



ELECTRA

5-6 DÉCEMBRE 2024

HOTEL VILLA MASSALIA,
MARSEILLE | FRANCE

18^{èmes} journées françaises
pratiques de rythmologie
& de stimulation cardiaque

WWW.CONGRES-ELECTRA.COM

2004 - 2024

20
ans
ELECTRA

LES TV du « sommet »



P Maury, Toulouse

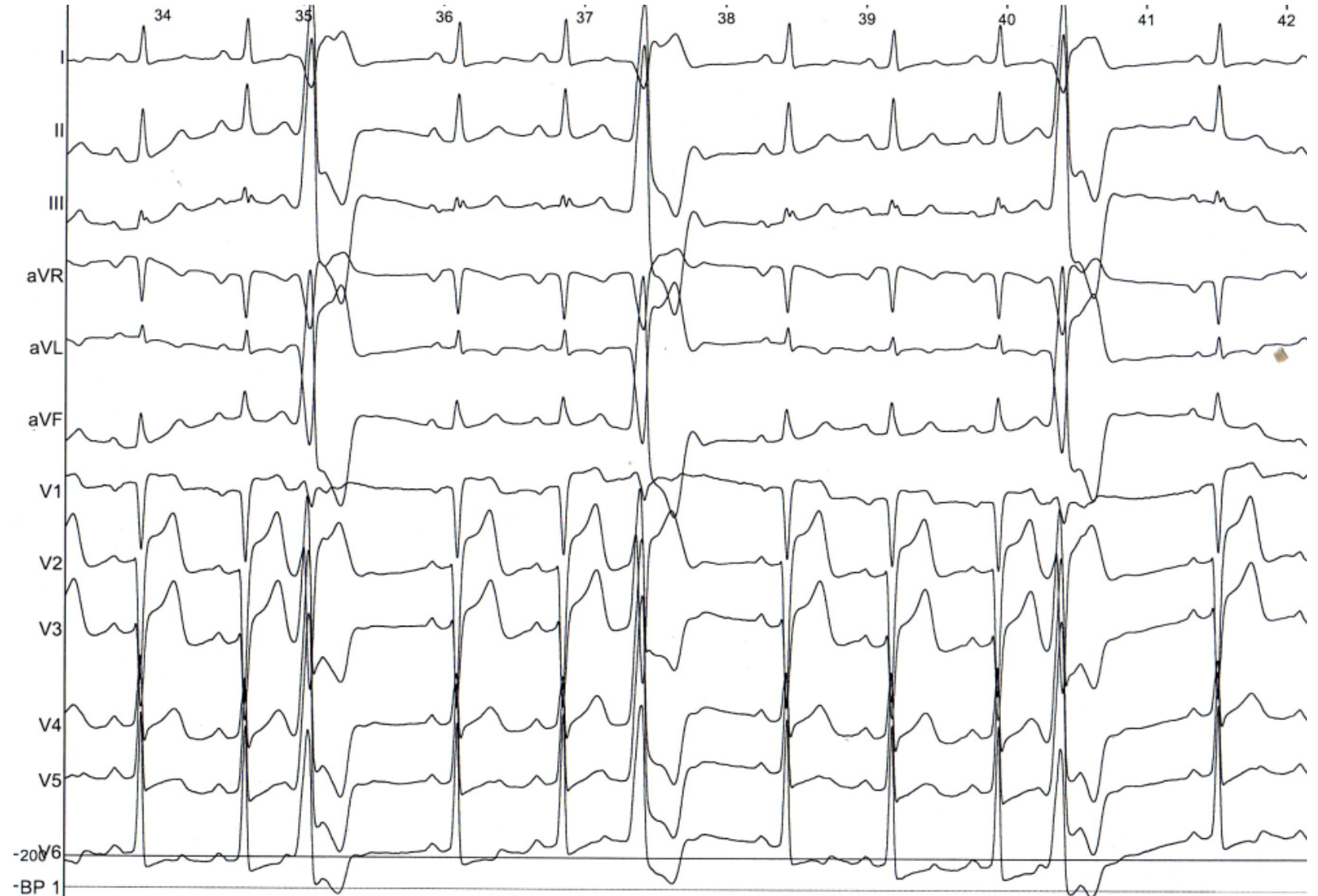
Homme 45 ans

30000 ESV/j

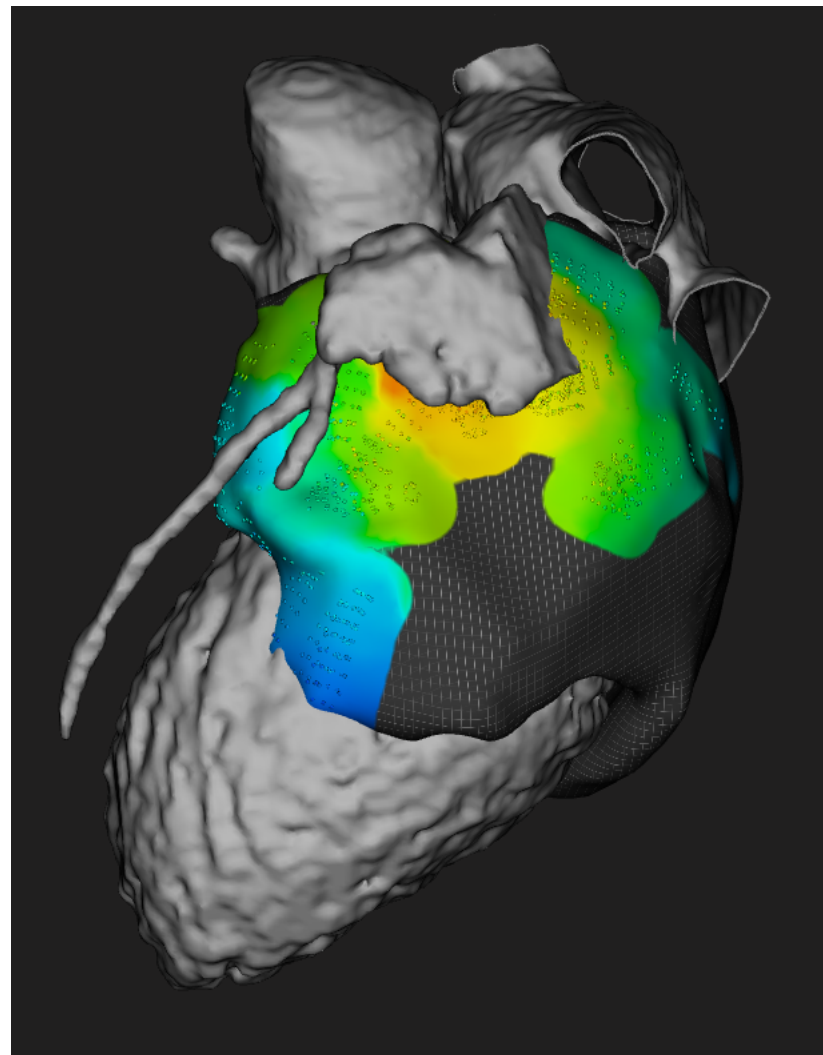
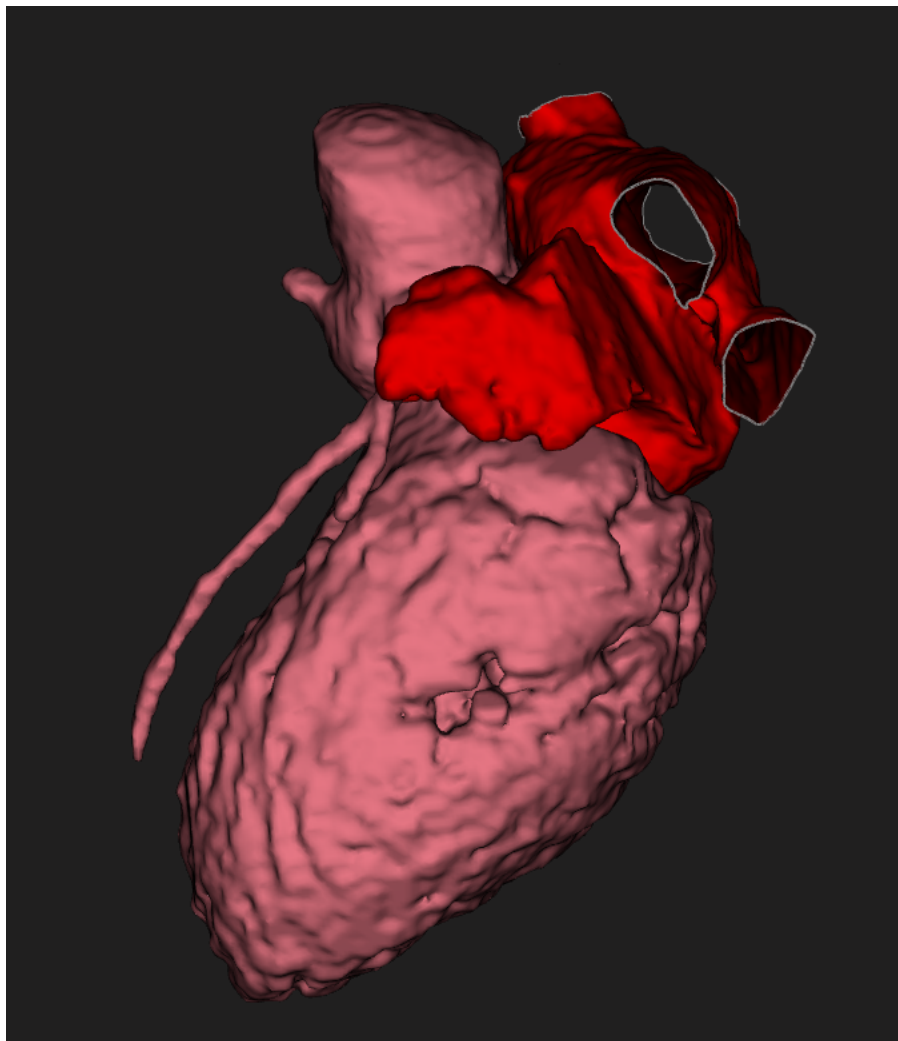
Echec BB, échec 1ere RF autre centre

Succes transitoire pendant RF SC distal/veine IVA region LV summit, ou tronc AP ou endo sous LV summit

Mais reapparaissent ...



Nouvelle procedure avec imagerie ad-hoc



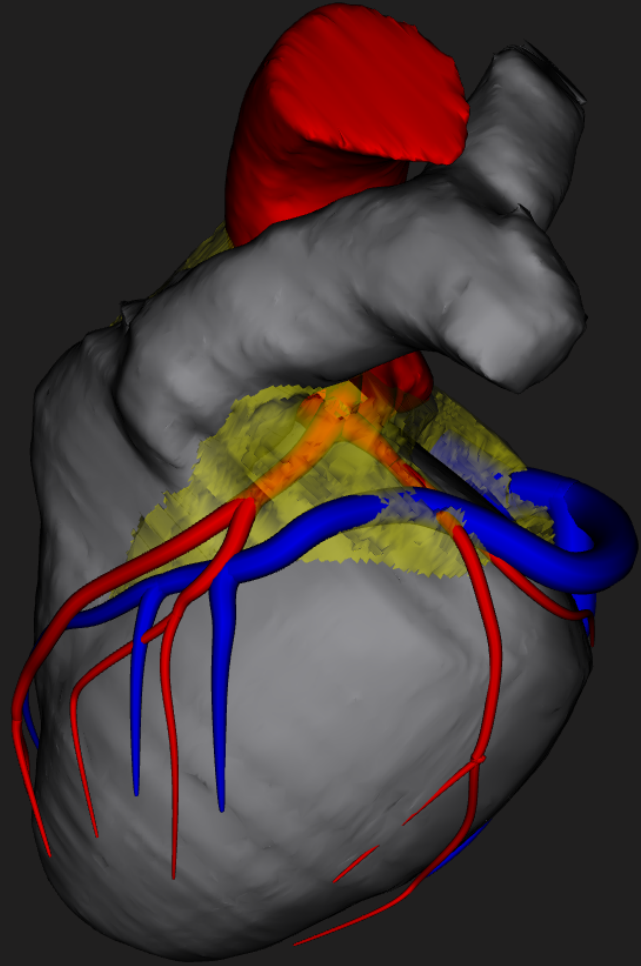
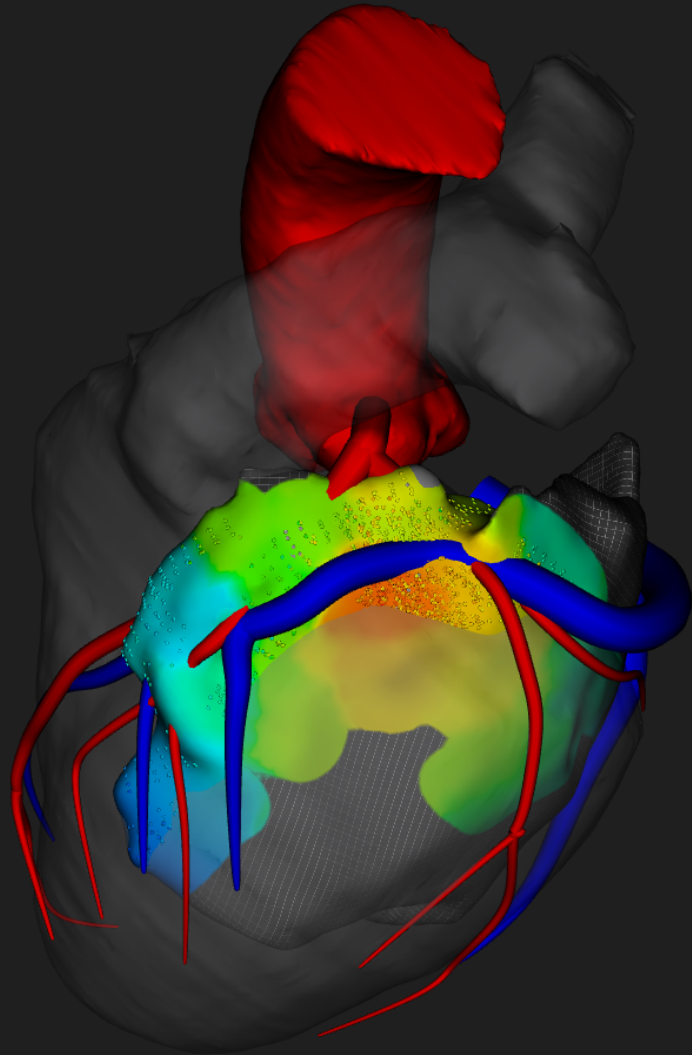
10 LV epi ...

13 VTK

-113 ms 43 ms
-139 ms 43 ms

B.Time ▾

13 VTK



Beat Review Graph Anterior Parameters Review



Auto



INF

SUP

RL

LL

RAO

LAO

PA

AP



Statistics: multiple maps are visible



Auto



INF

SUP

RL

LL

RAO

LAO

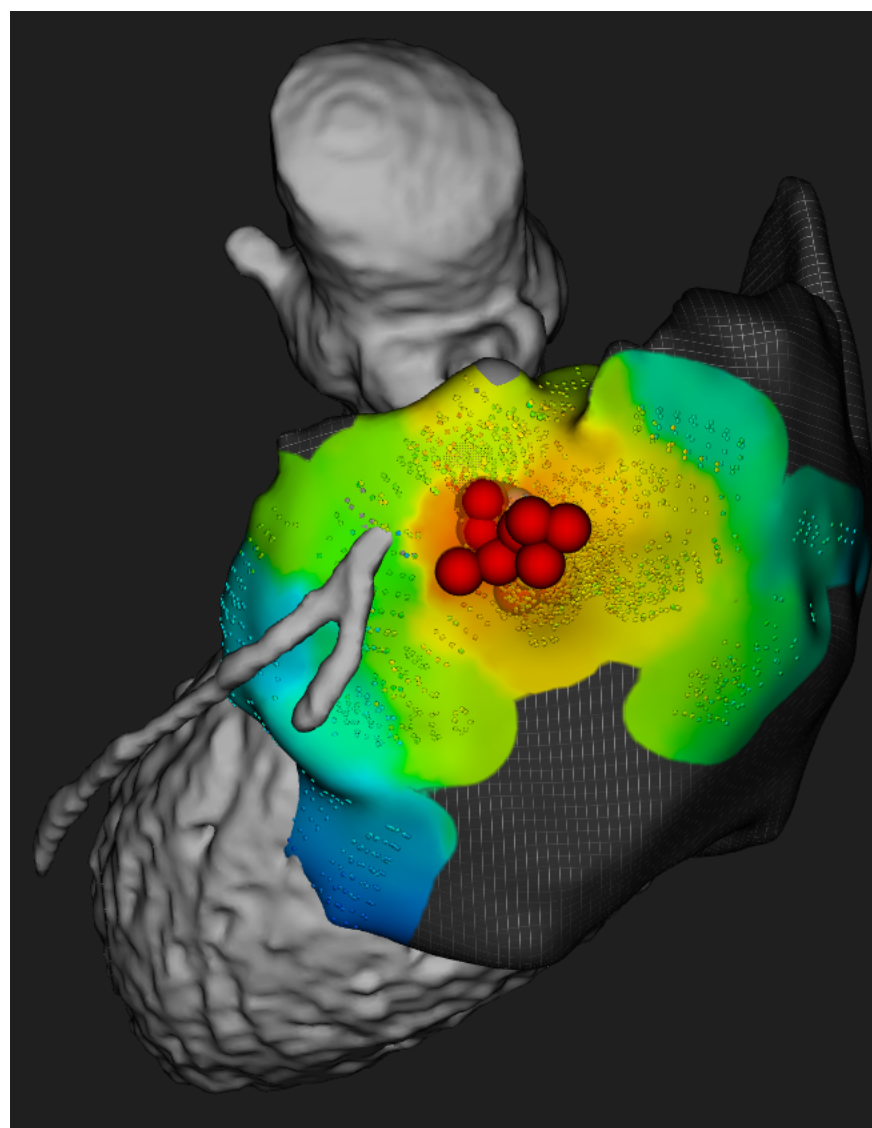
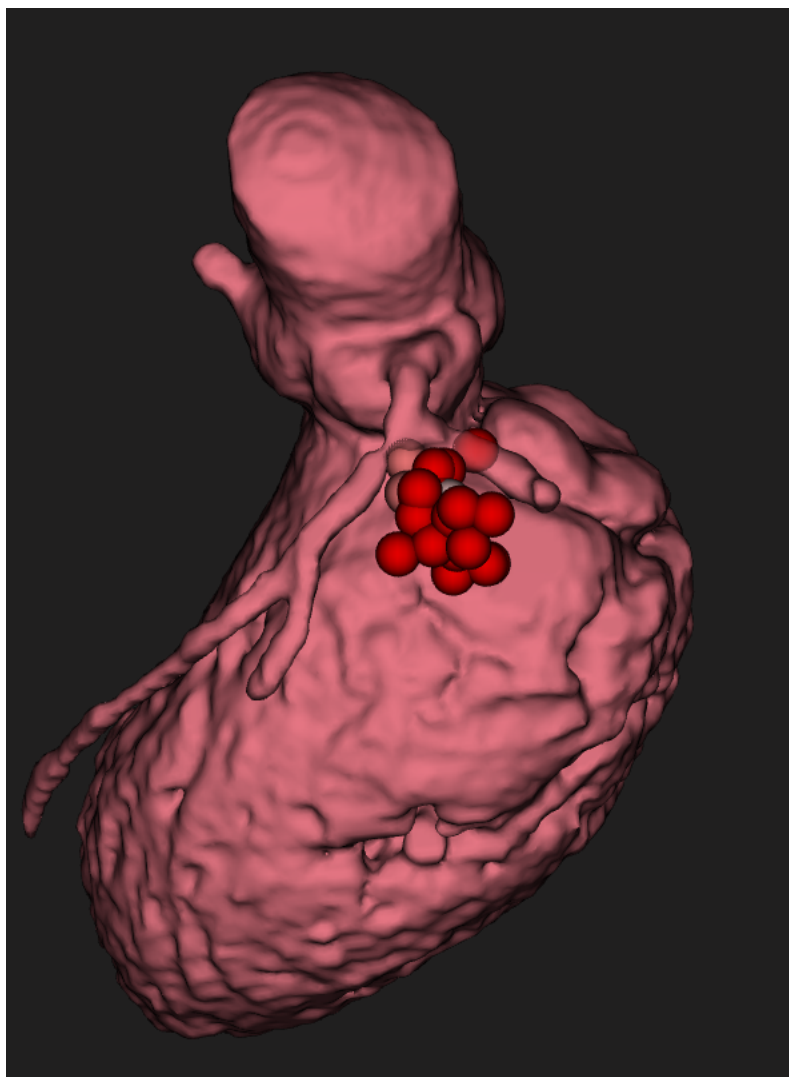
PA

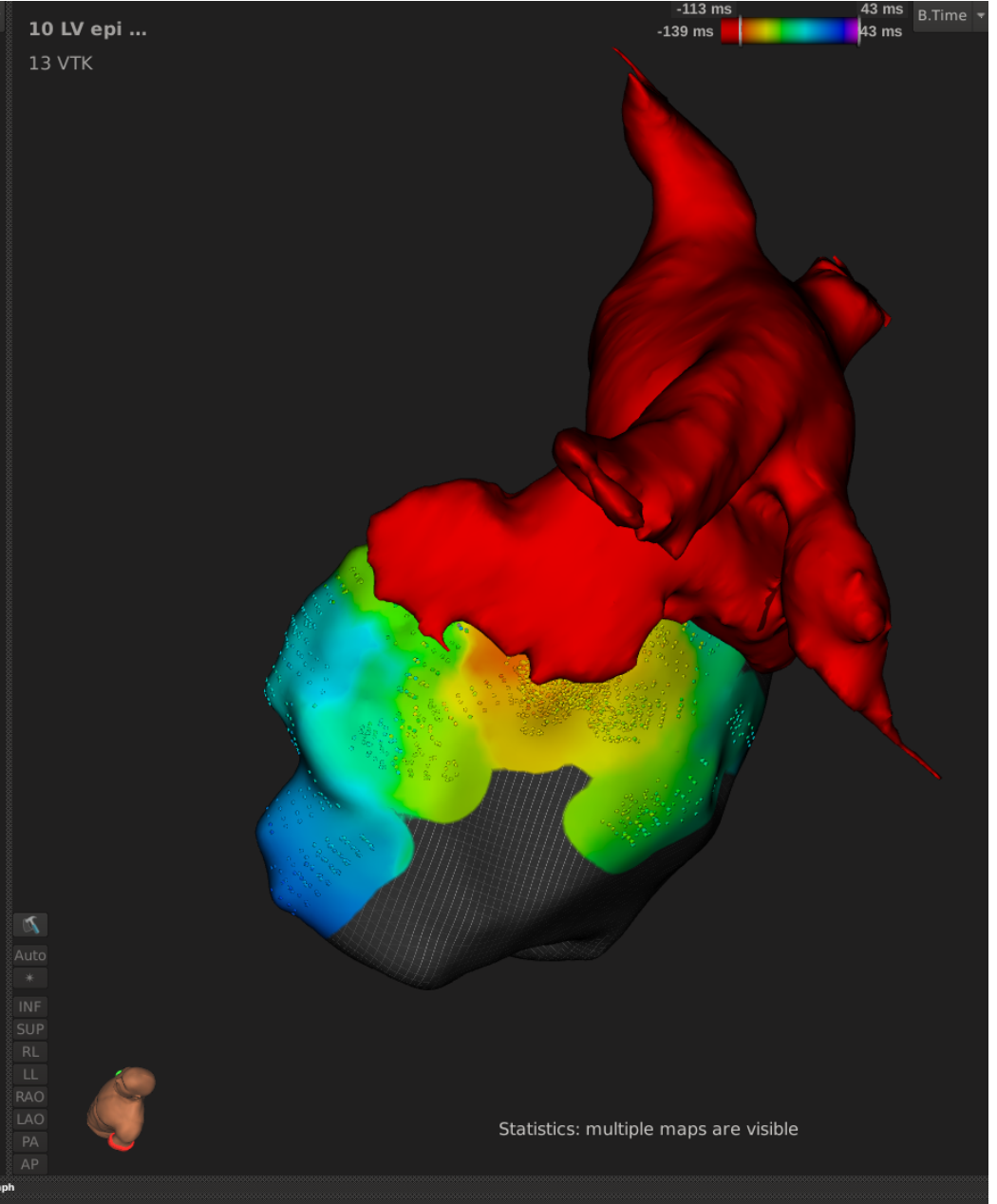
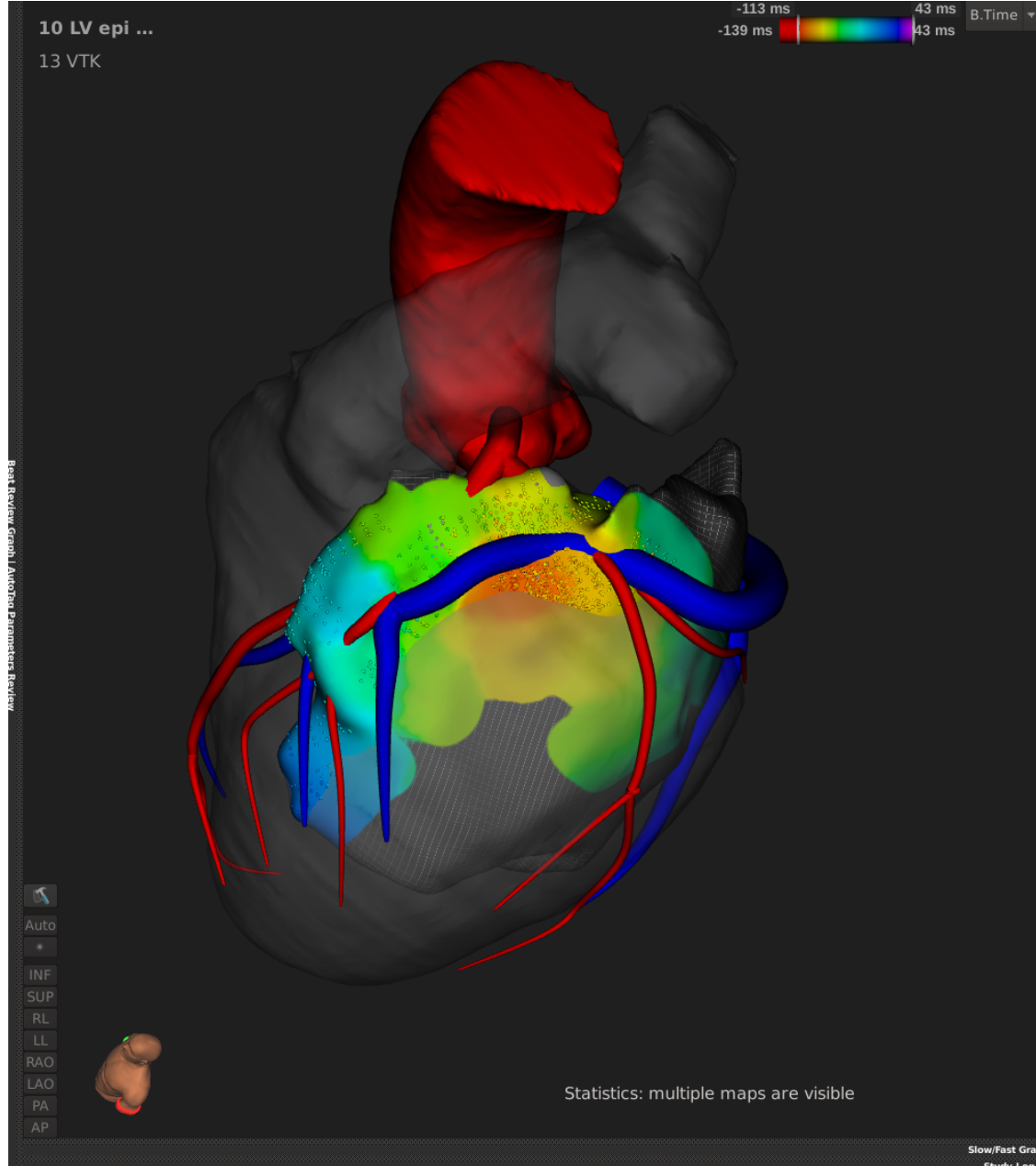
AP



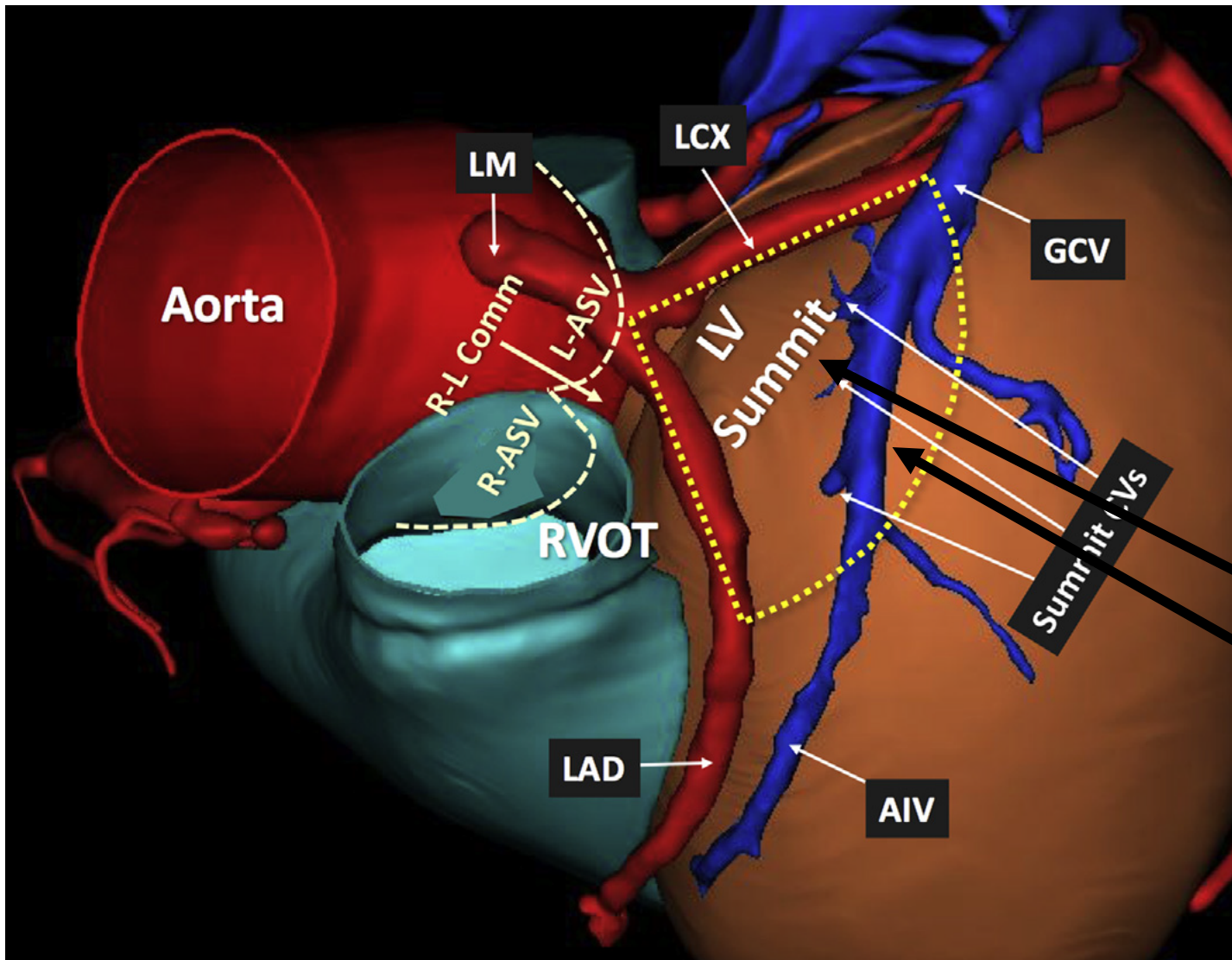
Statistics: multiple maps are visible

Slow/Fast Graph
Study Log

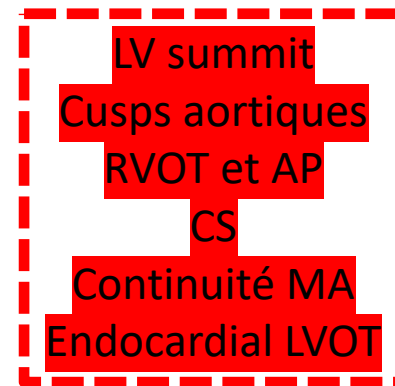




La chambre de chasse VG (LVOT)



30% des ESV/TV sur cœur sain

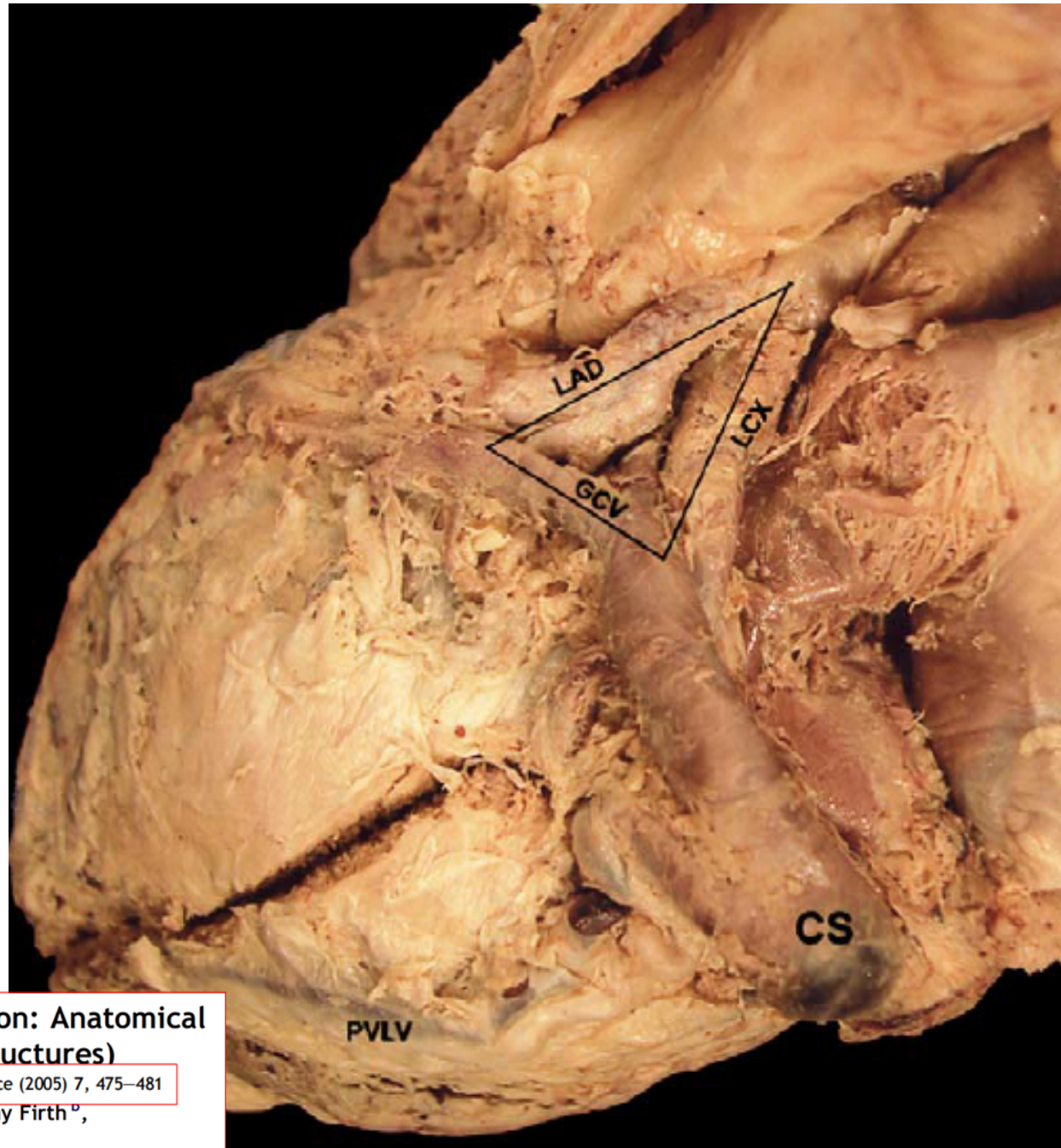


Portion basale « inaccessible »

Portion apicale

McAlpine WA. Heart and Coronary Arteries. New York, NY: Springer Verlag, 1975.

Le triangle de Brock et Mouchet

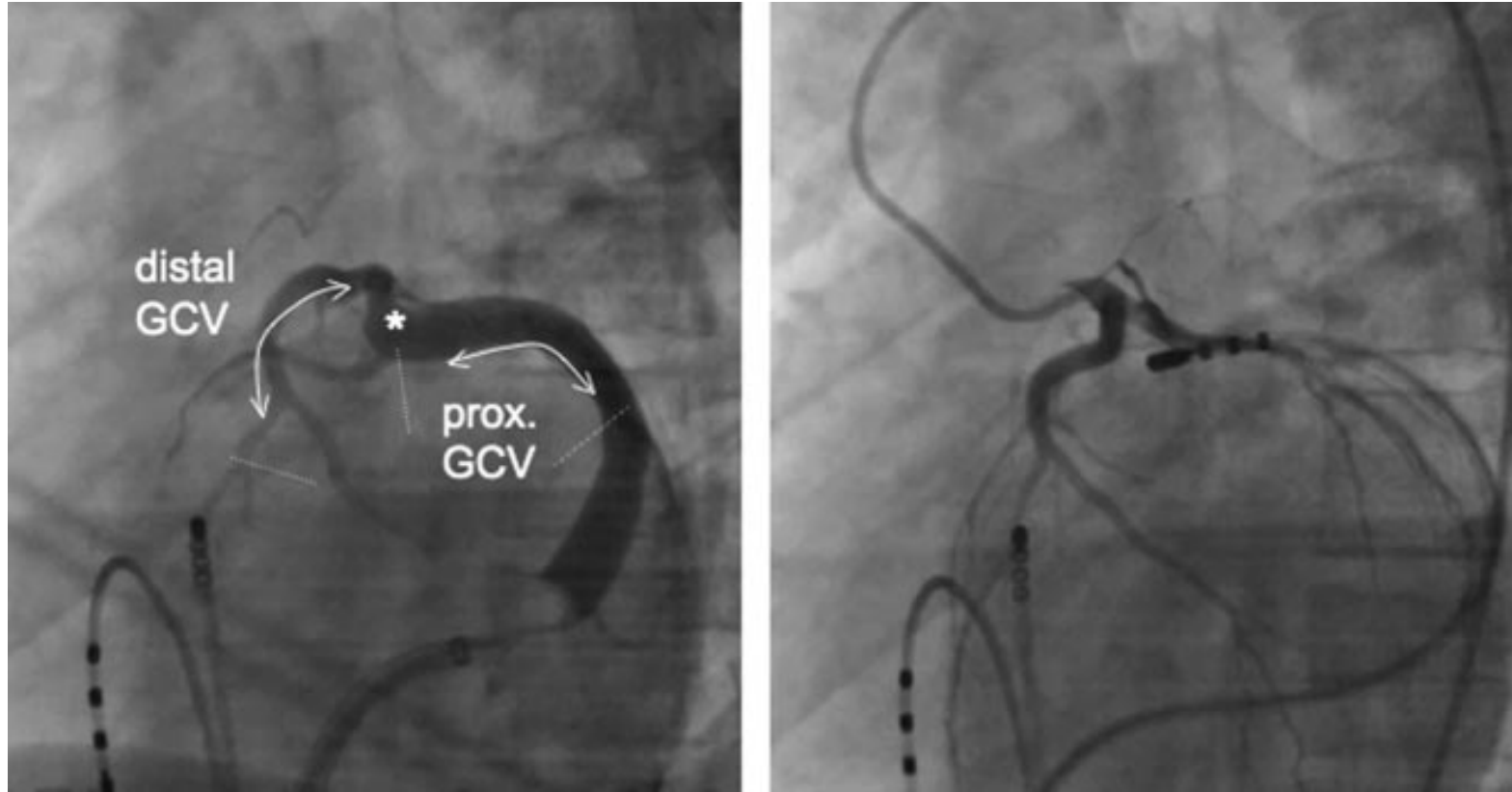


The coronary sinus conduit function: Anatomical study (relationship to adjacent structures)

Europace (2005) 7, 475–481

Shirley El-Maasarany^a, Colin G. Ferrett^b, Anthony Firth^v,
Mary Sheppard^b, Michael Y. Henein^{b,*}

Ablation dans le SC distal ?



Mapping and Ablation of Epicardial Idiopathic Ventricular Arrhythmias From Within the Coronary Venous System

Timir S. Baman, MD; Karl J. Ilg, MD; Sanjaya K. Gupta, MD; Eric Good, DO; Aman Chugh, MD;
Krit Jongnarangsin, MD; Frank Pelosi, Jr, MD; Matthew Ebinger, DO; Thomas Crawford, MD;
Hakan Oral, MD; Fred Morady, MD; Frank Bogun, MD

(*Circ Arrhythm Electrophysiol.* 2010;3:274-279.)

Mapping and Ablation of Epicardial Idiopathic Ventricular Arrhythmias From Within the Coronary Venous System

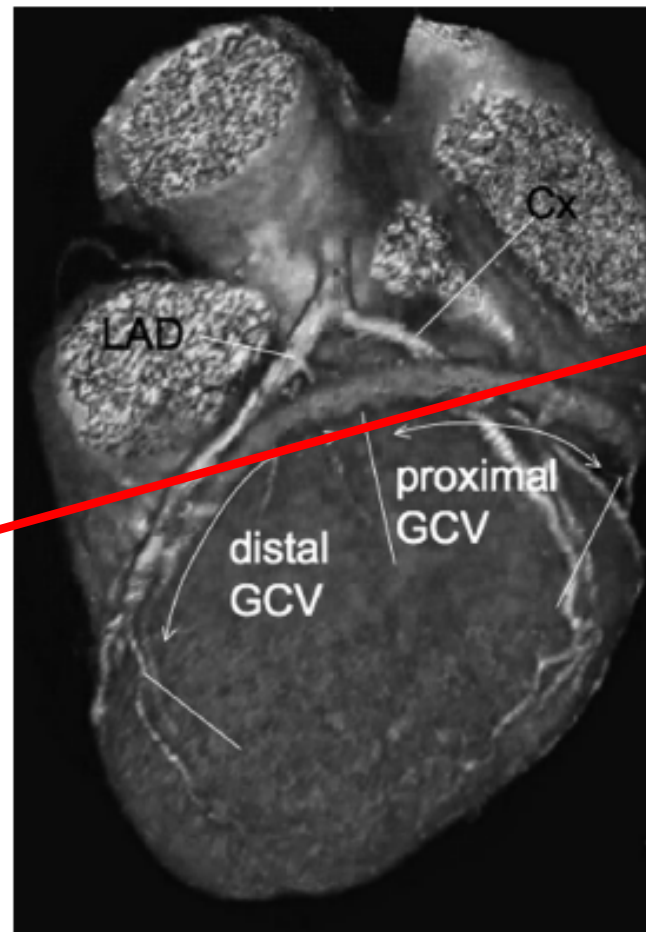
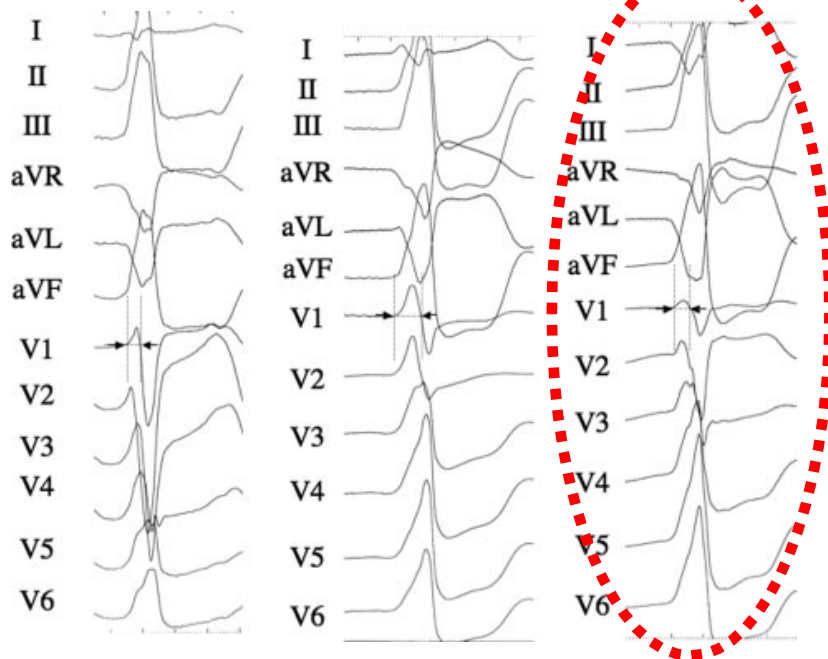
Timir S. Baman, MD; Karl J. Ilg, MD; Sanjaya K. Gupta, MD; Eric Good, DO; Aman Chugh, MD; Krit Jongnarangsin, MD; Frank Pelosi, Jr, MD; Matthew Ebinger, DO; Thomas Crawford, MD; Hakan Oral, MD; Fred Morady, MD; Frank Bogun, MD

(*Circ Arrhythm Electrophysiol.* 2010;3:274-279.)

Étude 2010 sur ESV/TV ablatées dans le CS (essentiellement axe D ici)

14% ESV/TV idiopathiques

70% efficacité ablation dans le CS



60 % avec retard gauche

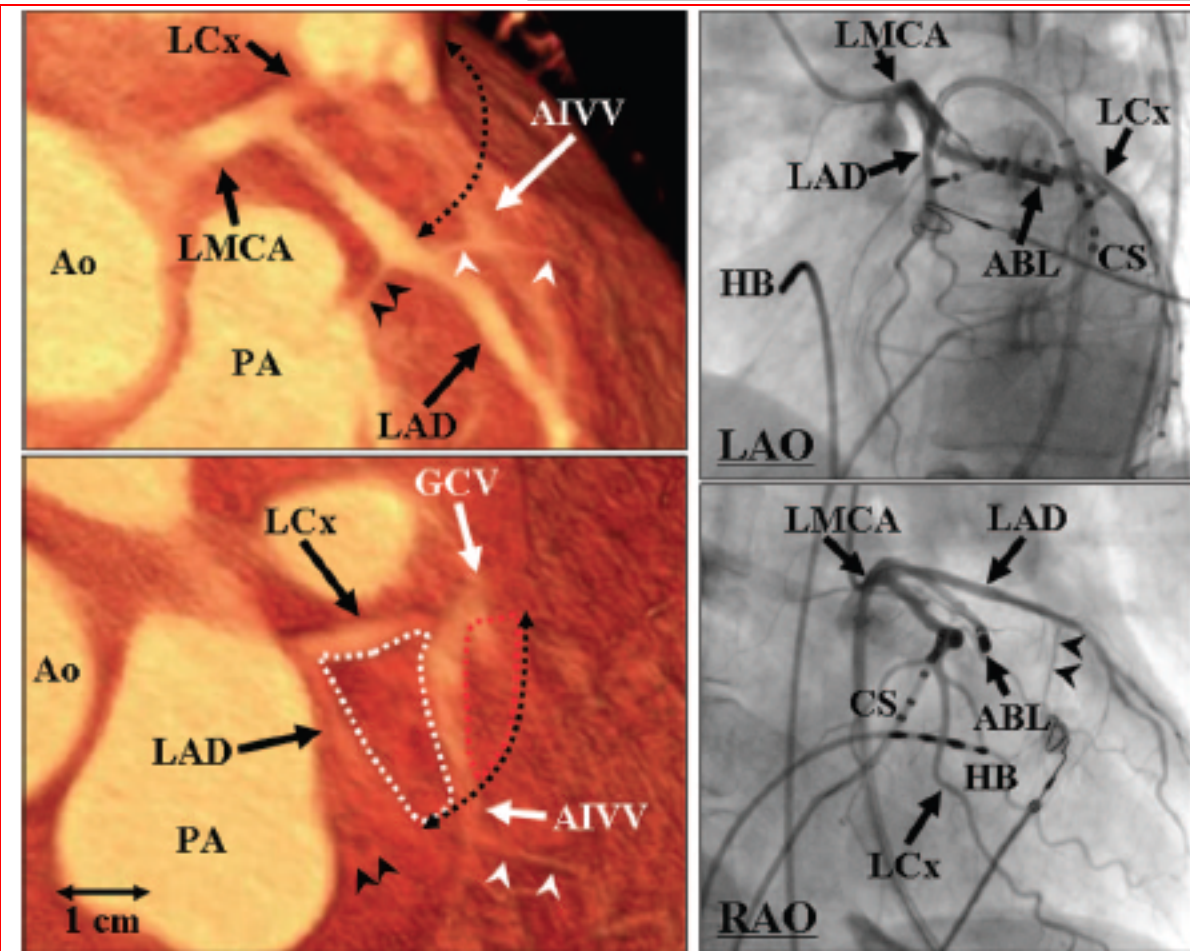
plus c'est distal IVA ... plus c'est retard G

Idiopathic Ventricular Arrhythmias Originating From the Left Ventricular Summit

Anatomic Concepts Relevant to Ablation

Takumi Yamada, MD; H. Thomas McElderry, MD; Harish Doppalapudi, MD; Taro Okada, MD; Yoshimasa Murakami, MD; Yukihiro Yoshida, MD; Naoki Yoshida, MD; Yasuya Inden, MD; Toyoaki Murohara, MD; Vance J. Plumb, MD; G. Neal Kay, MD

(*Circ Arrhythm Electrophysiol.* 2010;3:616-623.)



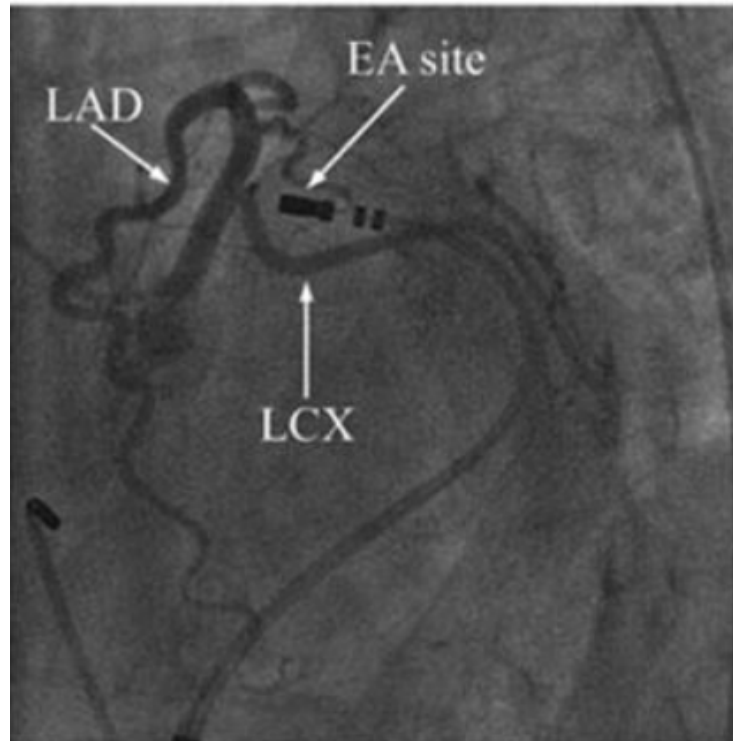
12% ESV/TV gauches idiop

50% ablatées SC
autres abord épicardique ou non ablatées
(zone « inaccessible »)

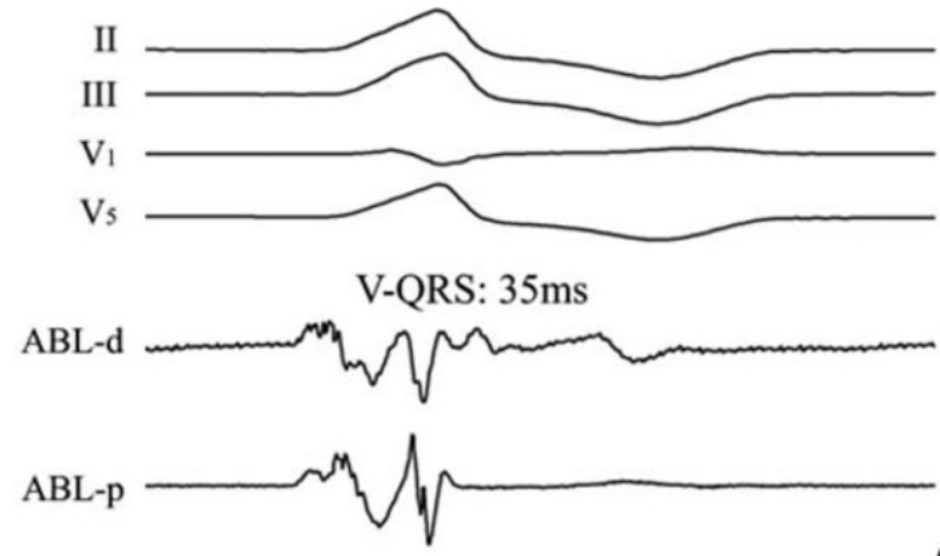
Ablation dans le SC distal ?

Site optimal grande veine cardiaque < 5 mm artère coronaire

75% des patients



Risque perforation
Risque occlusion Cx



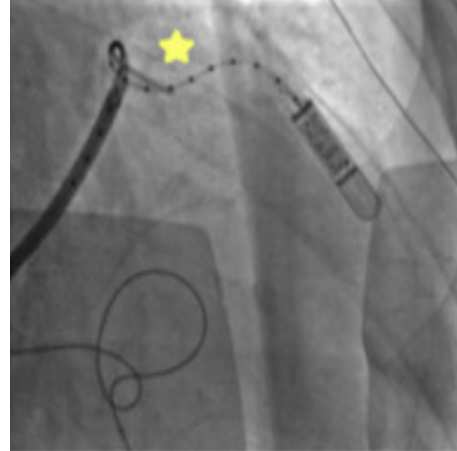
Mapping dans le SC



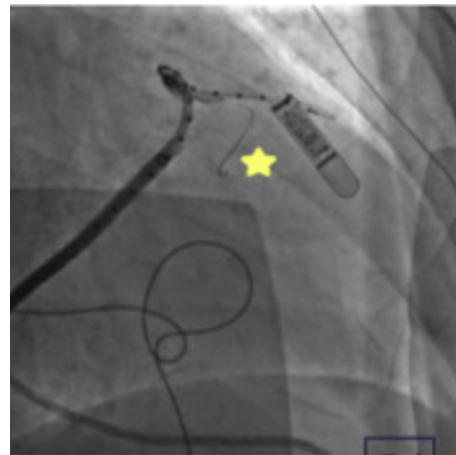
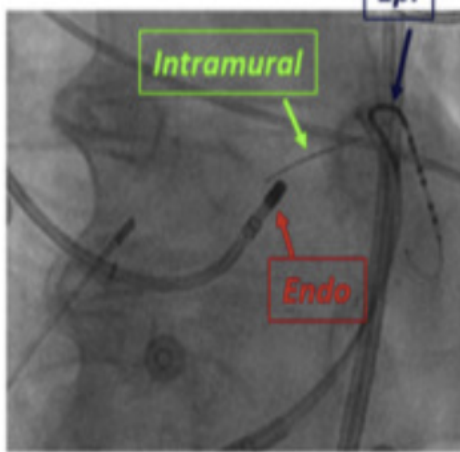
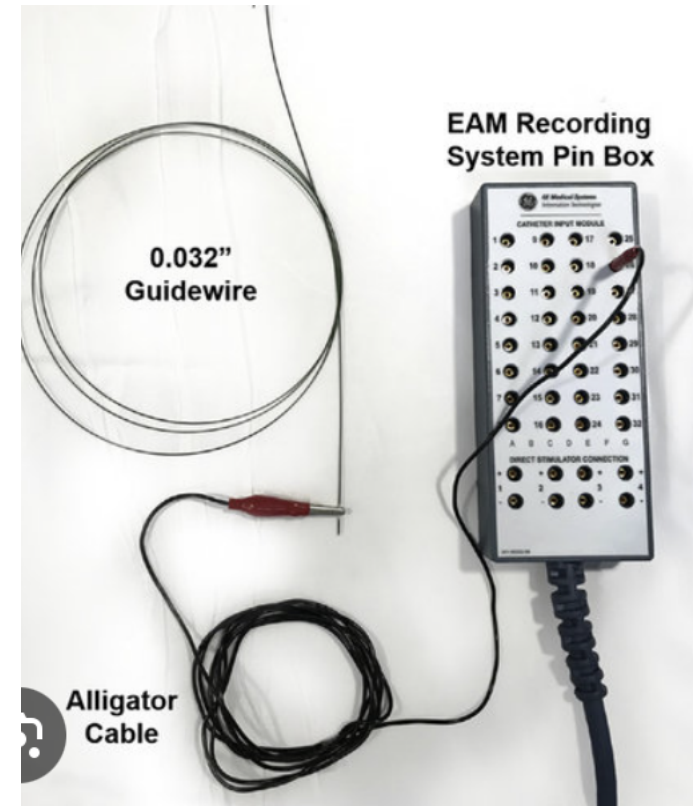
Gaine SC



Angio SC



3 Fr multipolaire (inutile)



Guide 0.14 +++ unipolaire

Briceno DF, et al. JACC Clin Electrophysiol. 2019.

Ablation à tous les sites précoces ou à des sites opposés

13% patients avec TV/ESV LVOT **avec sites multiples de même prématurité**

(moins précoce que patients avec un seul site)
ablation séquentielle de tous ces sites 93% succès

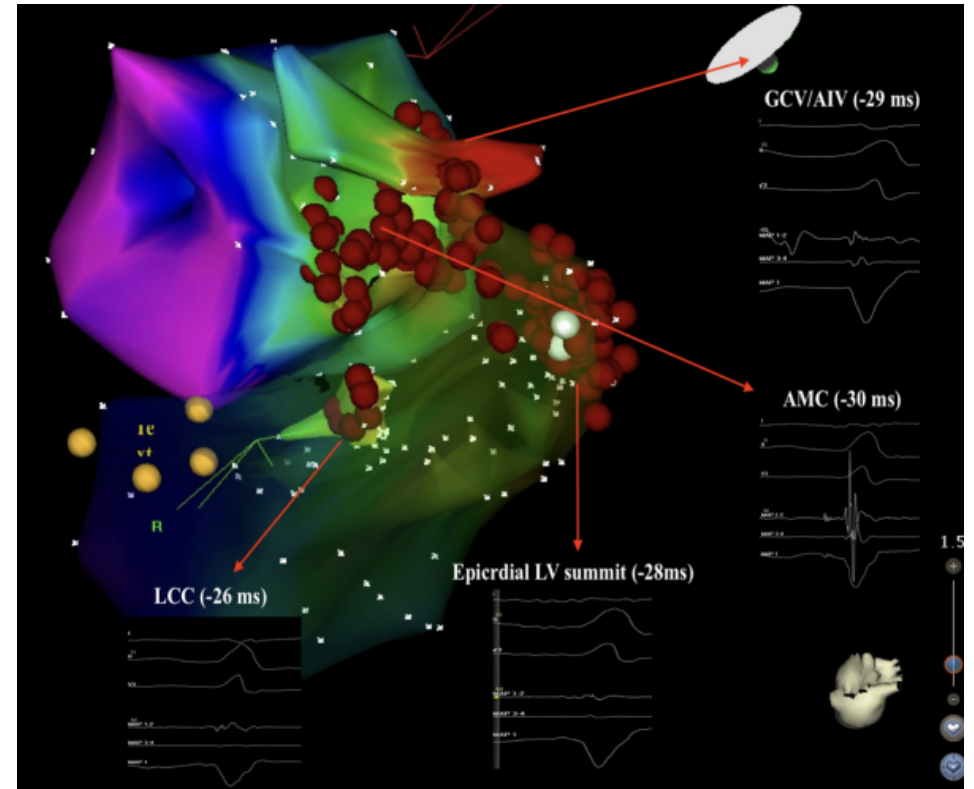
Di Biase, et al. HeartRhythm. 2019;16:724-732.

56% succès cusp G et/ou endocarde VG en face

Jauregui Abularach et al. Heart Rhythm. 2012;9:865-73

12% succès acces endo + cusp seuls

Yokokawa M, et al. Heart Rhythm 2011;8:1525–1529.



Ablation dans l'épicarde ?

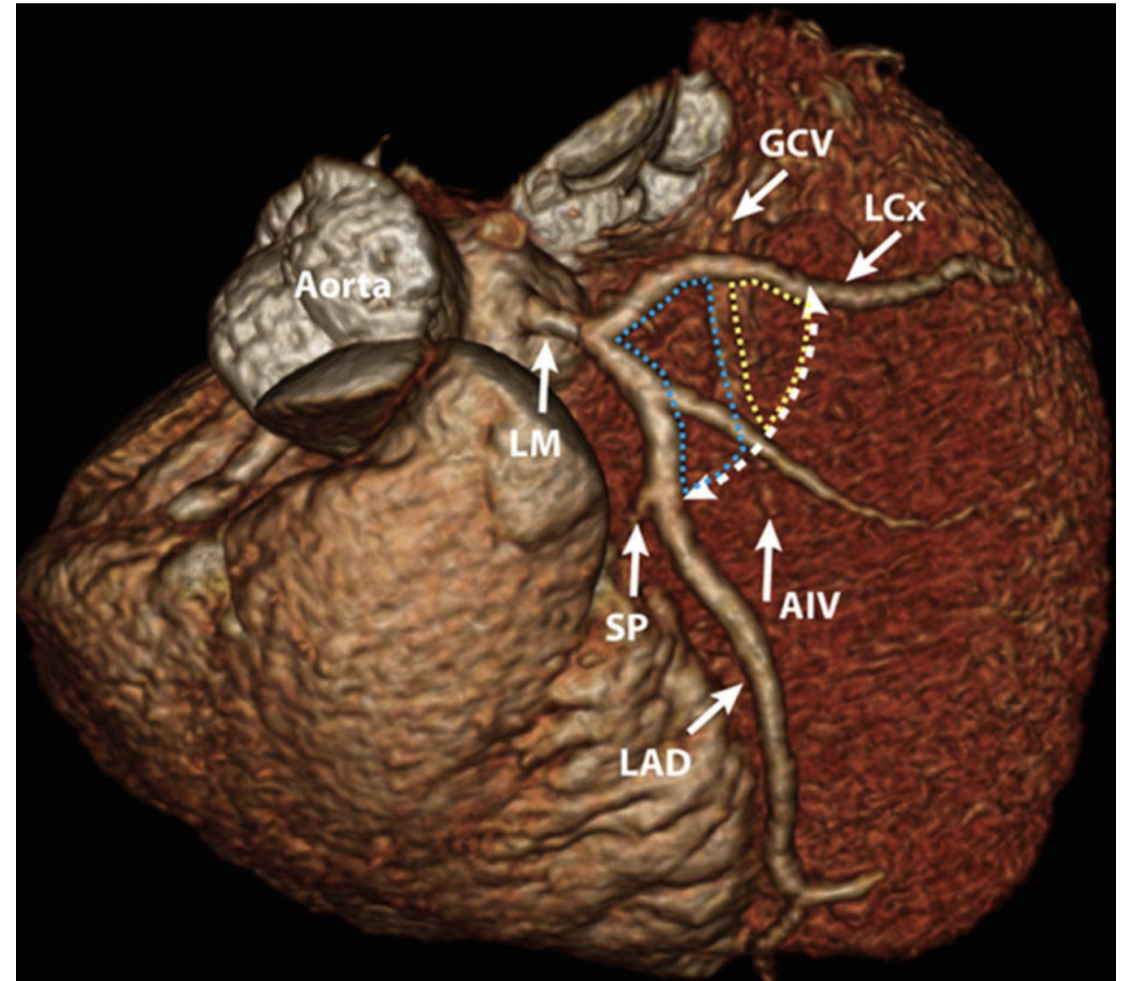
Site optimal épicaarde < 5 mm artère coronaire

80 % des patients

22% succès seulement



Q-wave amplitude ratio in aVL/aVR > 1.85
ratio of R/S wave > 2 in V1
No initial q wave in lead V1



Santangeli P, et al. Circ Arrhythm Electrophysiol 2015;8:337-343.

Nagashima K, et al. Circ Arrhythm Electrophysiol 2014;7:906-12

Transmural (prolonged) endocardial RF applications

Jauregui Abularach ME, Heart Rhythm. 2012;9:865–873.

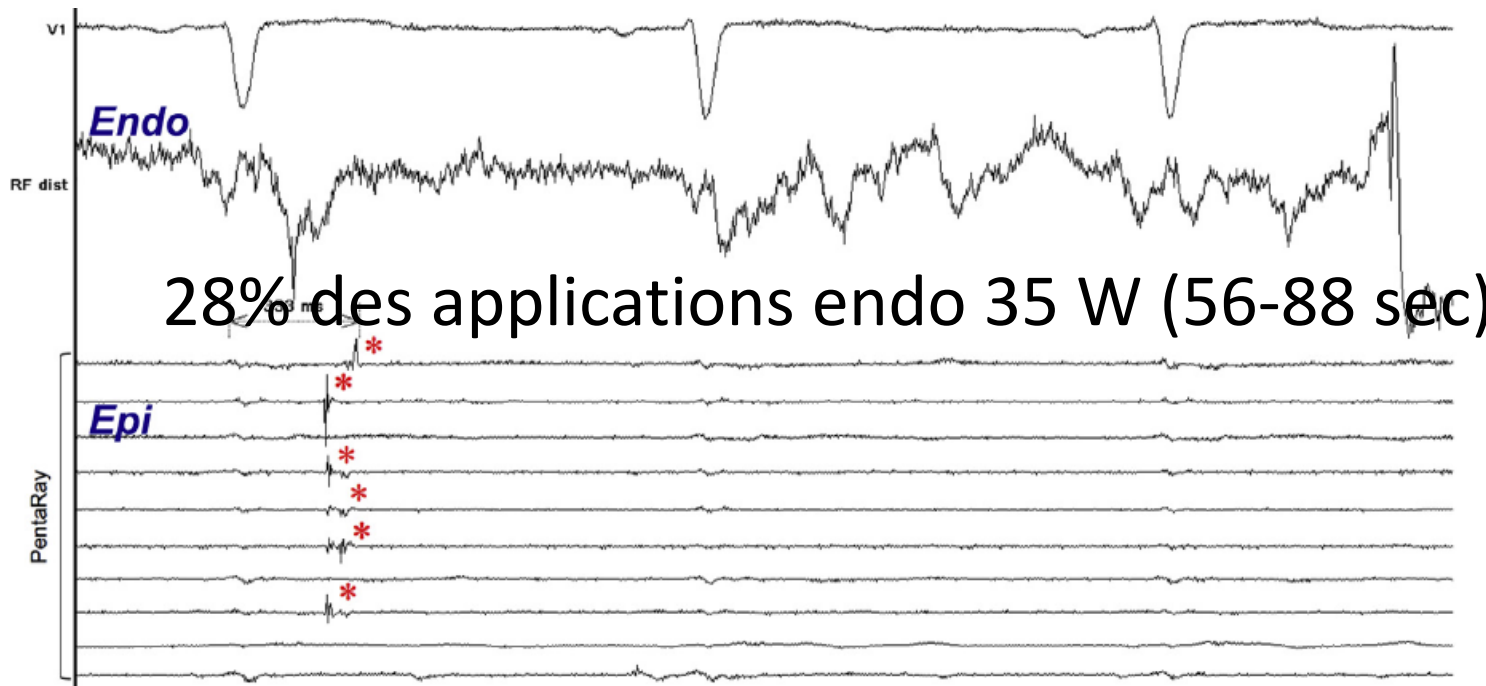
Romero, et al.; Heart Rhythm CaseReports. 2015;1:464-468

Full elimination LAVAs

30-40% ICM et ARVC

<10% NICM

< 5 mm thickness



Extending RF ablations up to 90 sec significantly increased the lesion depth (30-40%)

Ablations > 90 seconds : little incremental value

Komatsu Y, J Am Coll Cardiol. 2014;63:1416–1426

Bhaskaran A. Heart Lung Circ. 2017;26:219-225

Que faire quand SC/cups/endo/ RVOT/épi échoue ou impossible ?

Romero J, et al. Heart Rhythm. 2020 ;17:1609-1620.

Alcoolisation, coils ?

Bipolaire ou double unipolaire ?

Half saline (certainement ...)

PFA ?

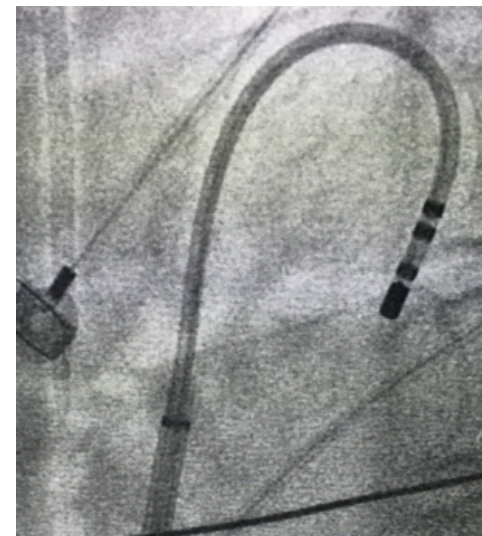
Aiguille ?

SBRT ? *Mages C, et al. Heart Rhythm Case Rep 2023;9:802-807*

LAA ? *Benhayon, et al. Case Rep 2018;6:1124-1127*

Chirurgie + cryo (mini invasive ?) *Nagashima K, et al. Circ EP 2014;7:906-12*

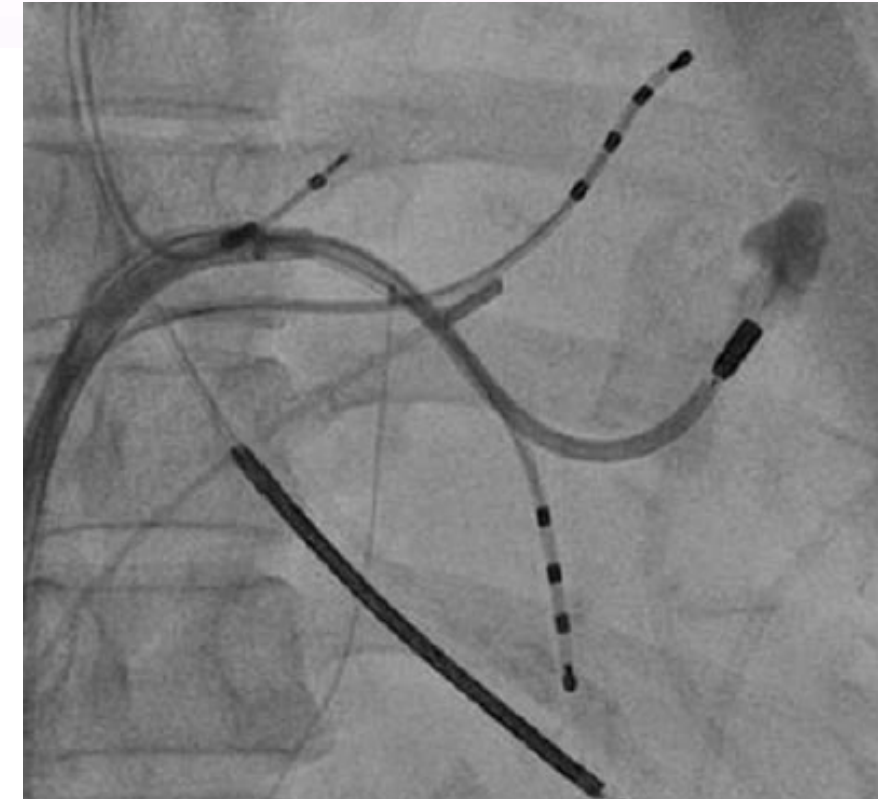
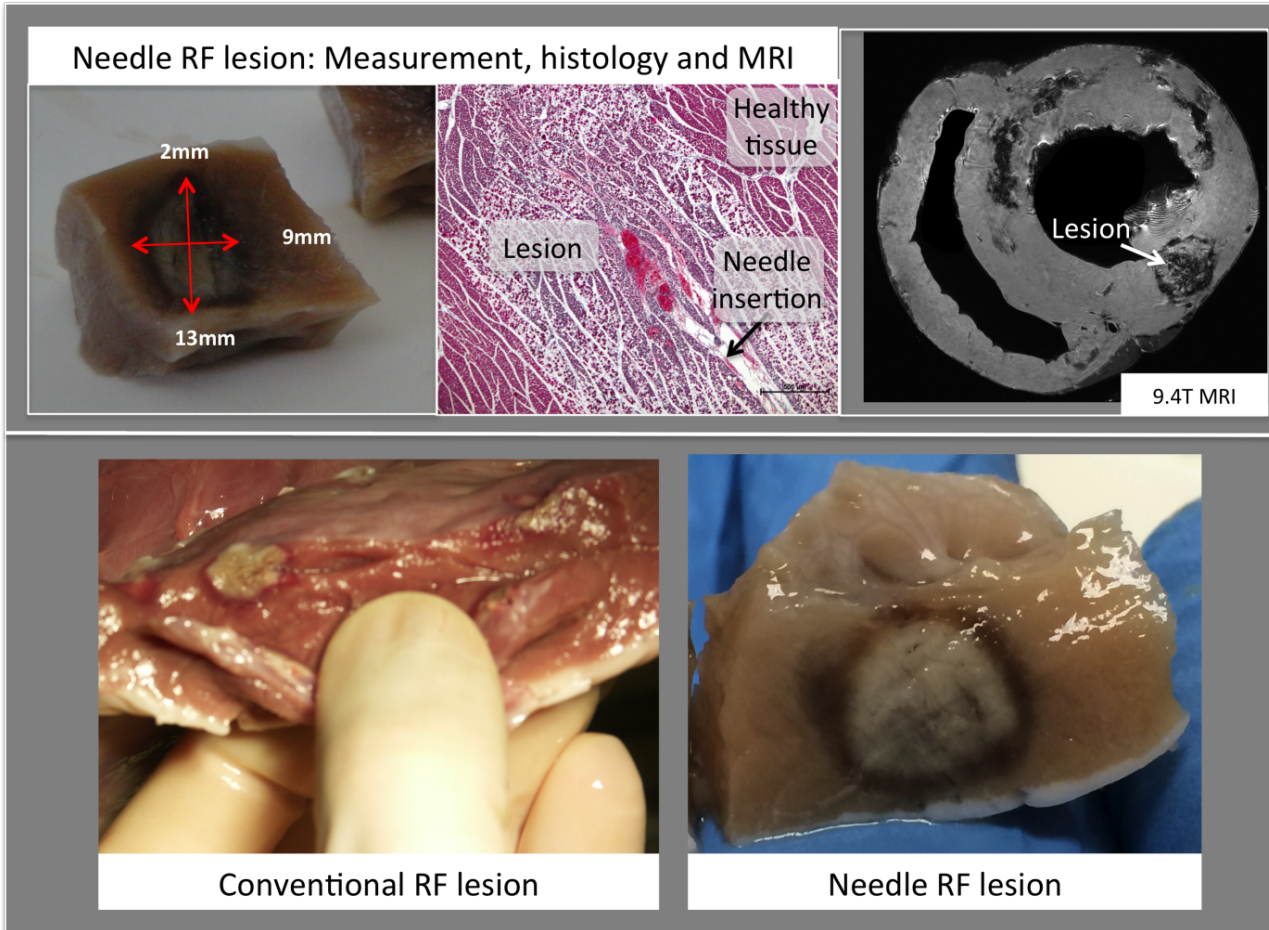
Tronc AP (« U ») ? *Futyma P, et al. Heart Rhythm 2020 ;17:1519-1527*



ablation "aiguille"

Biosense, retiré

Sapp JL, Cooper JM, Soejima K, Sorrell T, Lopera G, Satti SD, et al. Deep myocardial ablation lesions can be created with a retractable needle-tipped catheter. *Pacing and Clinical Electrophysiology*. 2004; 27: 594-599.
Sapp JL, Cooper JM, Zei P, Stevenson WG. Large radiofrequency ablation lesions can be created with a retractable infusion-needle catheter. *Journal of Cardiovascular Electrophysiology*. 2006; 17: 657-661.



Berte B et al, *Circ Arrhythm Electrophysiol*. 2015;8:1498-506
Sapp J and Stevenson W et al, *Circulation* 2013;128:2289-95
Stevenson WG, et al. *JACC*. 2019;73:1413-1425

ablation "aiguille"

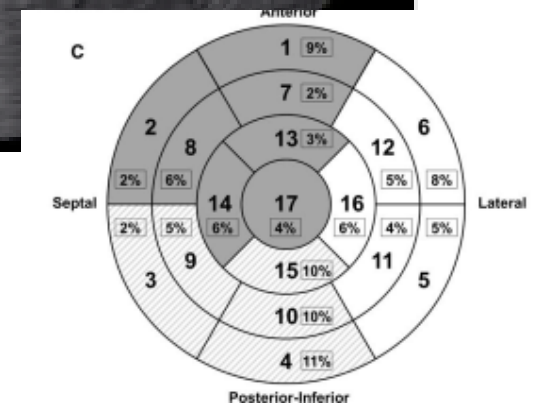
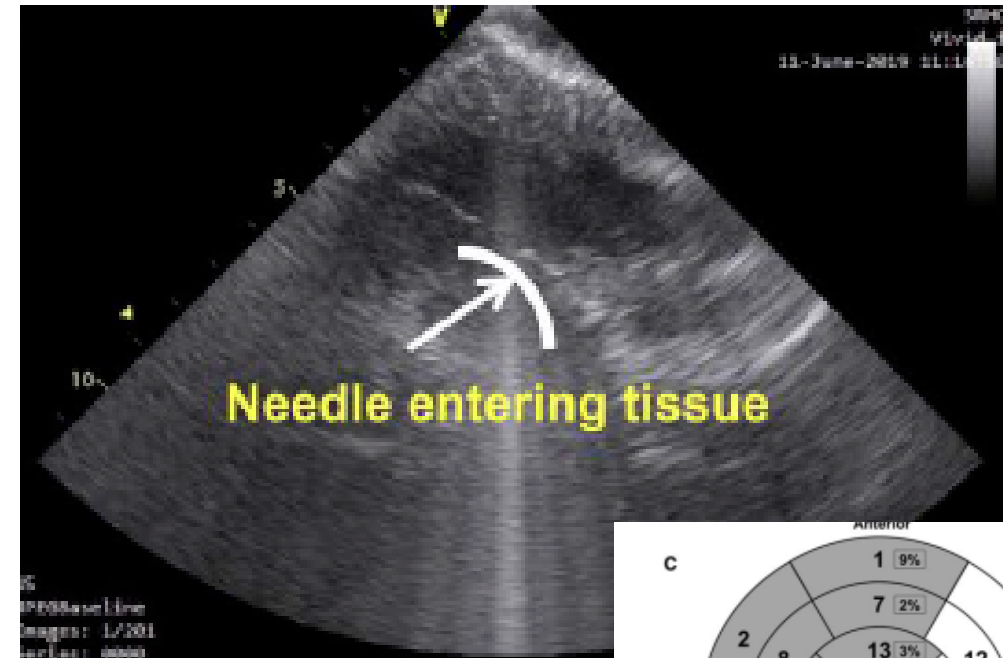
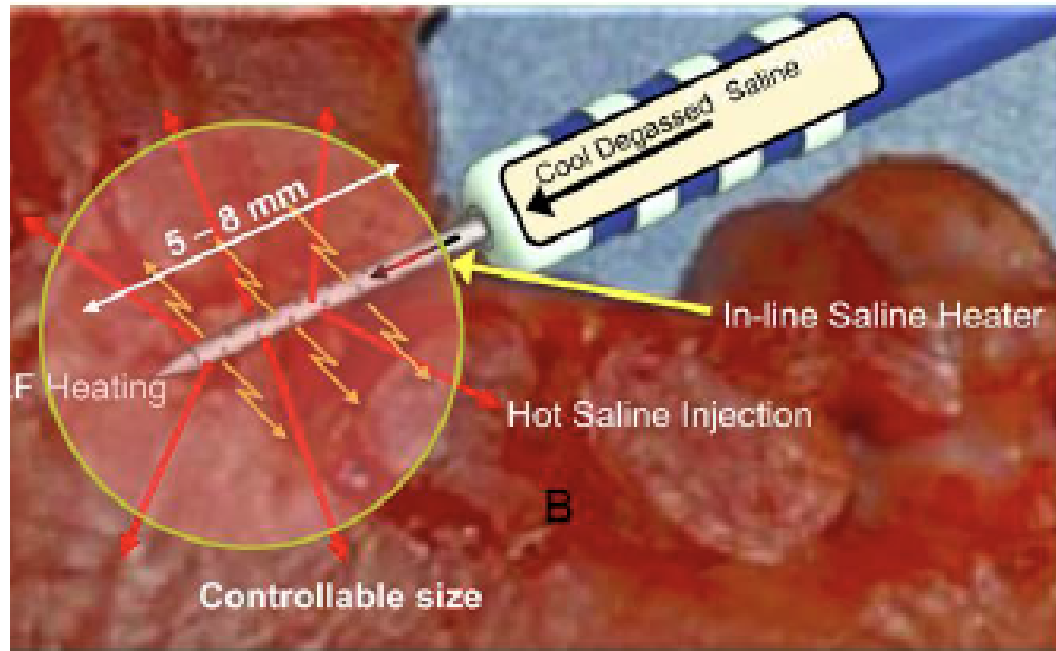
DURABLATE, Thermedical, Waltham, MA

Ablation of Refractory Ventricular Tachycardia Using Intramyocardial Needle Delivered Heated Saline-Enhanced Radiofrequency Energy: A First-in-Man Feasibility Trial

Douglas L. Packer, MDRS; David J. Wilber, MD; Suraj Kapa, MD; Katia Dyrda, MD; Isabelle Nault, MD; Ammar M. Killu, MBBS; Arvindh Kanagasundram, MD; Travis Richardson, MD; William Stevenson, MD; Atul Verma, MD; Michael Curley, PhD; for the SERF Investigators

irrigation via multiple ports sur large surface plus petite aiguille

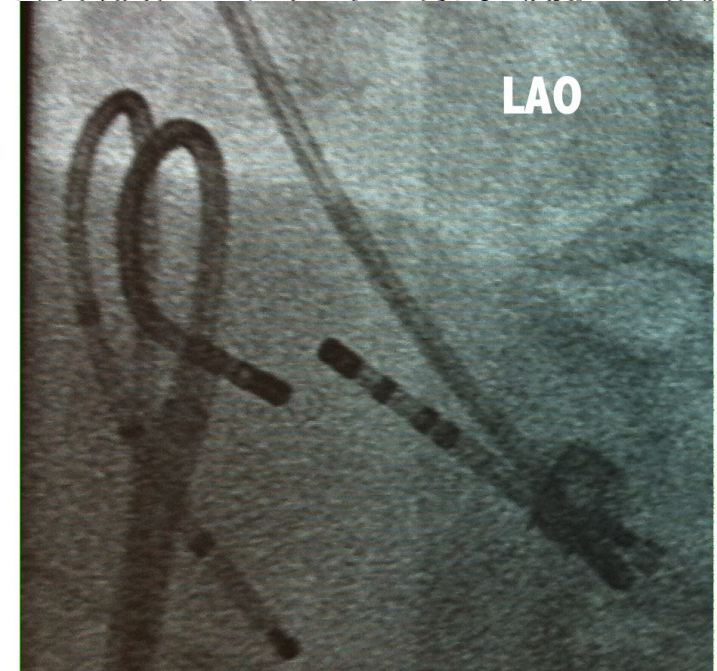
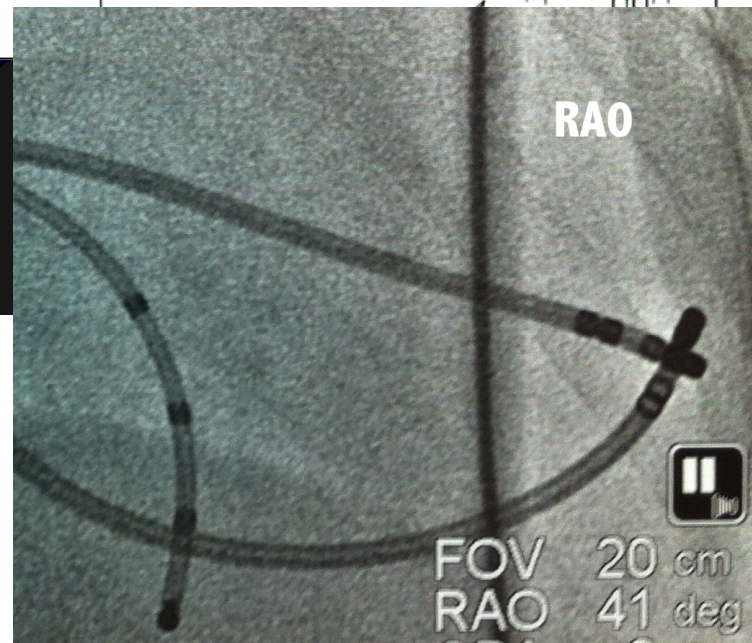
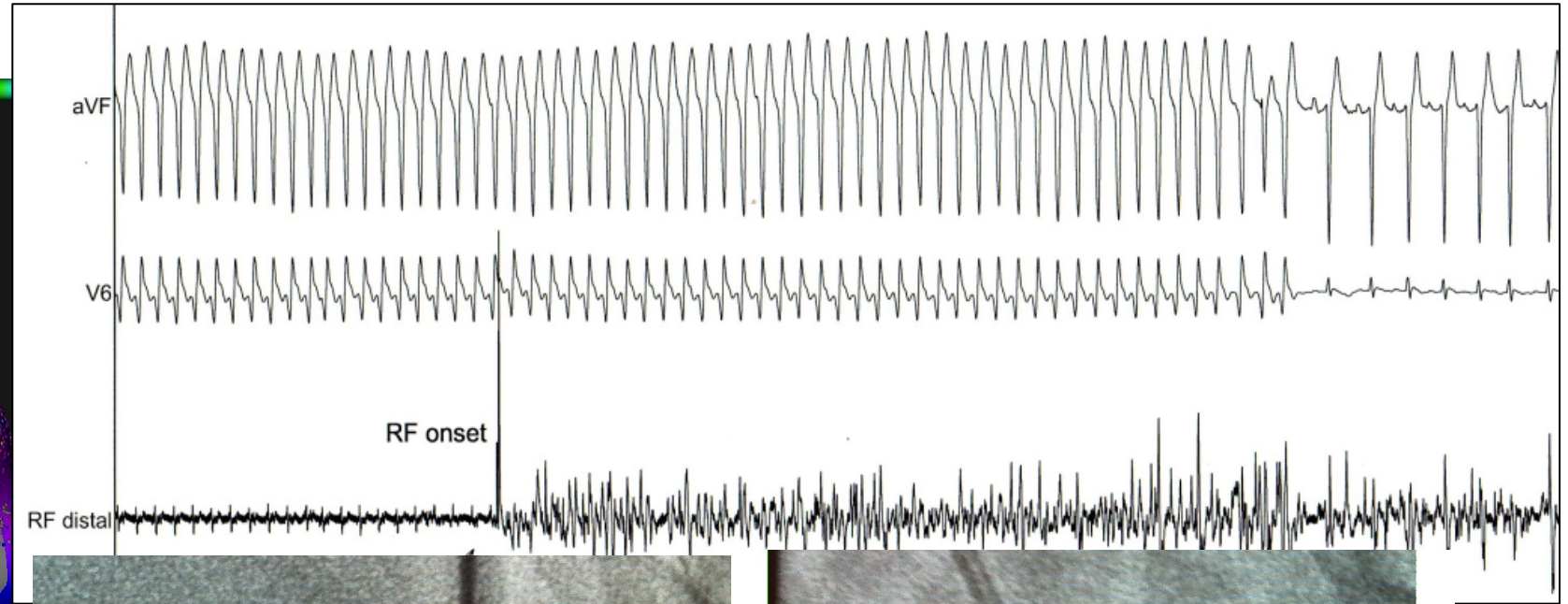
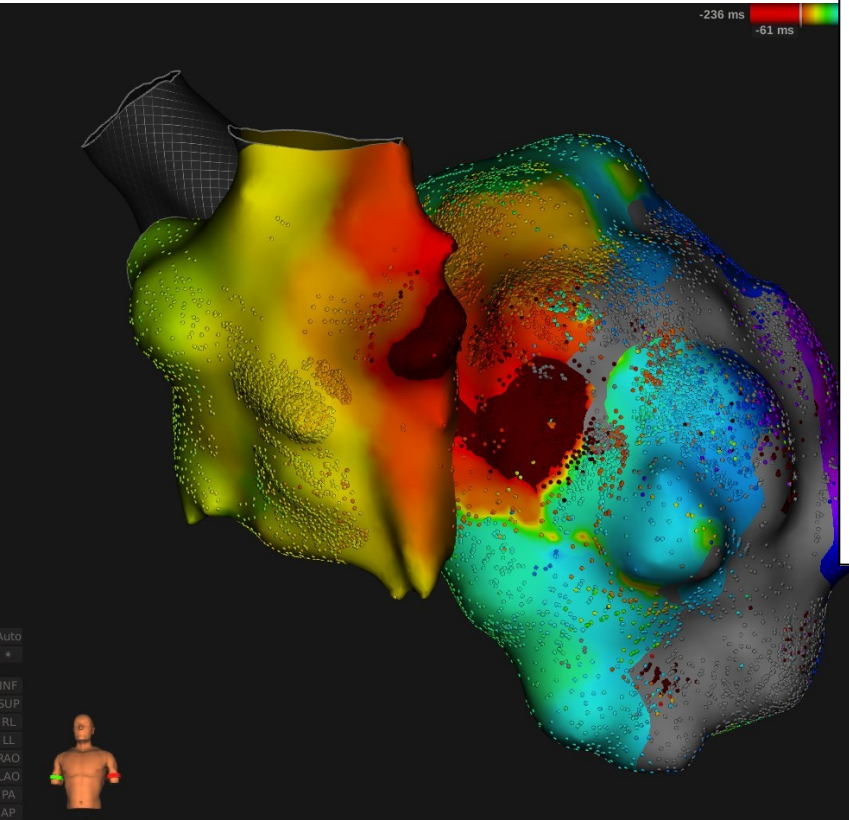
Irrigation serum salé chaud



97% succès sur échecs ... mais tamponnade, embols, deces, AVC ...

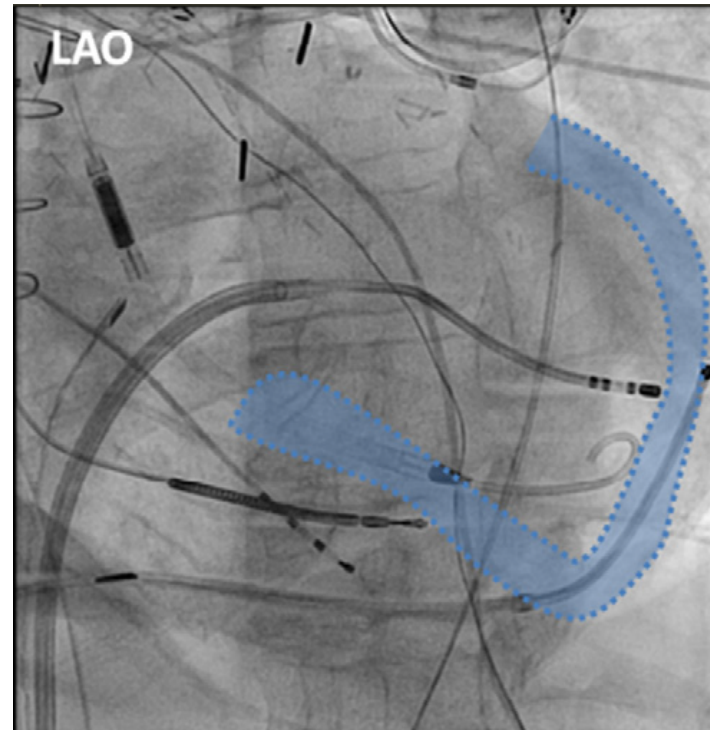
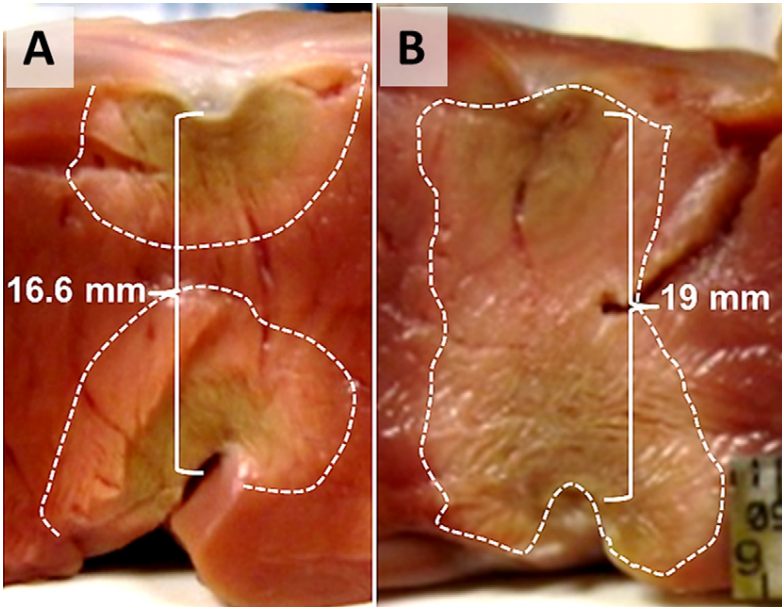
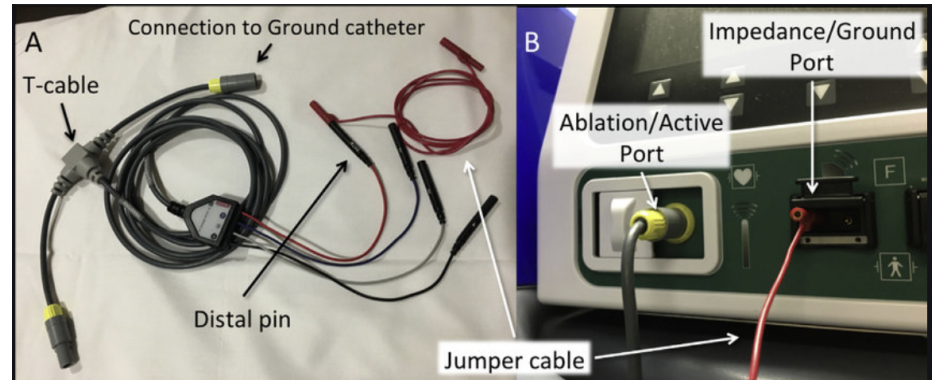
Packer D, et al. Circ Arrhythm Electrophysiol. 2022;15:e010347.

Ablation bipolaire



Maury P et al.,
JACC Clin Electrophysiol. 2016;2:526-528

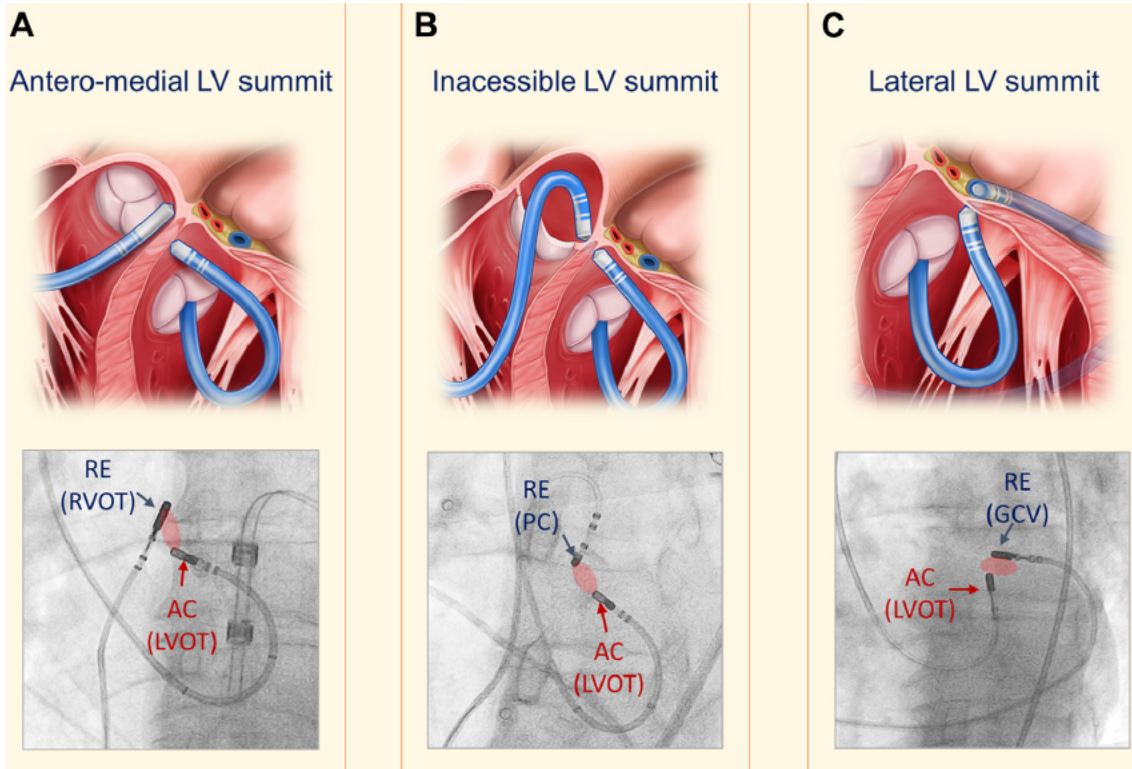
Ablation bipolaire



6 patients
77% succes
50% recurrences
Mais pas de LV summit ici

Koruth JS,. Heart Rhythm 2012;9:1932-41.

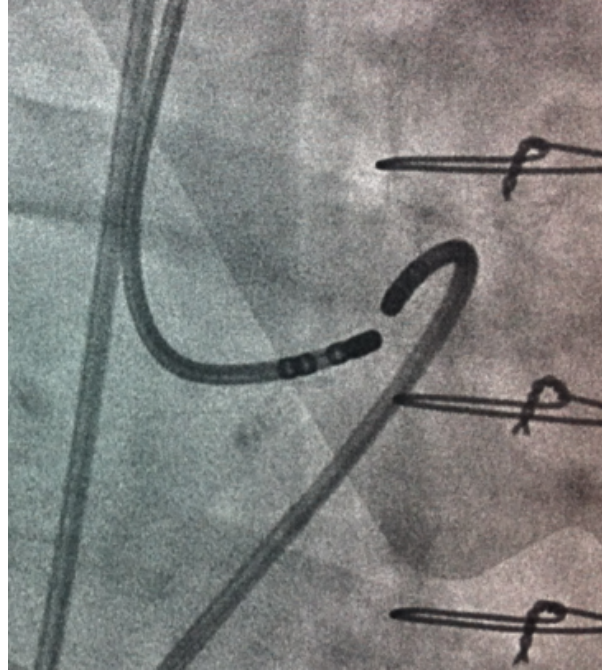
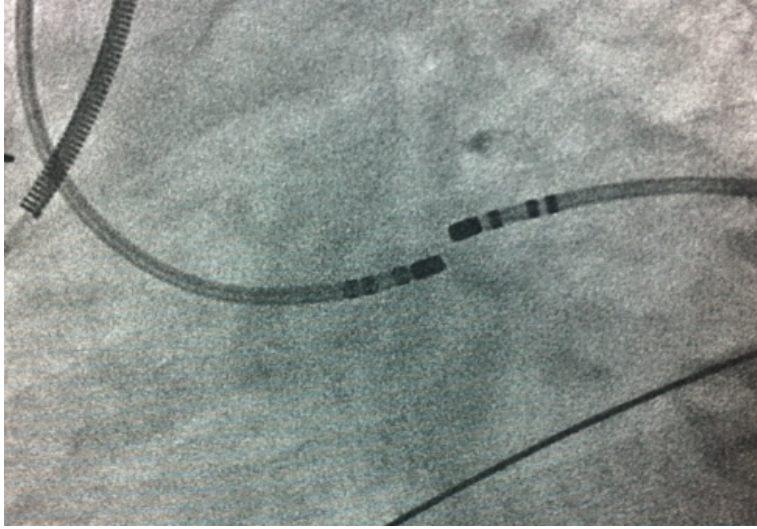
Ablation bipolaire LV summit



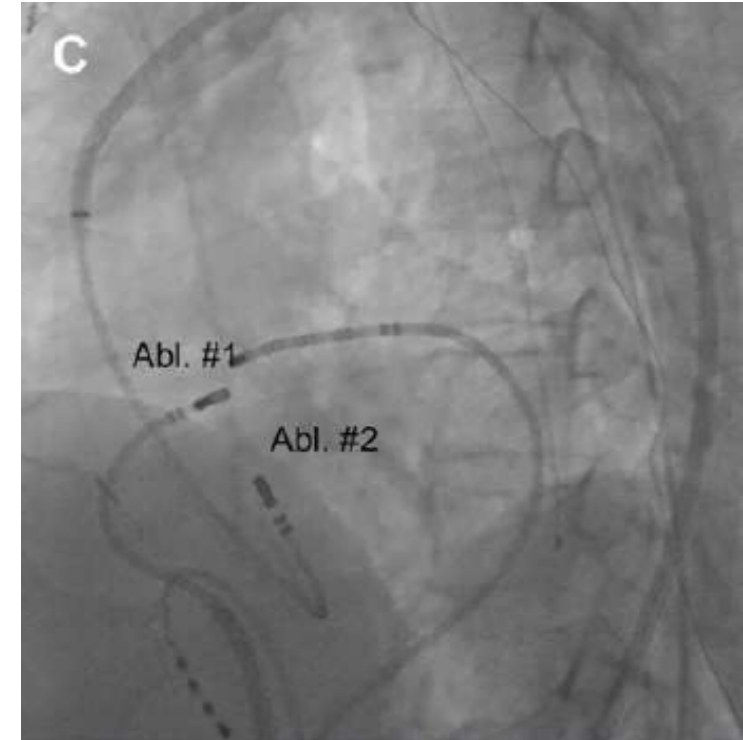
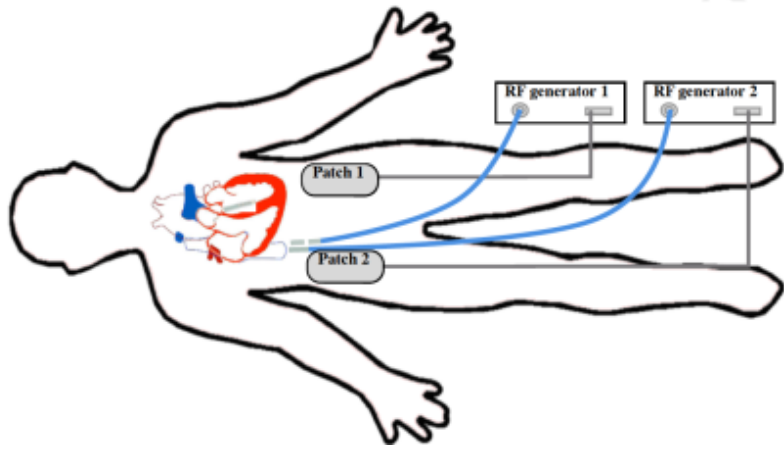
Study	Patients	Ablation Targets	Power (W)	Complications	Follow-Up
Teh et al, ⁷	4	Anteromedial LV summit	Up to 35	None	75% success during follow-up
Nguyen et al, ²⁵ 2016	1	Anteromedial LV summit	50	None	Recurrence
Futyma et al, ⁸	4	Lateral LV summit	24 ± 6	None	No VT recurrence, 83% PVC burden reduction
Tokioka et al, ¹⁹ 2020	3	Lateral LV summit	35–40	None	Acute success
Igarashi et al, ²⁶ 2020	4	LV summit	Up to 45	None in the LV summit cohort	Acute success
Futyma et al, ⁹ 2020	7	Inaccessible LV summit	36 ± 7	None	No VT recurrence in VT group, overall 84% PVC burden reduction
Enriquez et al, ²⁷ 2019	1	Anteromedial LV summit	Up to 45 with half normal saline (HNS) irrigation	None	No PVC after 4 wk
Sauer et al, ²⁹ 2018	1	Anteromedial LV summit	50	None	No VT after 6 mo

Futyma P, Sauer WH. Card Electrophysiol Clin. 2023;15:57-62.

Ablation bipolaire LV summit



Simultaneous unipolar ablations ?

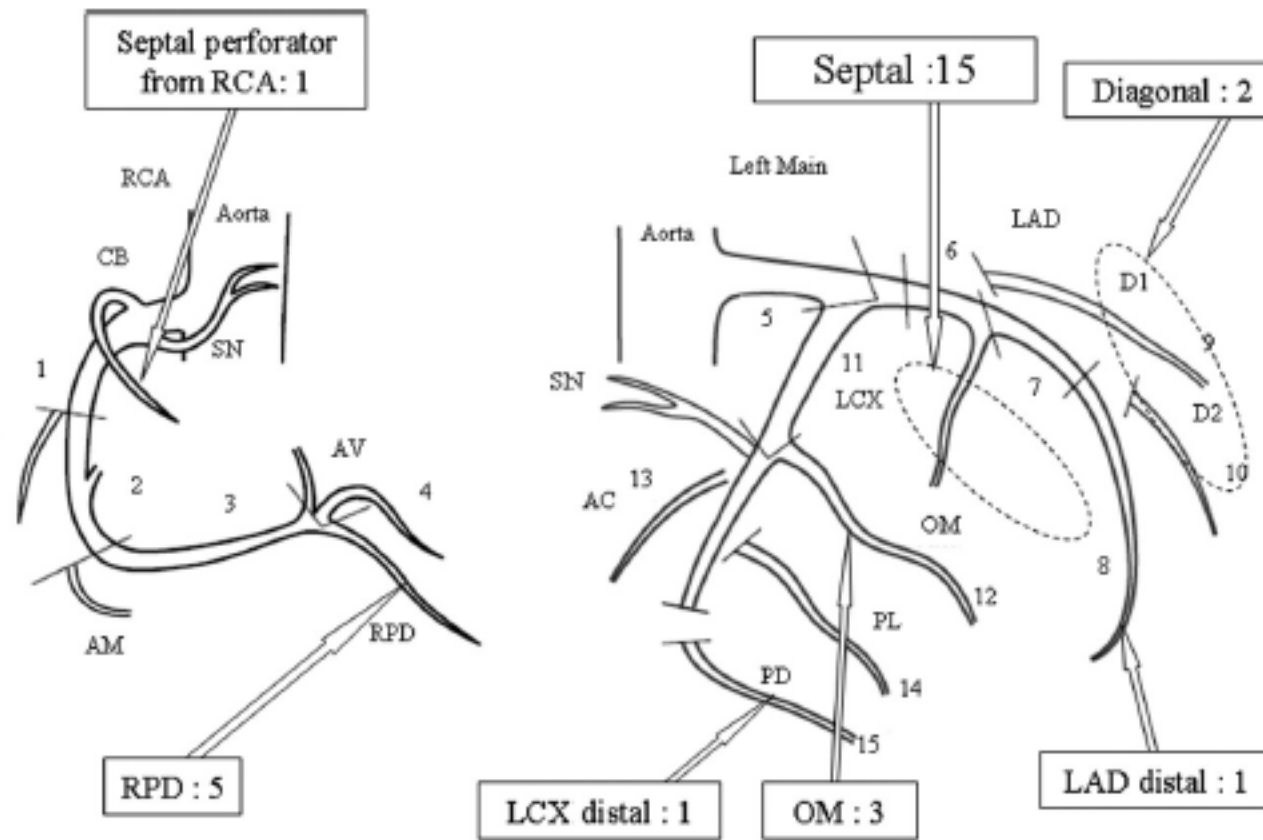
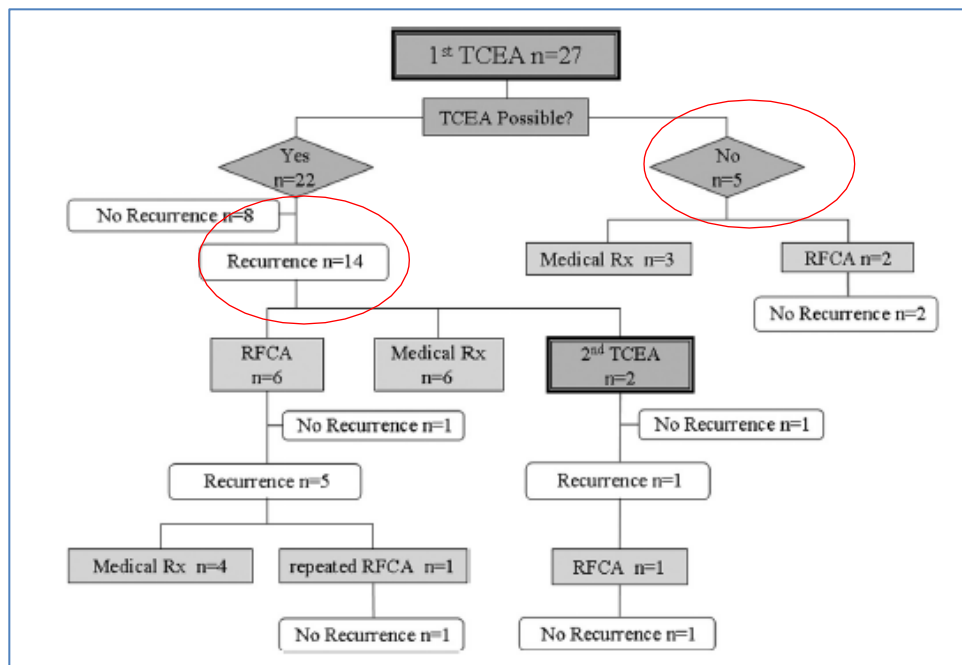


6 patients avec TV intra septale (pas de LV summit quoique ...)
chez 50% la TV s'arrete tardivement apres longue RF unipolaire (3
mn)

Simultaneous unipolar ablation 100% succes aigu (2/3 a long terme)

Yang J, et al. Heart Rhythm. 2019;16:863-870.

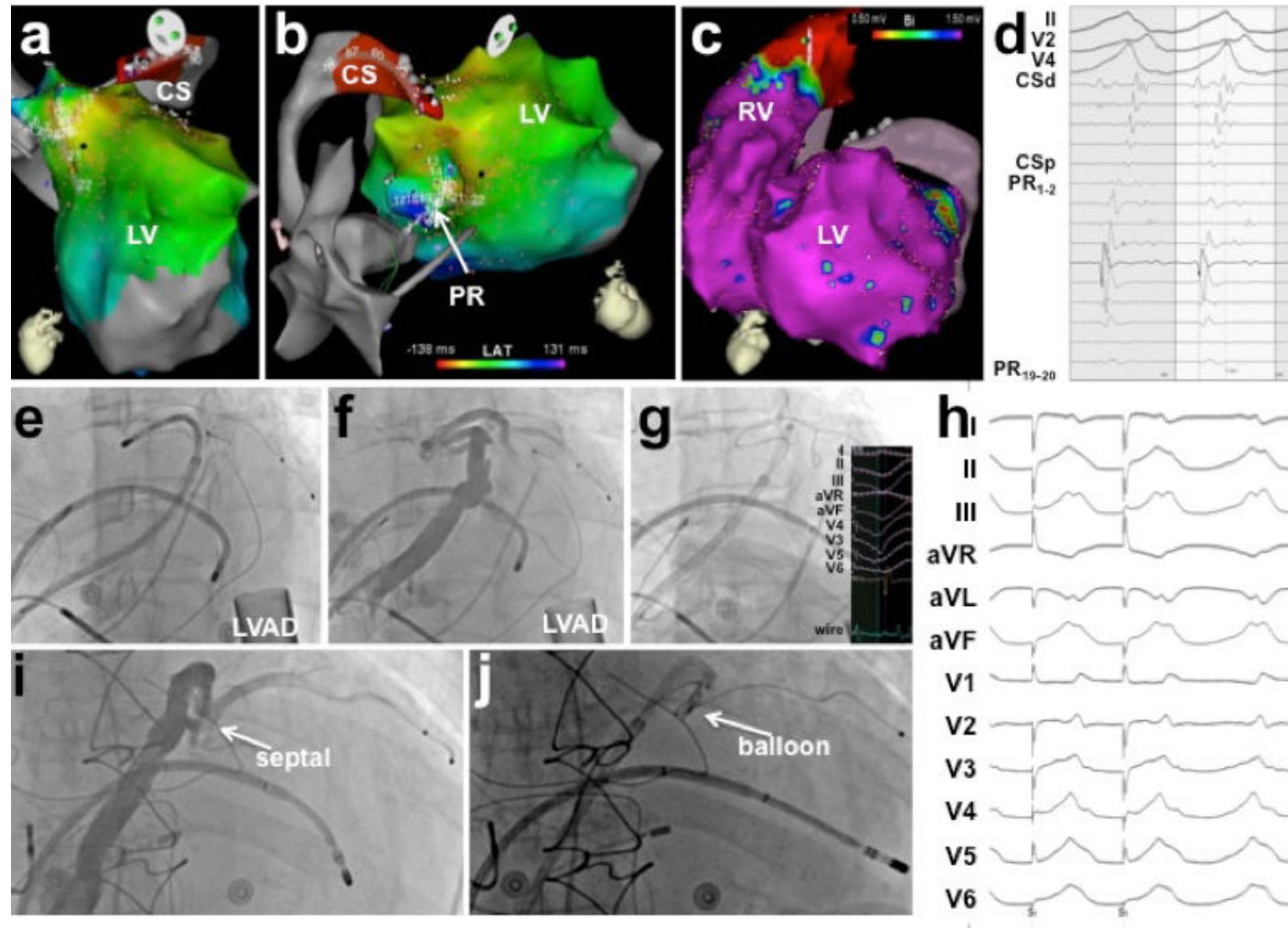
ethanol artériel ?



20% sans artère cible
 38% Bloc AV si artère septal
 Récidives 2/3
 Mortalité 1/3

Pas de LV summit ici

Ethanol CS

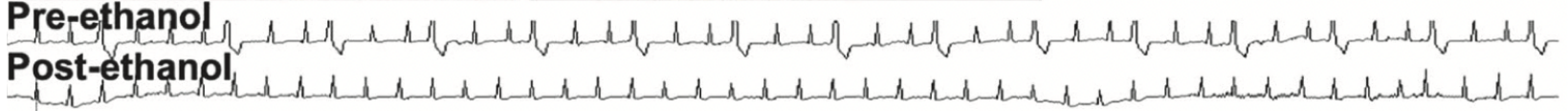
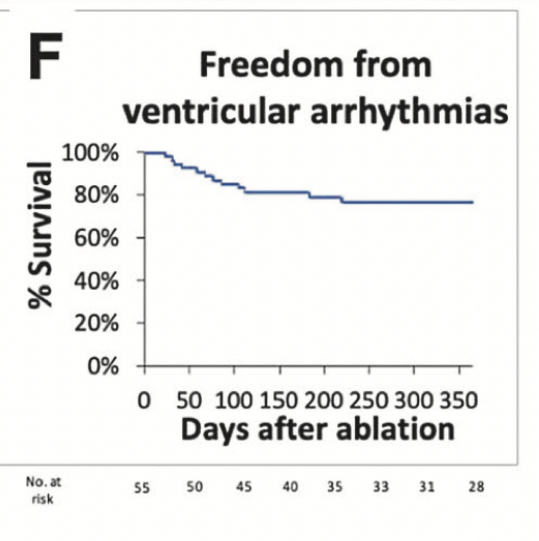
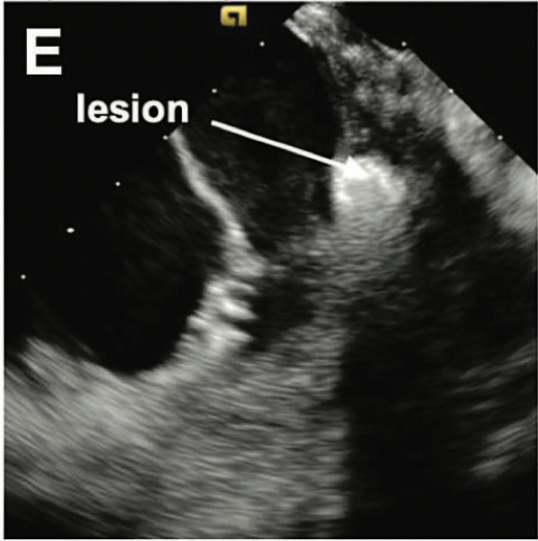
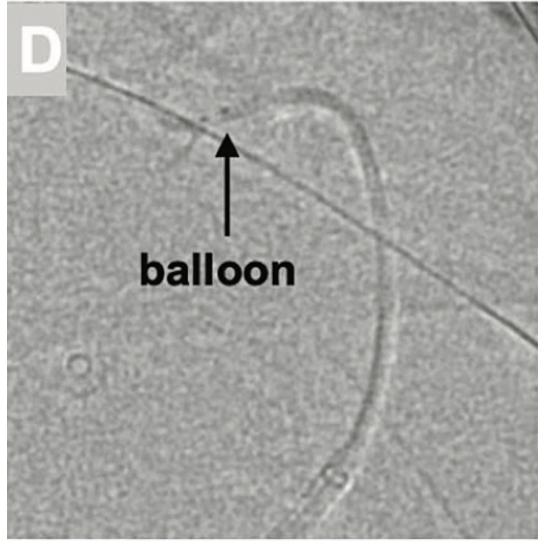
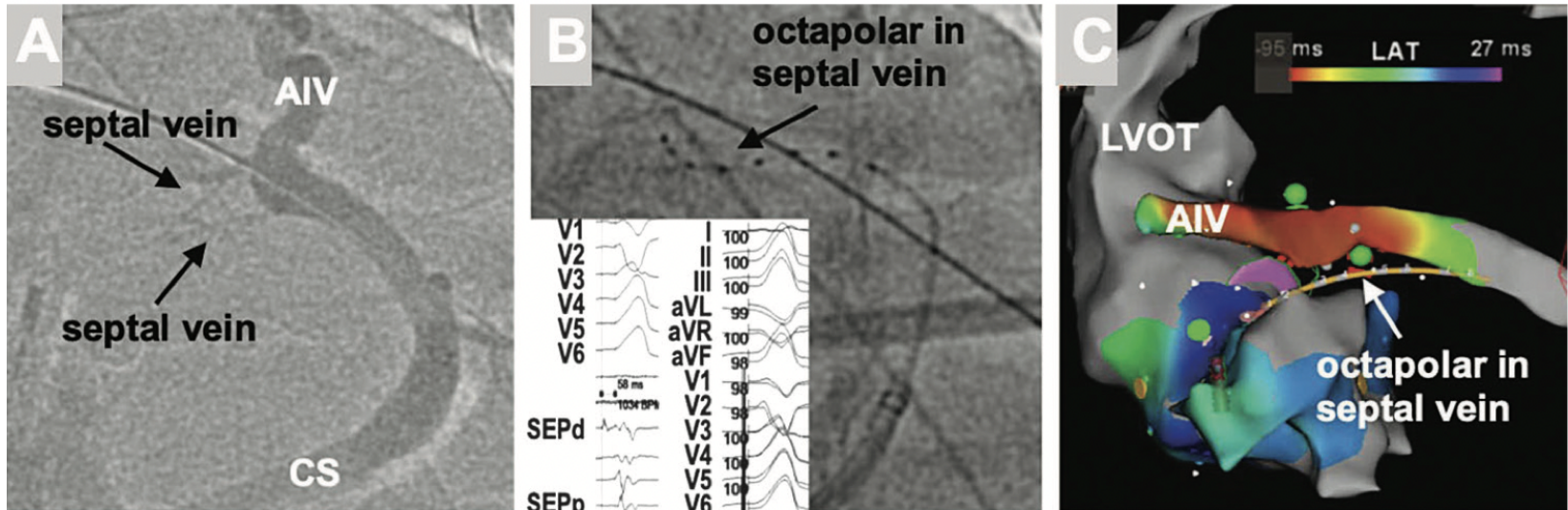


LV summit

5 patients
Veine septale

100% acute success
57% recurrences

Kreidieh B., Circ Arrhythmia & Electrophysiol 2016;9 doi:10.1161.



LV summit

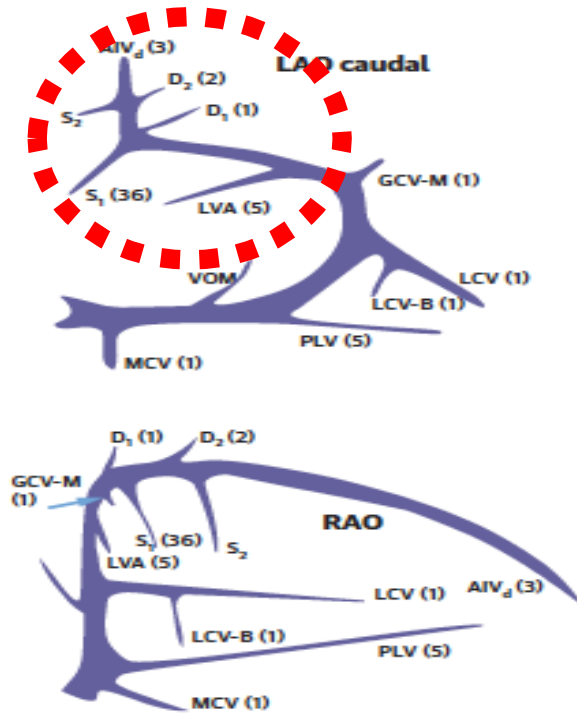
Okishige K. Clin Case Rep. 2019
 Sasaki T. Heart- Rhythm Case Rep. 2020
 BaszkoA. Cardiol J. 2020
 Kato K. Heart Rhythm Case Rep. 2018

Intramural Venous Ethanol Infusion for Refractory Ventricular Arrhythmias

Outcomes of a Multicenter Experience

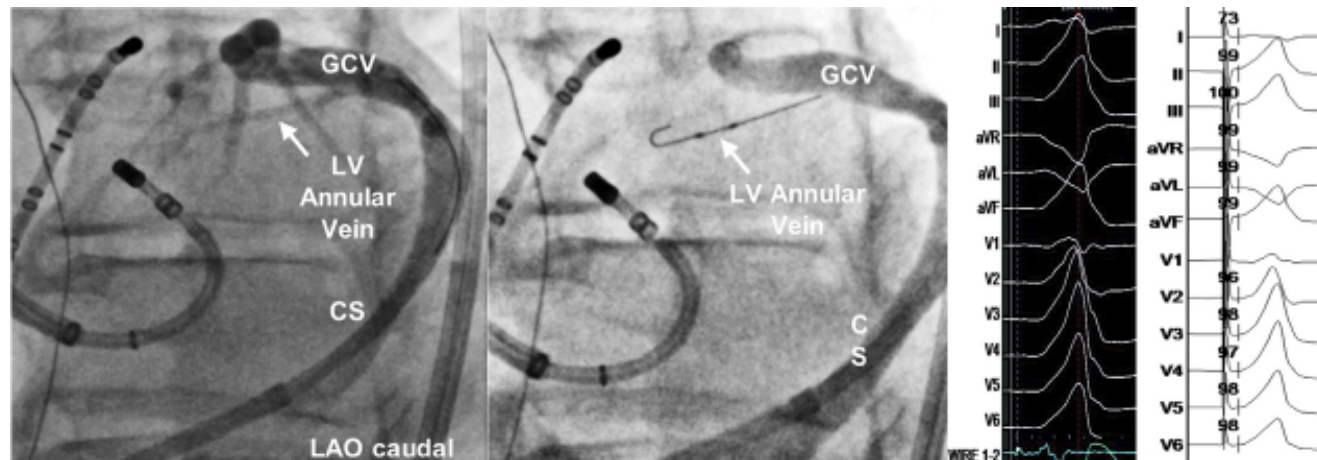
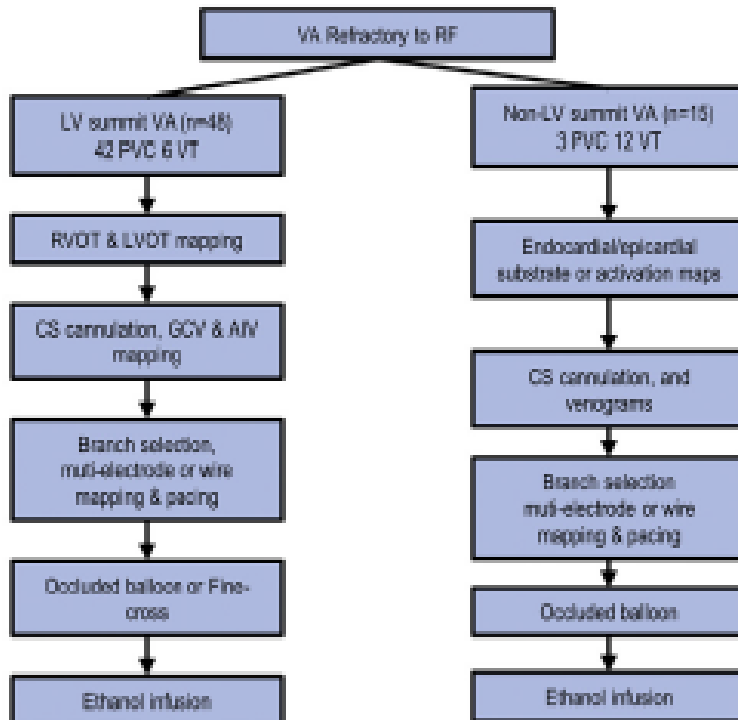
Liliana Tavares, MD,^a Adi Lador, MD,^a Stephanie Fuentes, MD,^a Akanibo Da-wariboko, MD,^a Krzysztof Blaszyk, MD, PhD,^b Katarzyna Malaczynska-Rajpold, MD, PhD,^b Giorgi Papiashvili, MD,^c Sergey Korolev, MD,^d Petr Peichl, MD,^e Josef Kautzner, MD, PhD,^e Matthew Webber, MD,^f Darren Hooks, MD, PhD,^f Moisés Rodríguez-Mañero, MD, PhD,^g Darío Di Toro, MD,^h Carlos Labadet, MD,^h Takeshi Sasaki, MD,ⁱ Kaoru Okishige, MD,^j Apoor Patel, MD,^a Paul A. Schurmann, MD,^a Amish S. Dave, MD, PhD,^a Tapan G. Rami, MD,^a Miguel Valderrábano, MD^a

(J Am Coll Cardiol EP 2020;6:1420-31)

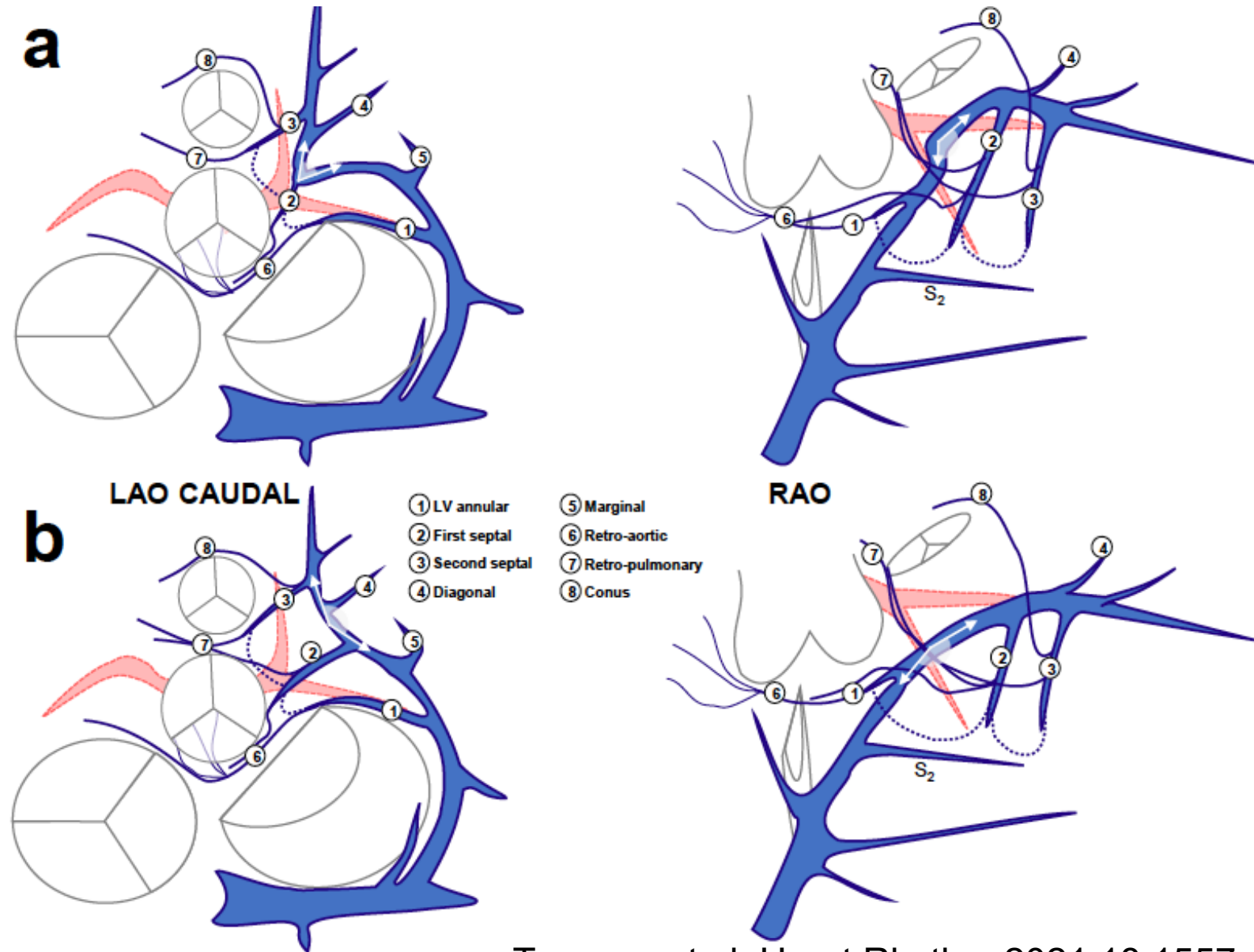


98 % succes aigu (+/- RF)
77% succes terme

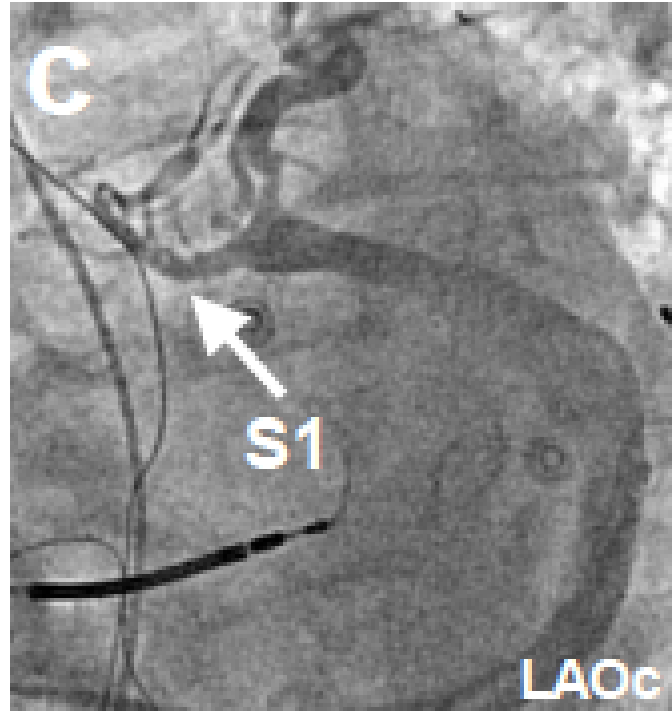
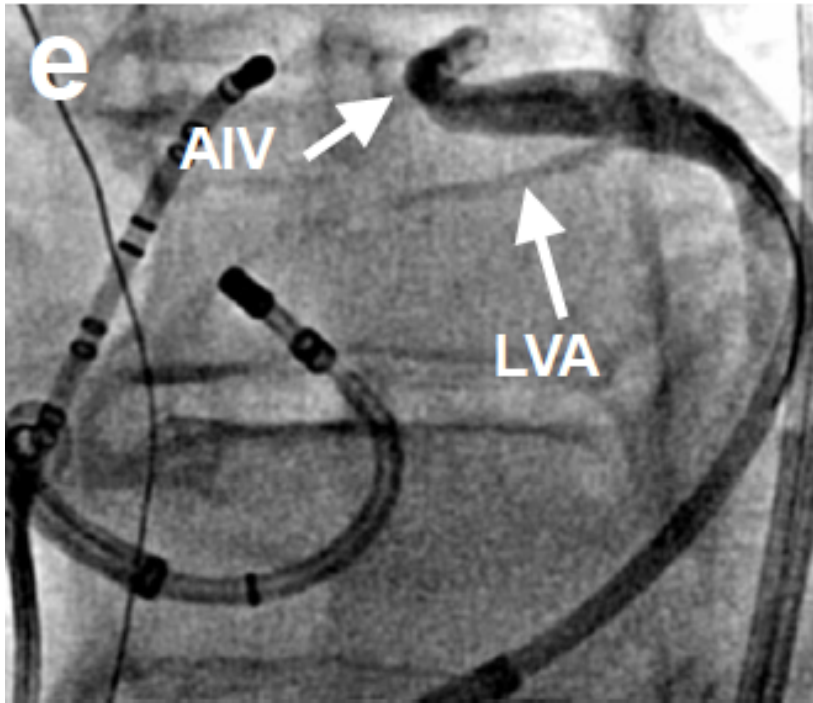
Procedural approach



Venous anatomy of the left ventricular summit: Therapeutic implications for ethanol infusion

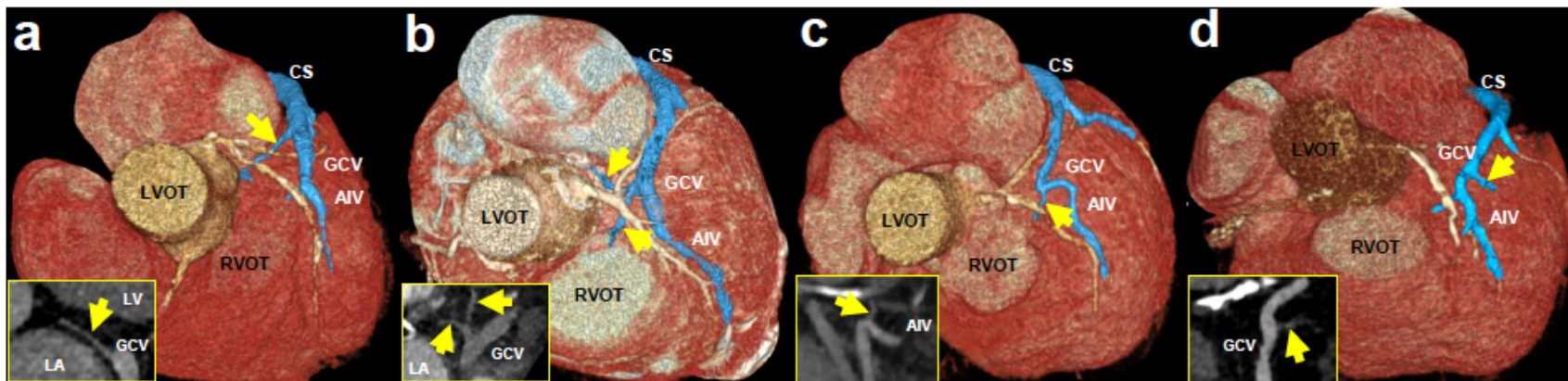


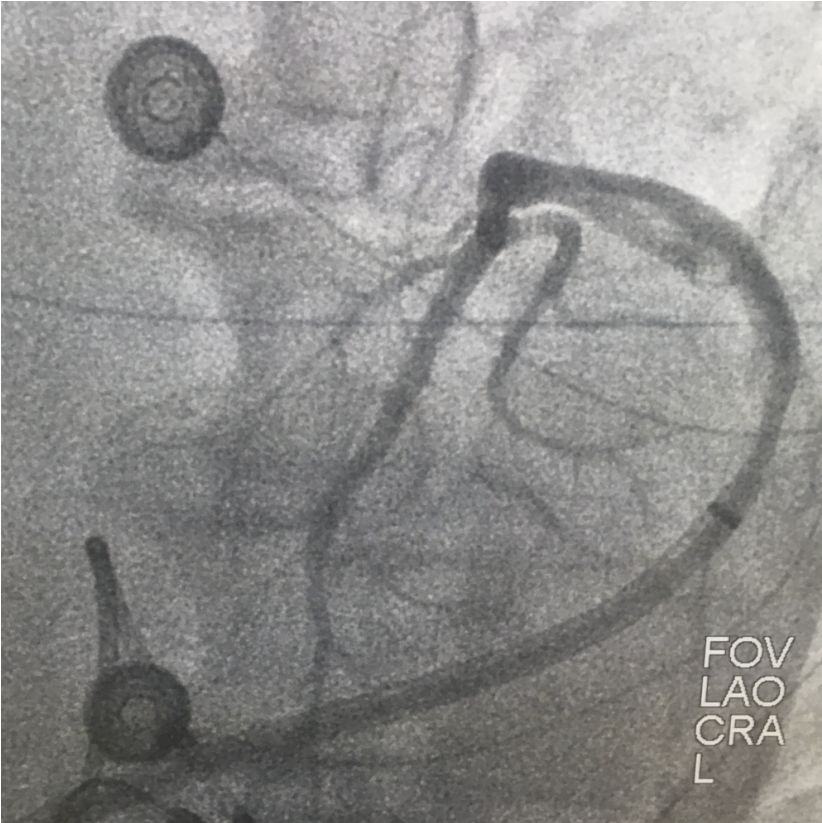
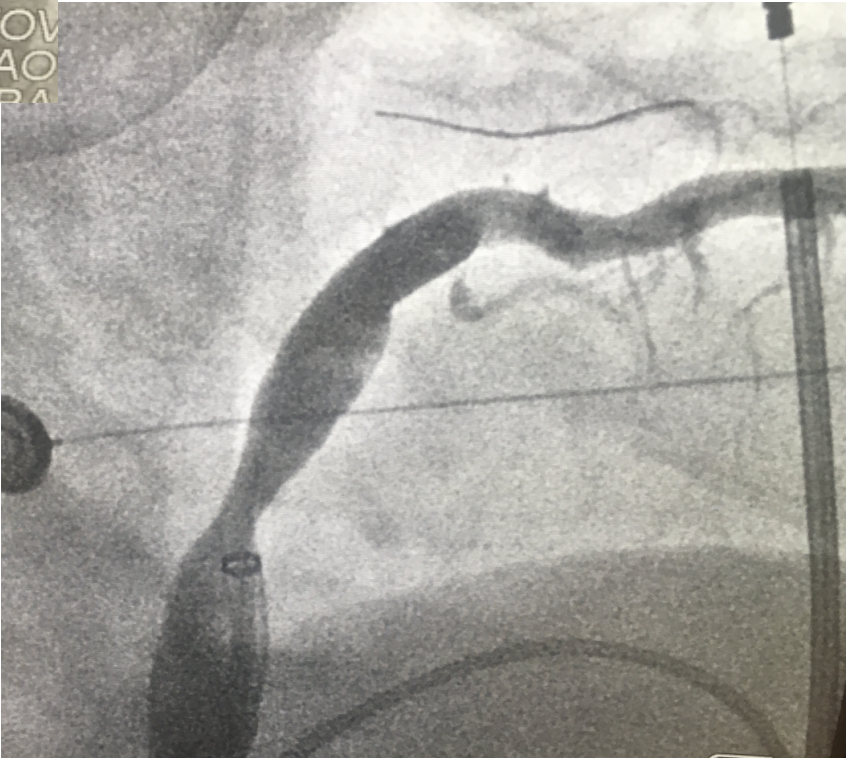
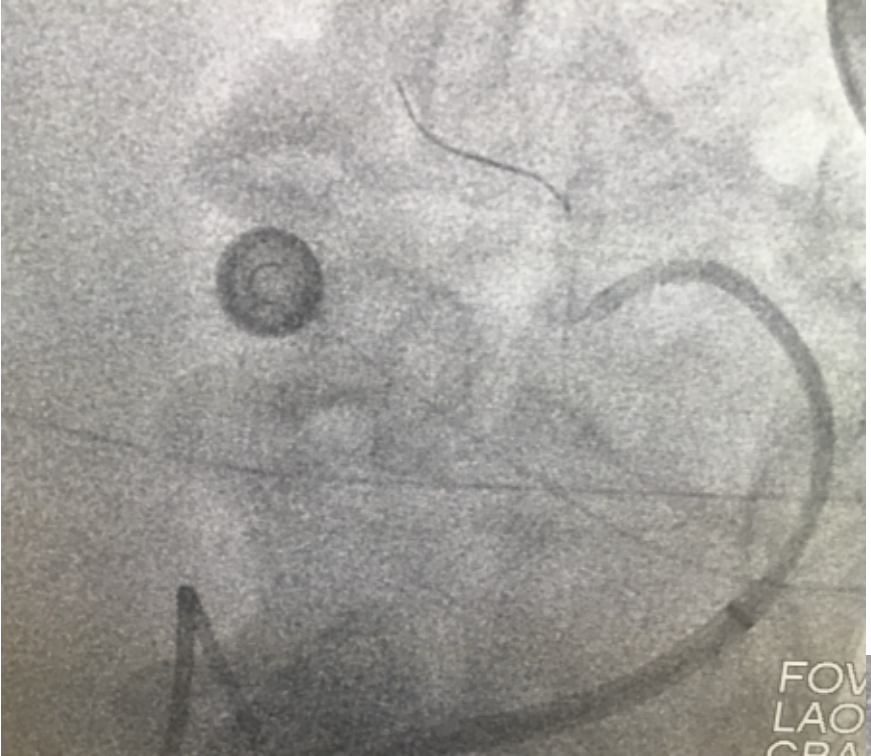
Venous anatomy of the left ventricular summit: Therapeutic implications for ethanol infusion



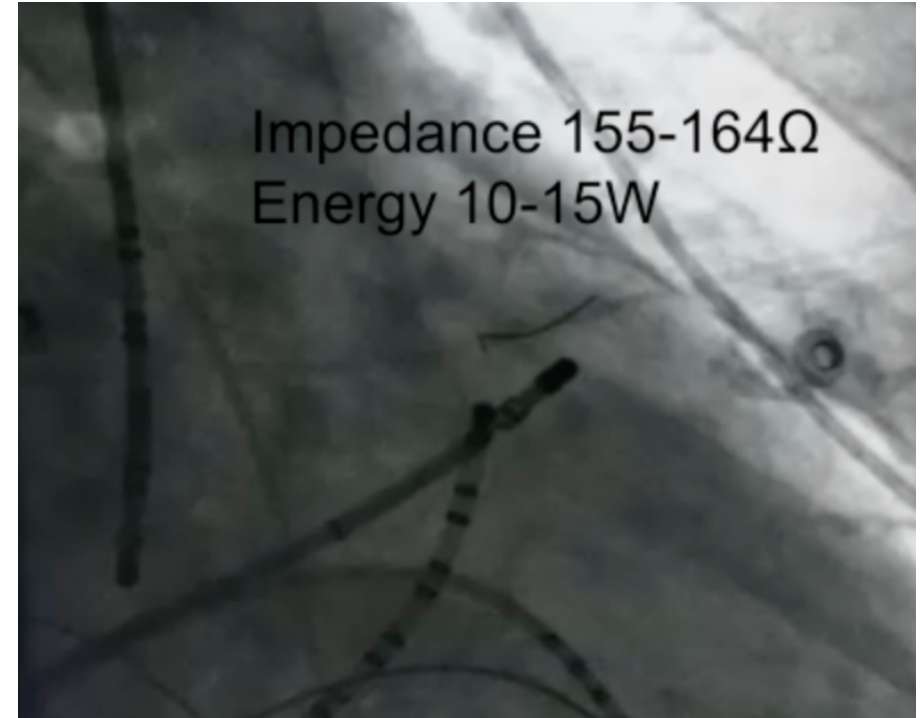
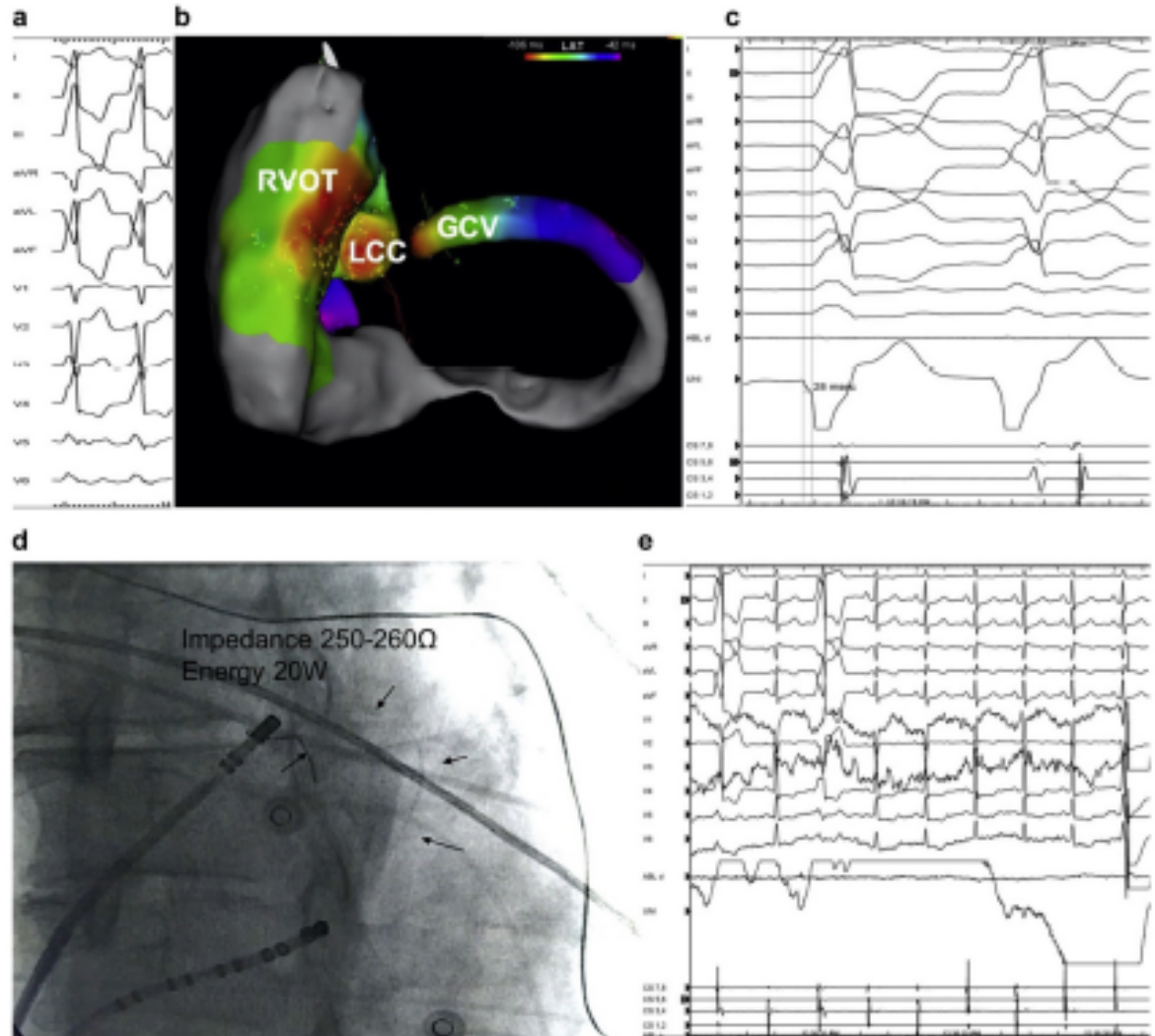
LV summit

Essentiellement veines septales et annulaire

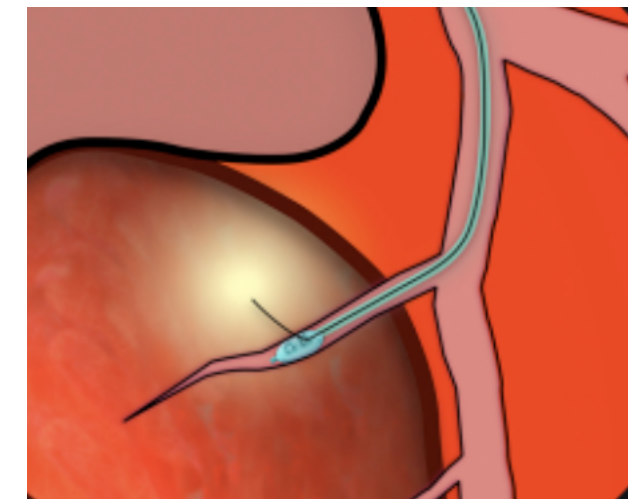
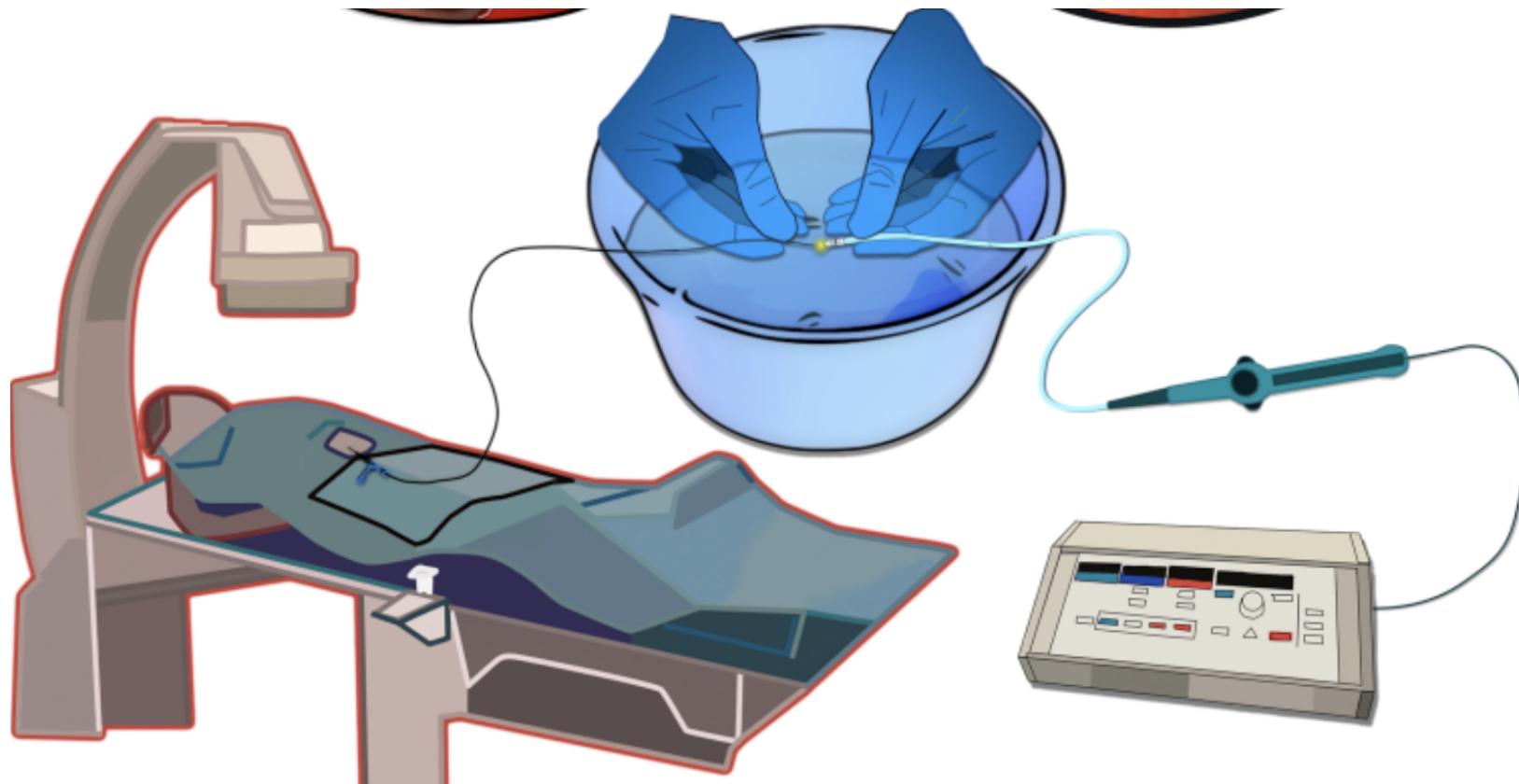




Guide + RF ?



Guide + RF ?



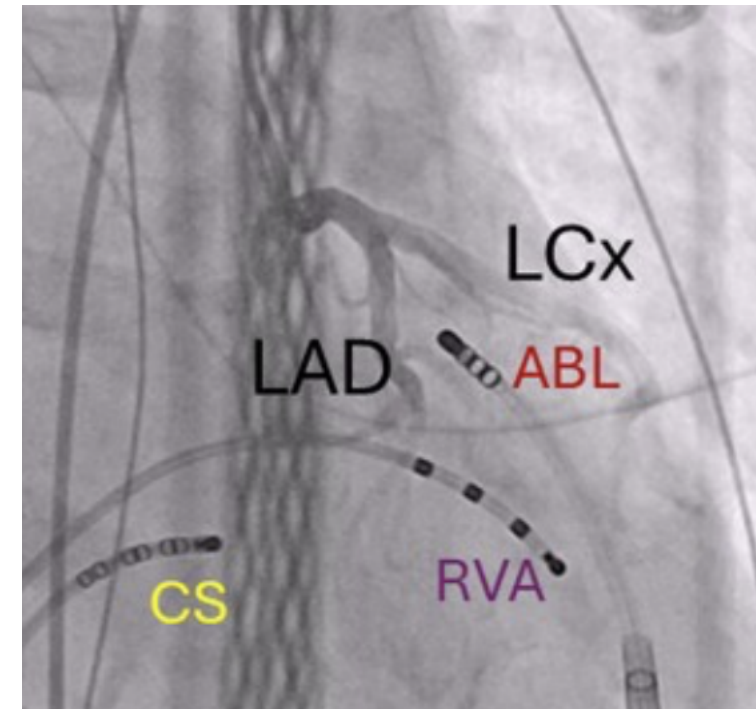
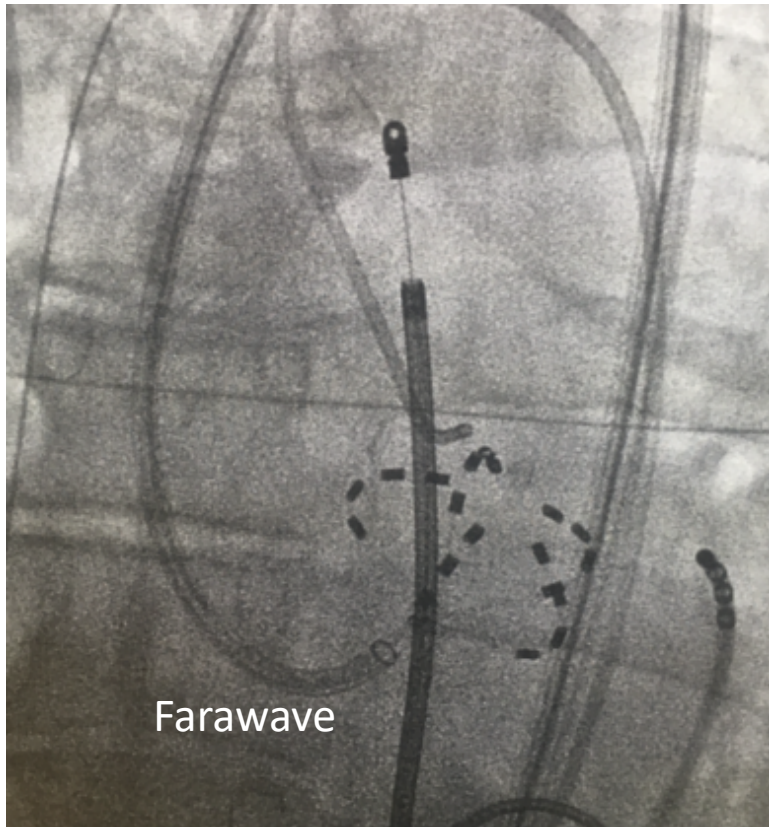
RF sur guide Stingray apres ballon Stingray et perforation veine

Stingray LP system balloon (Boston Scientific) pour CTO

Romero, et al. Heart Rhythm CaseRep. 2018;4:285-292.

Et PFA ?

(CENTAURI™, Galaxy Medical, FL, USA)



Dylan Spenkelnik, et al. Heart J Case Rep 2024 Sep 10;8(9):ytae478

Comment reconnaître LV summit ?

Les algorithmes



Table 1. Common published ECG differentiation algorithms for successful localization of OT PVC origins.

ECG FINDINGS	DEFINITION	RESULTS	COMMENTS
Transition in precordial leads [8]	1st precordial lead with R>S	V1 or V2→LVOT origin V4 and after→RVOT origin	Cardiac rotation affects reliability
R wave duration index in leads V1 or V2 [9]	Percentage of longer R wave duration in V1 or V2 to QRS complex duration	R wave duration index $\geq 50\%$ suggestive of a left-sided origin	Discriminates RVOT vs aortic sinus cusp origins
V2 transition ratio [10]	Percentage of R wave during PVC $(R/R+S)_{VT}$ in V2 divided by the percentage of R wave in sinus rhythm $(R/R+S)_{SR}$	Values ≥ 0.6 predict left origin (91% accuracy)	Used only if PVC precordial transition in lead V3
Transition Zone index (TZ index) [11]	TZ score of PVC minus TZ score of sinus rhythm	If TZ index < 0 , predictive of left sided origin with 88% sensitivity and 82% specificity	
V2S/V3R index [12]	S wave in V2 divided by R wave amplitude in V3 during PVC	Values ≤ 1.5 predict left sided origin with 89% sensitivity and 94% specificity	It can be applied irrespective of precordial transition
V4/V8 ratio [13]	Ratio of PVC R wave in V4 to PVC R wave in V8	Values > 3 suggestive of left sided origins with 88% sensitivity and 77% specificity	V8 lead located at the inferior tip of the left scapula
V4/V8 index [13]	Ratio of PVC R wave V4/V8 divided by R wave V4/V8 in sinus rhythm	Values > 2.28 suggestive of left-sided origins with 67% sensitivity and 98% specificity	V8 lead located at the inferior tip of the left scapula
V3R/V7 index [14]	R wave amplitude in lead V3R during PVC, divided by R wave amplitude in lead V7 during PVC	V3R/V7 ≥ 0.85 predictive of LVOT origin with 87% sensitivity and 96% specificity	V3R located at the right correspondent place of V3 and V7 at the left posterior axillary line at 5th intercostal space
The RV1–V3 transition ratio [15]	$(RV1+RV2+RV3)_{PVC} / (RV1+RV2+RV3)_{SR}$	Values ≥ 0.9 predict LVOT origin with 94% sensitivity and 73% specificity	Only for OT PVCs with precordial transition in lead V3

[Modern mapping and ablation of idiopathic outflow tract ventricular arrhythmias.](#)

Dragasis S. Rev Cardiovasc Med. 2022;23:103.

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zone inaccessible

aVL/aVR Q ratio < 1.6

R-wave ratio III/II < 1.4 :

(Romero case report)

- LBBB pattern

- QRS duration ≤ 175 ms

- maximum deflection index of ≥ 0.55

Yamada T. *Circ Arrhythm Electrophysiol* 2016;9: e004202.

LBBB pattern

larger R wave amplitude in the inferior leads

absence of S wave in V5–V6

Enriquez A, *HeartRhythm*. 2017;14:141-148.

perte R V2 (break pattern): zone inaccessible

aVL/aVR Q-wave ratio < 1.45 : cusp ou supra valvulaire

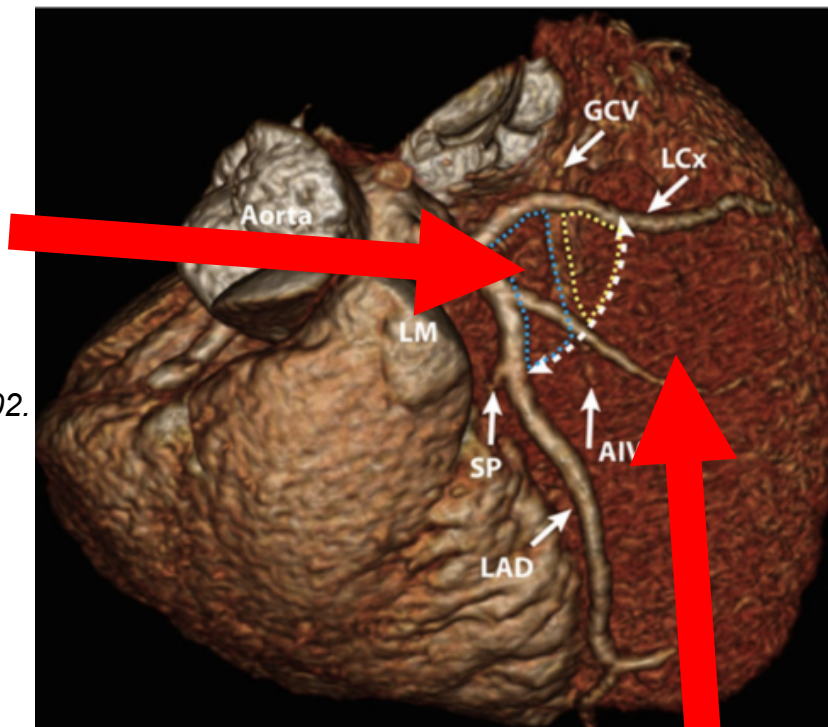
Kanagaratnam, et al. *J Am Coll Cardiol* 2001;37:1408-1414

aVL/aVR Q-wave ratio of > 1.75 approche epicardique (plus épais)

Yamada T, et al. *Circ Arrhythm Electrophysiol* 2010;3:616-623

Santangeli P, et al. *Circ Arrhythm Electrophysiol* 2015;8:337-343

Lin CY, et al. *Heart Rhythm* 2016;13:111-121.



Zone accessible (SC ou épi)

VL $>$ VR

S V5-V6

DIII $>$ DII

retard droit