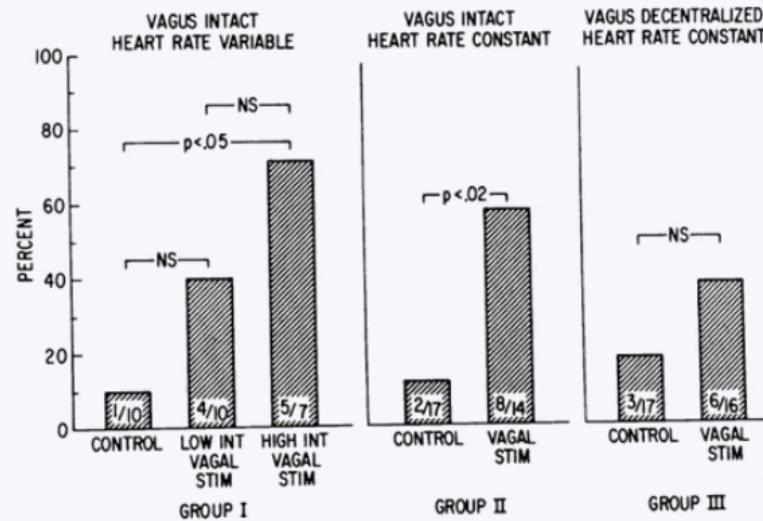
Vagal function is inversely correlated with VT/VF risk

VNS ↑ VF threshold



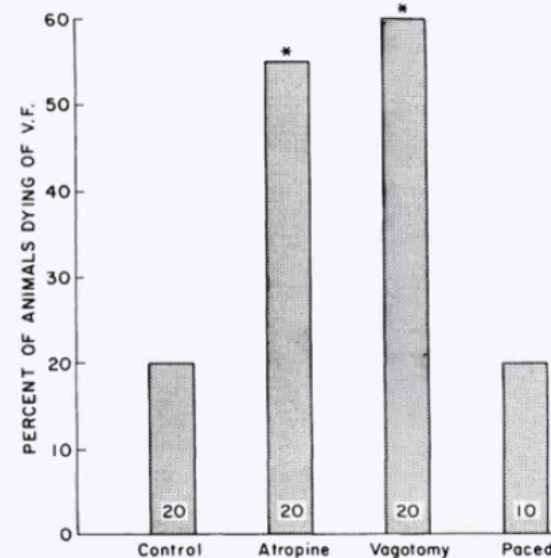
Kent et al, 1973

VNS ↓ ischemia induced VF,
independent of heart rate



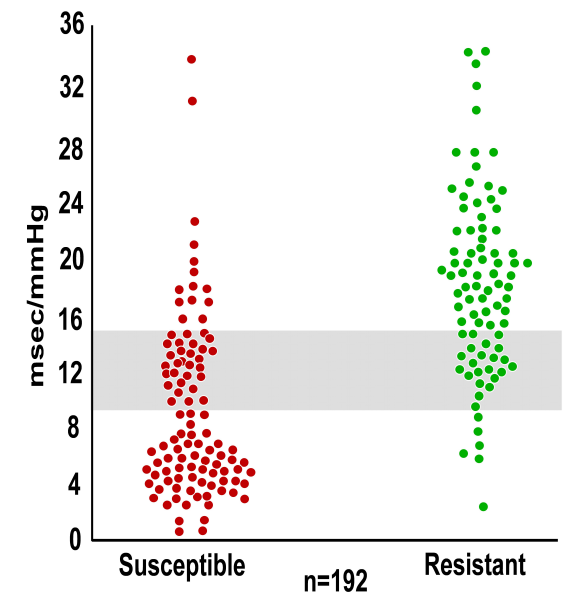
Mayers et al, 1973

atropine/vagotomy ↑
ischemia induced VF



Corr et al, 1974

↓ BRS Post-MI and ↑↑ Risk for
exercise+ ischemia induced VF



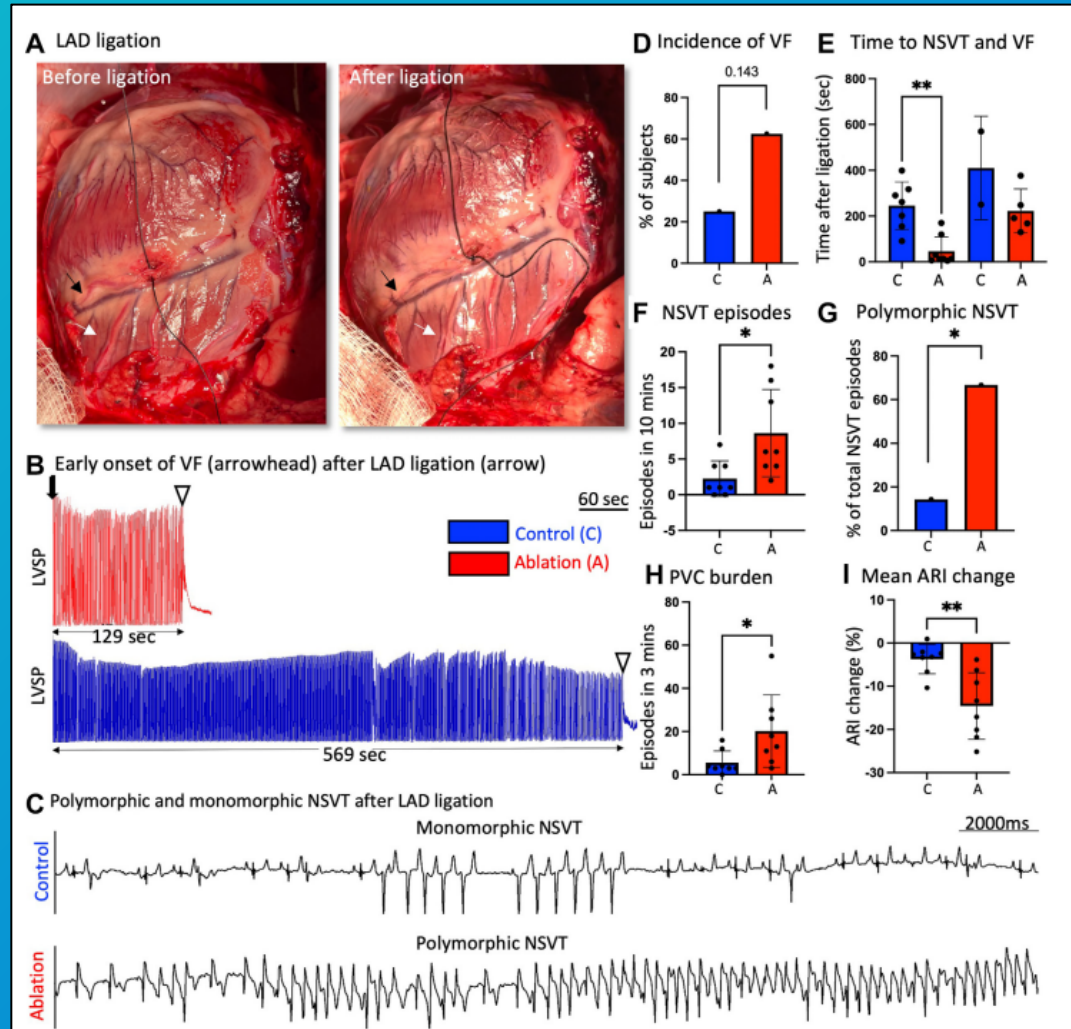
Schwartz et al, 1988

Vagal function is inversely correlated with VT/VF risk

Ischemia-induced ventricular proarrhythmia and cardiovascular autonomic dysreflexia after cardioneuroablation ^e

Wei-Hsin Chung, MD,^{*†} Kiyoshi Masuyama, MD, PhD,^{*} Ronald Challita, MD,^{*} Justin Hayase, MD,^{*} Shumpei Mori, MD, PhD,^{*} Steven Cha, BS,^{*} Jason S. Bradfield, MD,^{*} Jeffery L. Ardell, PhD,^{*} Kalyanam Shivkumar, MD, PhD,^{*} Olujimi Ajijola, MD, PhD^{*}

16 pigs randomized to:
- CNA (SPSGP and LSGP)
- Sham ablation

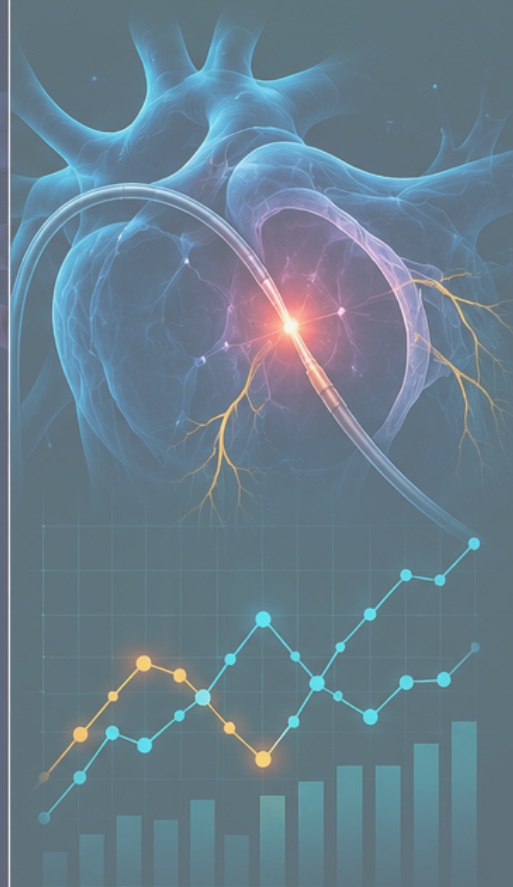




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Technology Integration



Better Outcomes

Biatrial CNA: concluding remarks

- ❑ **Middle-term efficacy:** ✓ (numerical trend in favour of biatrial approach)
- ❑ **Acute safety:** ✓ (but need of transeptal puncture)
- ❑ **Procedural standardization:** ✗ → need to standardize:
 - Target GPs
(limited paraseptal GPs targeting?)
 - Acute endpoint
(ECVS or not?)
- ❑ **Longer term follow up:** ?
 - Long term recurrences?
 - Ventricular pro-arrhythmia?

ILR-CNA II: Biatrial vs right atrial ablation

16 Italian Centers

CLINICAL PROTOCOL & ELIGIBILITY



RIGHT ATRIAL vs. BI-ATRIAL ABLATION

Evaluating site strategies
to optimize ablation
efficacy and patient
outcomes.



INCLUSION: SEVERE ASYSTOLIC SYNCOPE

Patients 18–60 with
documented pauses
>6s or asystolic
syncope >3s.



CONTINUOUS ILR MONITORING

Using LuxDx® recorders to
provide objective, continuous
ECG data before and after
ablation.

STUDY ENDPOINTS & TIMELINE



PRIMARY ENDPOINT: MONTHLY ASYSTOLIC FREQUENCY

Measuring the monthly
rate of asystolic
episodes (>3 sec)
post-procedure.



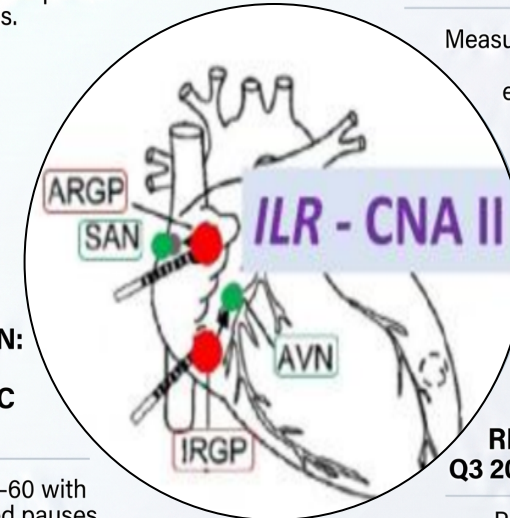
RECRUITMENT: Q3 2025 – Dec 2026

Patient enrollment
spans 18 months, with
final follow-up ending
December 2027.



SECONDARY OUTCOMES

Tracking procedural
complications, syncope
burden, and heart rate
variability (HRV) patterns.



Thank you for your attention!

Do you have any questions?

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