24e réunion nationale GRCI 2017

40 ANS DE L'ANGIOPLASTIE

Prévention de la mort subite dans la maladie coronaire

L'ablation endocavitaire : Pour qui Pour quand?

CHU GRENOBLE ALPES

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DÉCLARATION DE LIENS D'INTÉRÊT AVEC LA PRÉSENTATION

Research grants and honoraria :

- Boston Scientific
- Medtronic
- Livanova
- Abott

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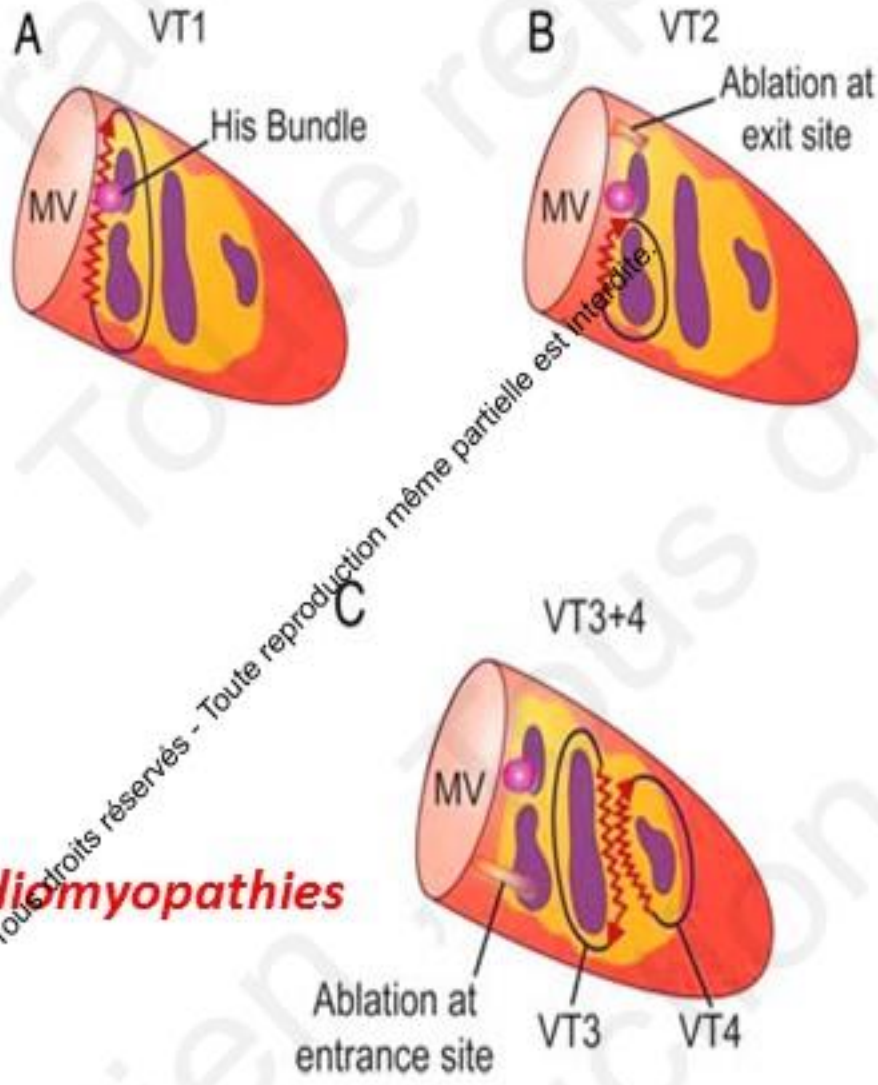
VT ablation : for who? when?

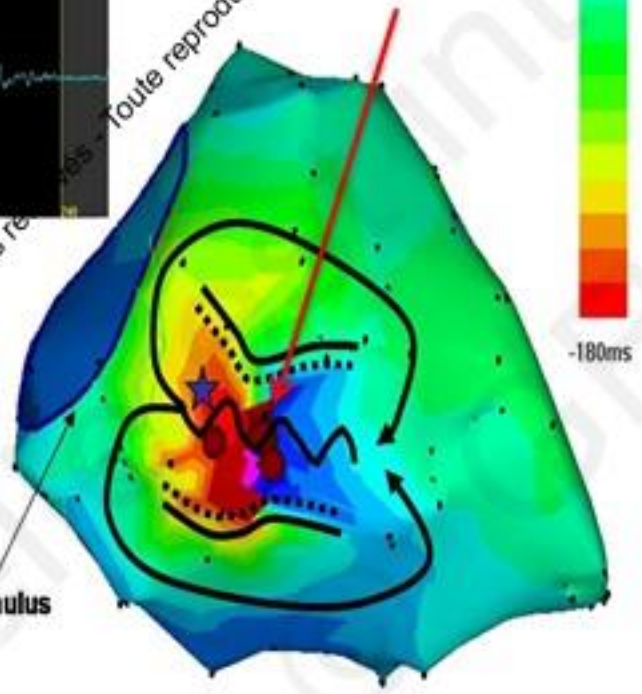
- VT is a significant cause of morbidity/mortality in ischemic CM
- **ICDs preventing SCD**, improving survival but not able to prevent VT episodes
- ICD shocks increase mortality and worsen QOL
- Amiodarone is the most-effective AAD but significant side-effects , discontinuation 25%

Increasing place for VT ablation in ischemic cardiomyopathies



Post- infarct mappable VT

Isthmus width = 16±8 mm (6 to 36)
Isthmus length=31±7 mm (18 to 41)
De Chillou Cet al Circulation 2002;105:726-31



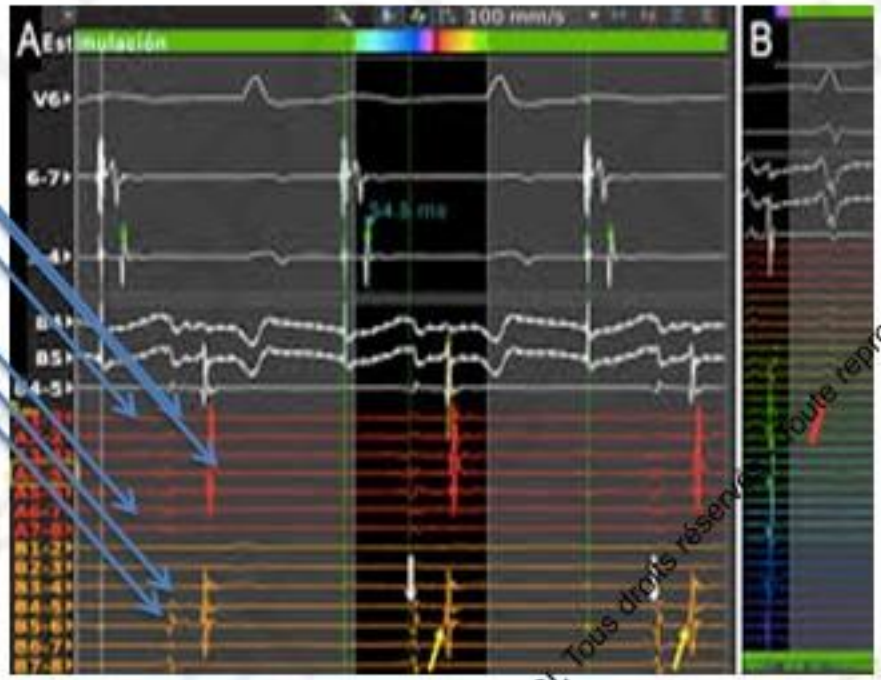
Endocardial reentry>90% of post-MI mappable VTs

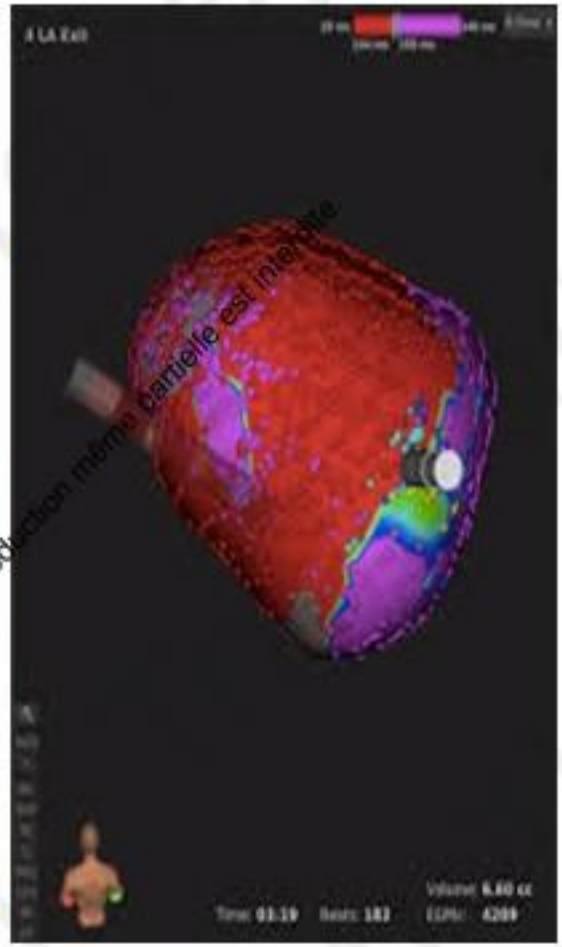
Surviving myocytes
+
Surrounding fibrosis

Slow conduction

De Bakker JMT et al Circulation 1993; 88:915-26

Advance for mapping
Multi-electrodes catheters





Prophylactic Catheter Ablation for the Prevention of Defibrillator Therapy

Vivek Y. Reddy, M.D., Matthew R. Reynolds, M.D., Petr Neuzil, M.D., Ph.D., Allison W. Richardson, M.D., Milos Taborsky, M.D., Ph.D., Krit Jongnarangsin, M.D., Stepan Kralovec, Lucie Sediva, M.D., Jeremy N. Ruskin, M.D., and Mark E. Josephson, M.D.

SMASH-VT

- 128 pts, ICM (87% male, age : 67 y.o.)
- Follow-up : 22,5±2,5 months
- No class I or III AR
- Substrate based approach
- 30 days mortality : 0

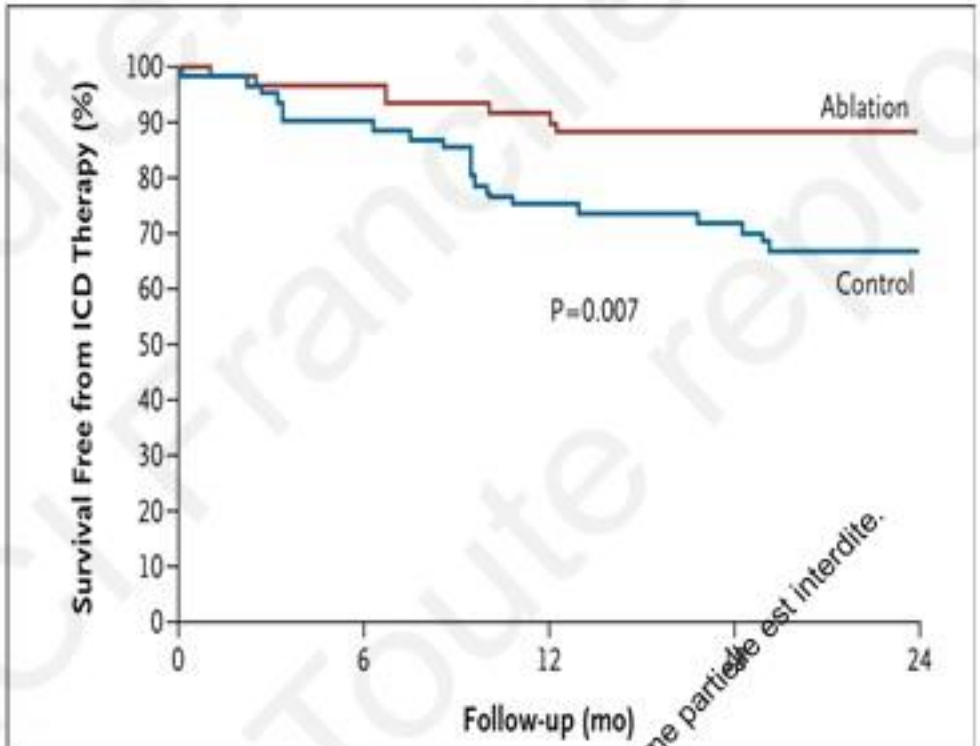


Figure 1. Kaplan–Meier Estimate of the Primary End Point of Survival Free from ICD Therapy.

ICD denotes implantable cardioverter–defibrillator.

Table 2. End Points.*

Variable	Ablation Group (N=64)	Control Group (N=64)	Hazard Ratio (95% CI)	P Value
	no. of patients (%)			
ICD events*	8 (12)	21 (33)	0.35 (0.15–0.78)	0.007†
ICD shocks	6 (9)	20 (31)	0.27 (0.11–0.67)	0.003†
ICD storms	4 (6)	12 (19)	0.30 (0.09–1.00)	0.06†

No mortality benefit

N Engl J Med 2007;357:265765

Catheter ablation of stable ventricular tachycardia before defibrillator implantation in patients with coronary heart disease (VTACH): a multicentre randomised controlled trial

Karl-Heinz Kuck, Anselm Schaumann, Lars Eckardt, Stephan Willems, Rodolfo Ventura, Etienne Delacrétaz, Heinz-Friedrich Schner, Josef Kautzner, Burghard Schumacher, Peter S Hansen, for the VTACH study group*

V-TACH

- 107 pts, ICM, 93% : male
- Mean age : 66 y.o.
- Follow-up : 22,5 months
- Amiodarone :35%, BB : 75%

- Mapping VT +substrate based
- 30 Days mortality : 0

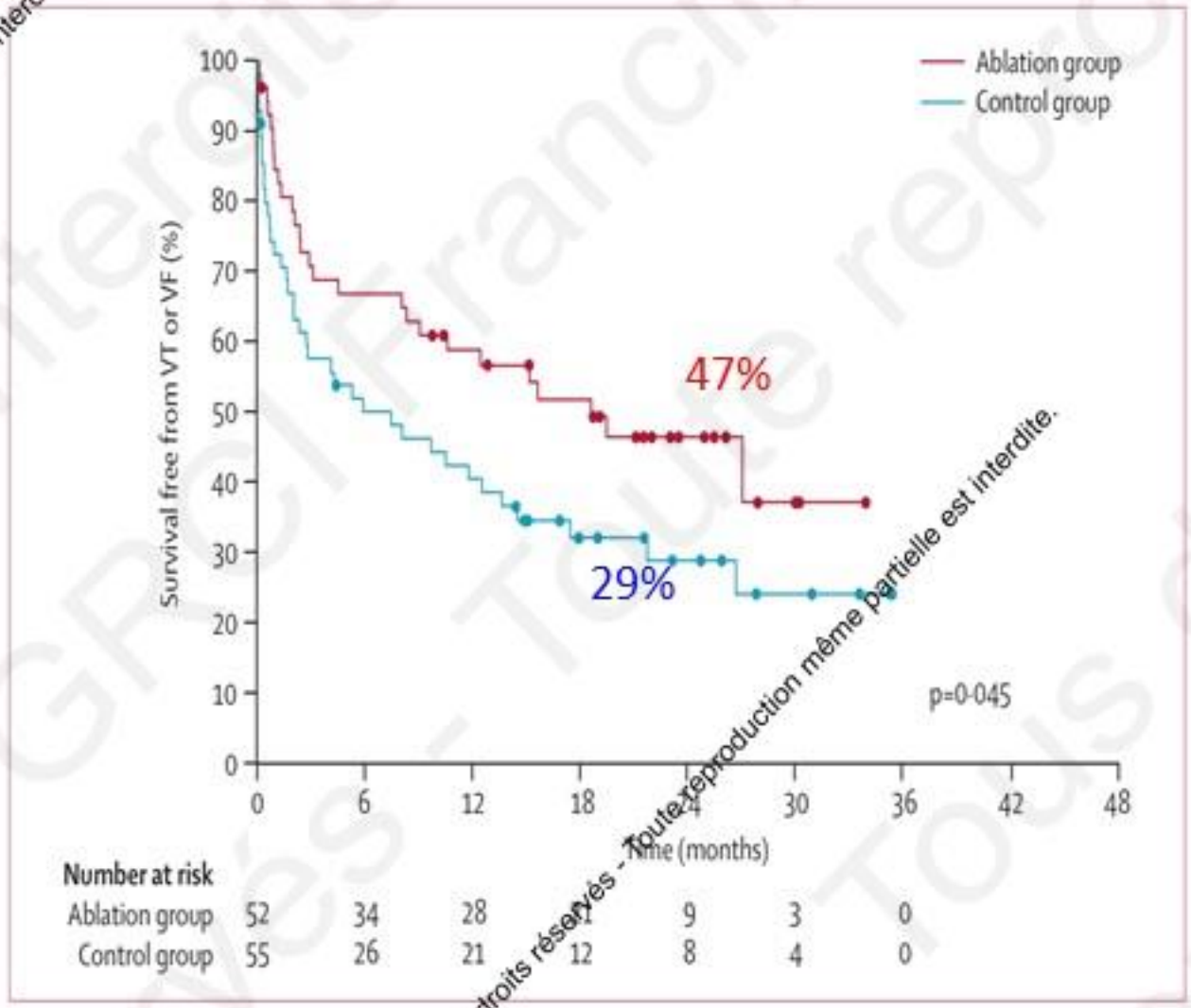


Figure 2: **Kaplan-Meier curves for the primary endpoint**
Estimates for survival free from ventricular tachycardia (VT) or ventricular fibrillation (VF). Censored patients are indicated by dots. The p value was calculated by log-rank test.

Time to first VT : 19 months versus 6 months

Lancet 2010; 375: 31–40

Catheter ablation of stable ventricular tachycardia before defibrillator implantation in patients with coronary heart disease (VTACH): a multicentre randomised controlled trial

Karl-Heinz Kuck, Anselm Schaumann, Lars Eckardt, Stephan Willems, Rodolfo Ventura, Etienne Delacrétaz, Heinz-Friedrich Taschner, Josef Kautzner, Burghard Schumacher, Peter S Hansen, for the VTACH study group*

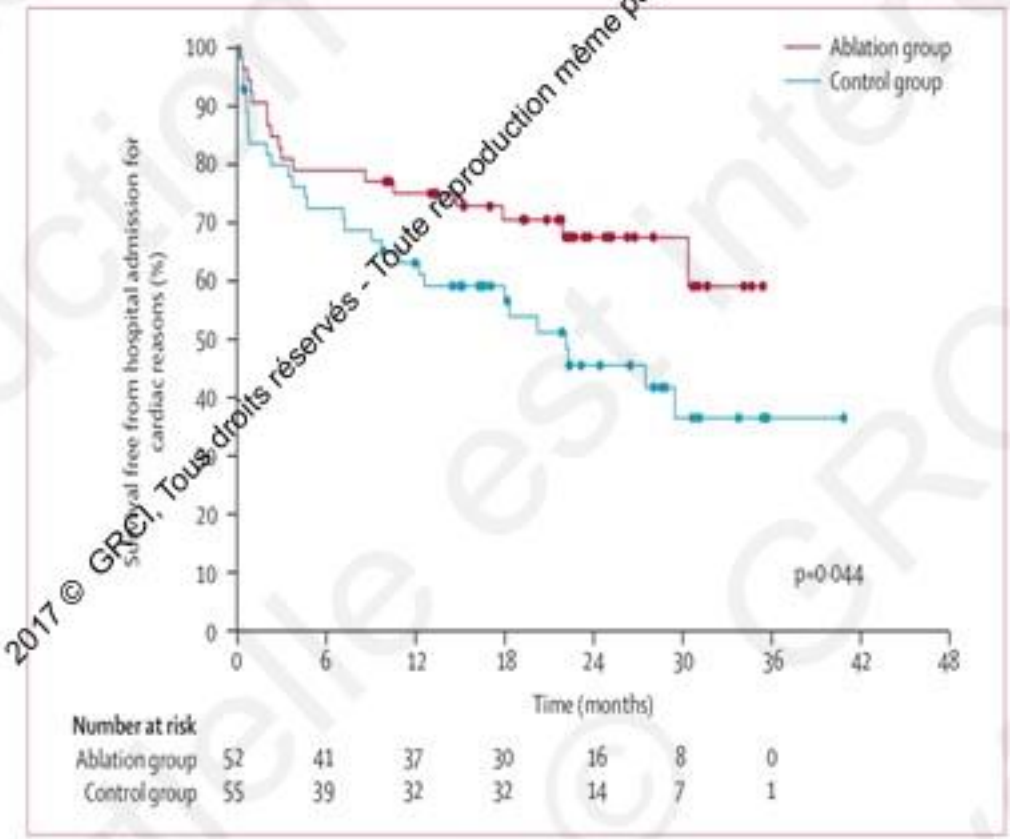


Figure 4: Kaplan-Meier curves for the secondary endpoint of hospital admission
Estimates of survival free from hospital admission for cardiac reasons. Censored patients are indicated by dots. The p value was calculated by log-rank test.

No mortality benefit

V-TACH

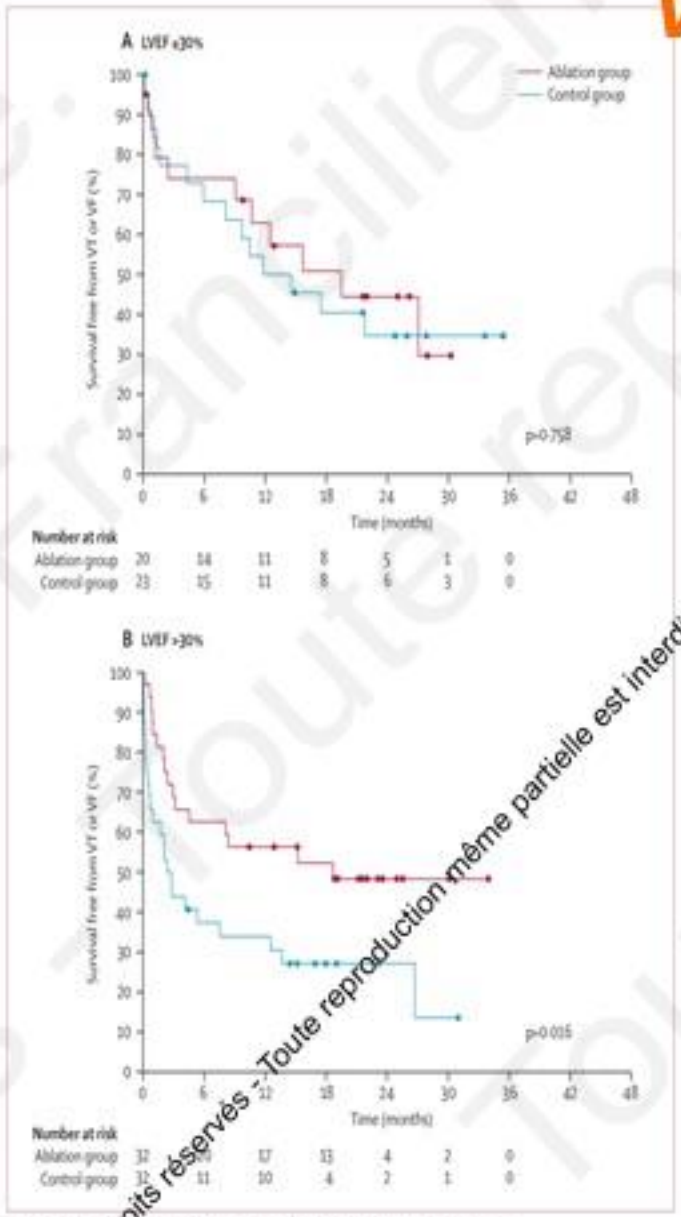


Figure 3: Kaplan-Meier curves for the primary endpoint by left-ventricular function
Graphs show estimates for survival free from ventricular tachycardia (VT) or ventricular fibrillation (VF) in patients with (A) left-ventricular ejection fraction (LVEF) of 30% or less and (B) left-ventricular ejection fraction more than 30%. Censored patients are indicated by dots. The p value was calculated by log-rank test.

Lancet 2010; 375: 31–40

Ventricular Tachycardia Ablation versus Escalation of Antiarrhythmic Drugs

John L. Sapp, M.D., George A. Wells, Ph.D., Ratika Parkash, M.D., William G. Stevenson, M.D., Louis Blier, M.D., Jean-Francois Sarrazin, M.D., Bernard Thibault, M.D., Lena Rivard, M.D., Lorne Gula, M.D., Peter Leong-Sit, M.D., Vidal Essebag, M.D., Ph.D., Pablo B. Nery, M.D., Stanley K. Tung, M.D., Jean-Marc Raymond, M.D., Laurence D. Sterns, M.D., George D. Veenhuyzen, M.D., Jeff S. Healey, M.D., Damian Redfearn, M.D., Jean-Francois Roux, M.D., and Anthony S.L. Tang, M.D.

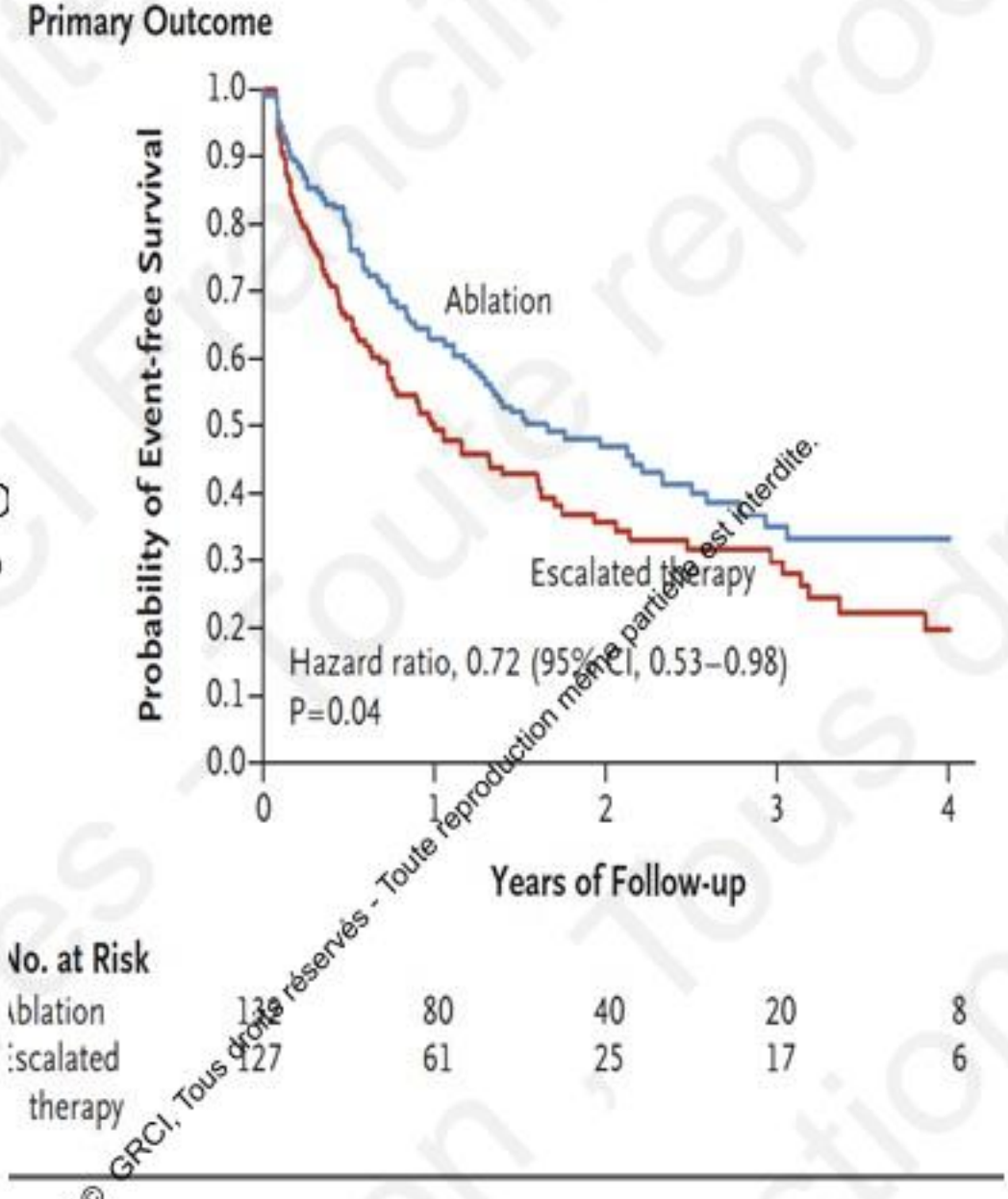
- 259 ICD-pts with ICM and VT despite AAD
- 93% male, mean age : 67y : Abl vs 70,3 : Esc
- Follow-up : 27,9±17,1 months

- Group A : catheter ablation (+continued AAD
- Group B : Escalated AAD (up to 300 mg amio ±mexiletine)

- Composite primary endpoint :

Death, ≥3VT/24 hrs, appropriate ICD shock

VANISH



N Engl J Med 2016;375:111-21.

Ventricular Tachycardia Ablation versus Escalation of Antiarrhythmic Drugs

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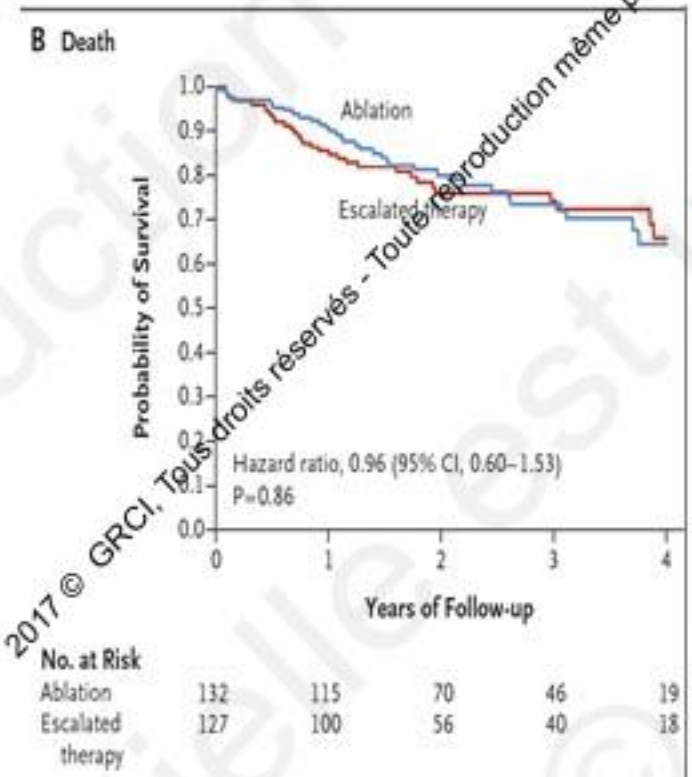

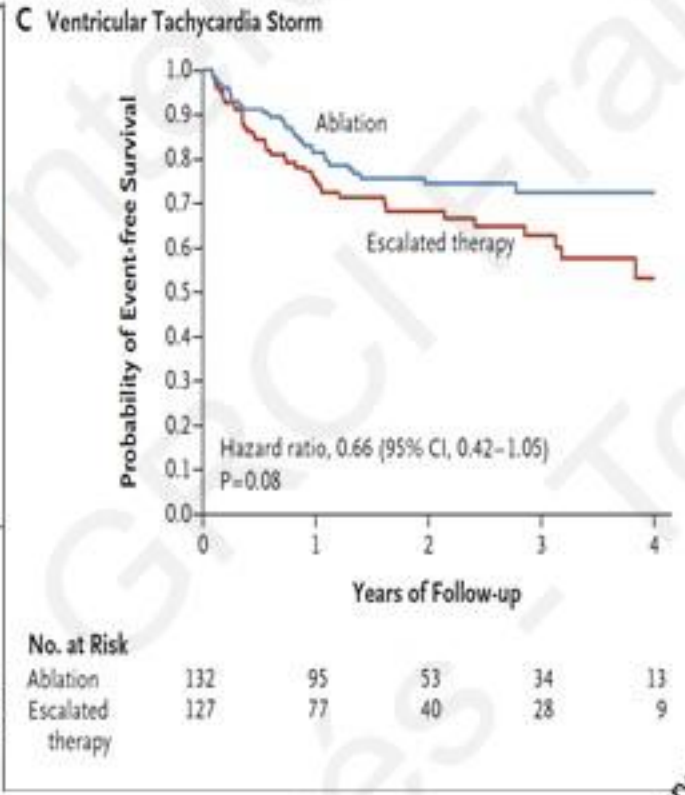

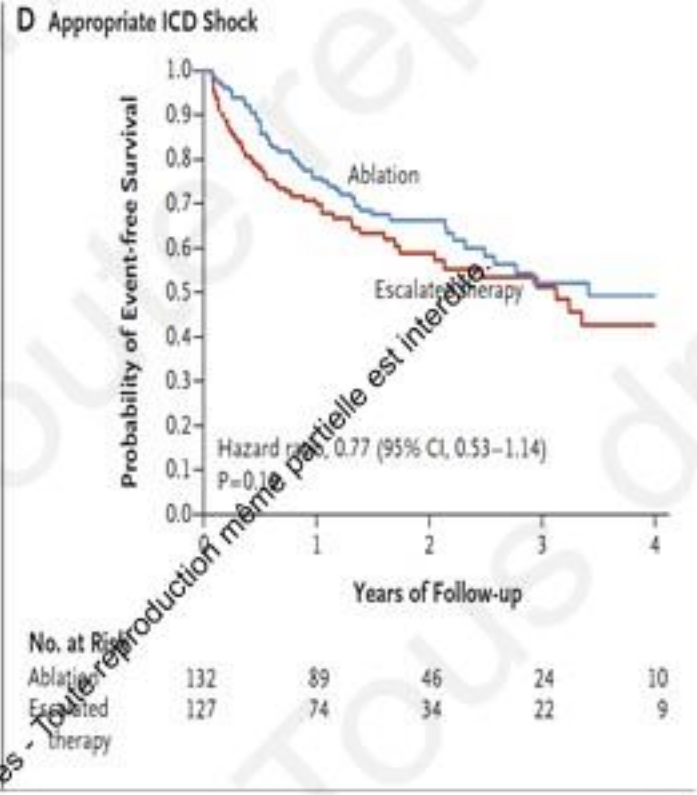

No mortality benefit

N Engl J Med 2016;375:111-21.

How perform VT ablation in ischemic cardiopathies ?

- Principal challenge:
  - Complexity of the arythmic scar
- Electro-anatomic remodelling of the scar= responsible of the VT occurrence by differents mechanisms:
  - Reentry circuits+++
  - Triggered activities(Early after depolarisation or delayed AD)
  - Automatisms
- Localisation of the scar :
  - Endocardial
  - Intramural
  - Epicardial
- Identification and targeting of the scar responsible of the clinical VT
- Procedure in sinus rhythm
- VT induction to confirm the circuit and get an end-point

How perform VT ablation in ischemic cardiopathies ?

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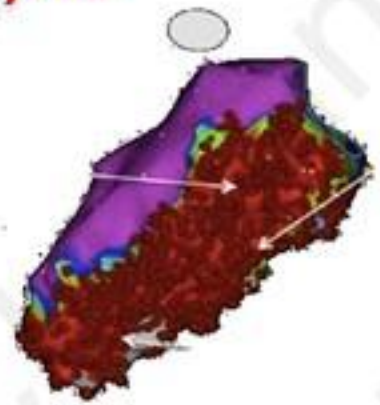
Different options for ablation in Sinus Rhythm

- **Scar homogeneization**



DiBiase L. JACC 2012

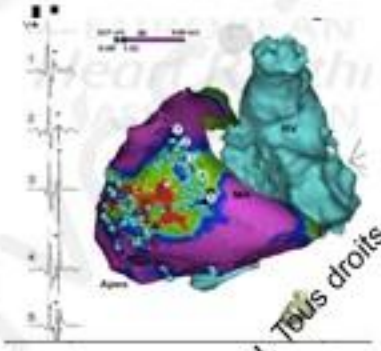
Jais P. Circulation 2012

- **LAVA ablation**

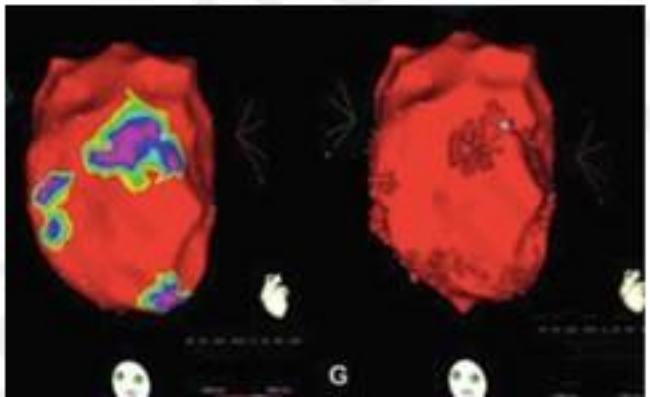
Vergara P. JCE 2012

Berruezo A. Circulation AE 2012

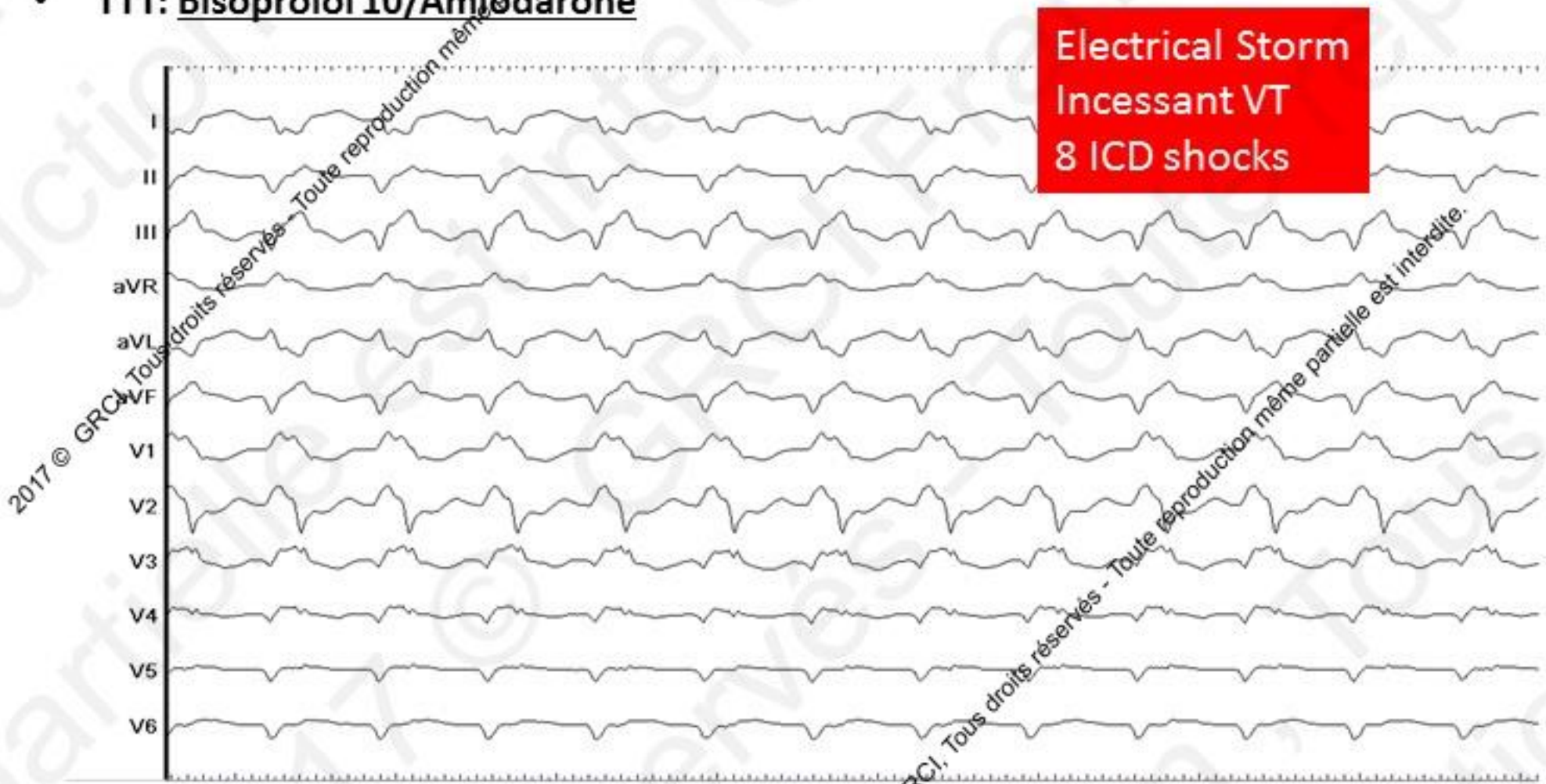
- **Scar Dechanneling**



- **Late potential abolition**

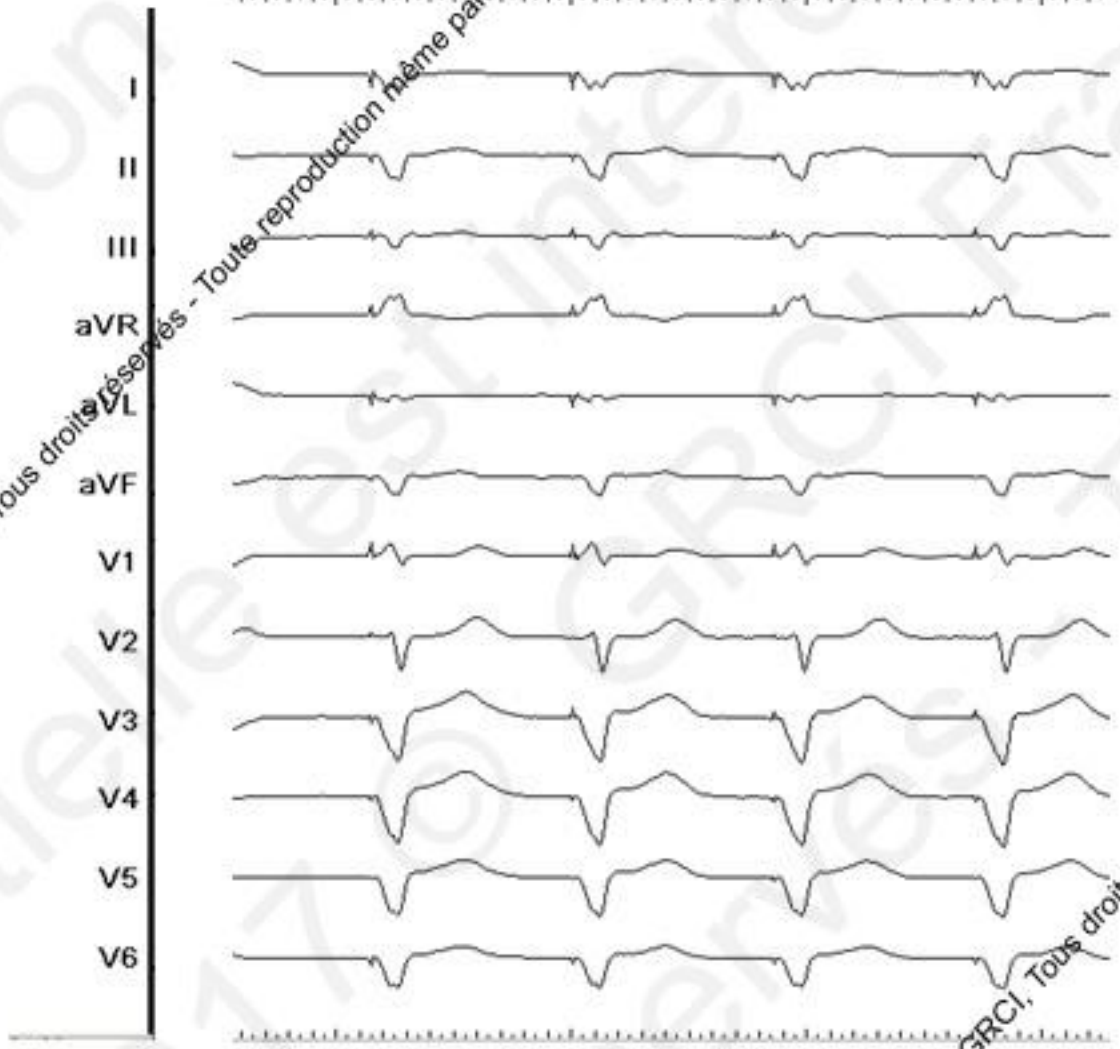


- 71 y.o
- Ischemic cardiopathy/ CABG 1998 LVEF 33%
- CRT-D I prevention2004
- Permanent AF
- TTT: <u>Bisoprolol 10/Amiodarone</u>



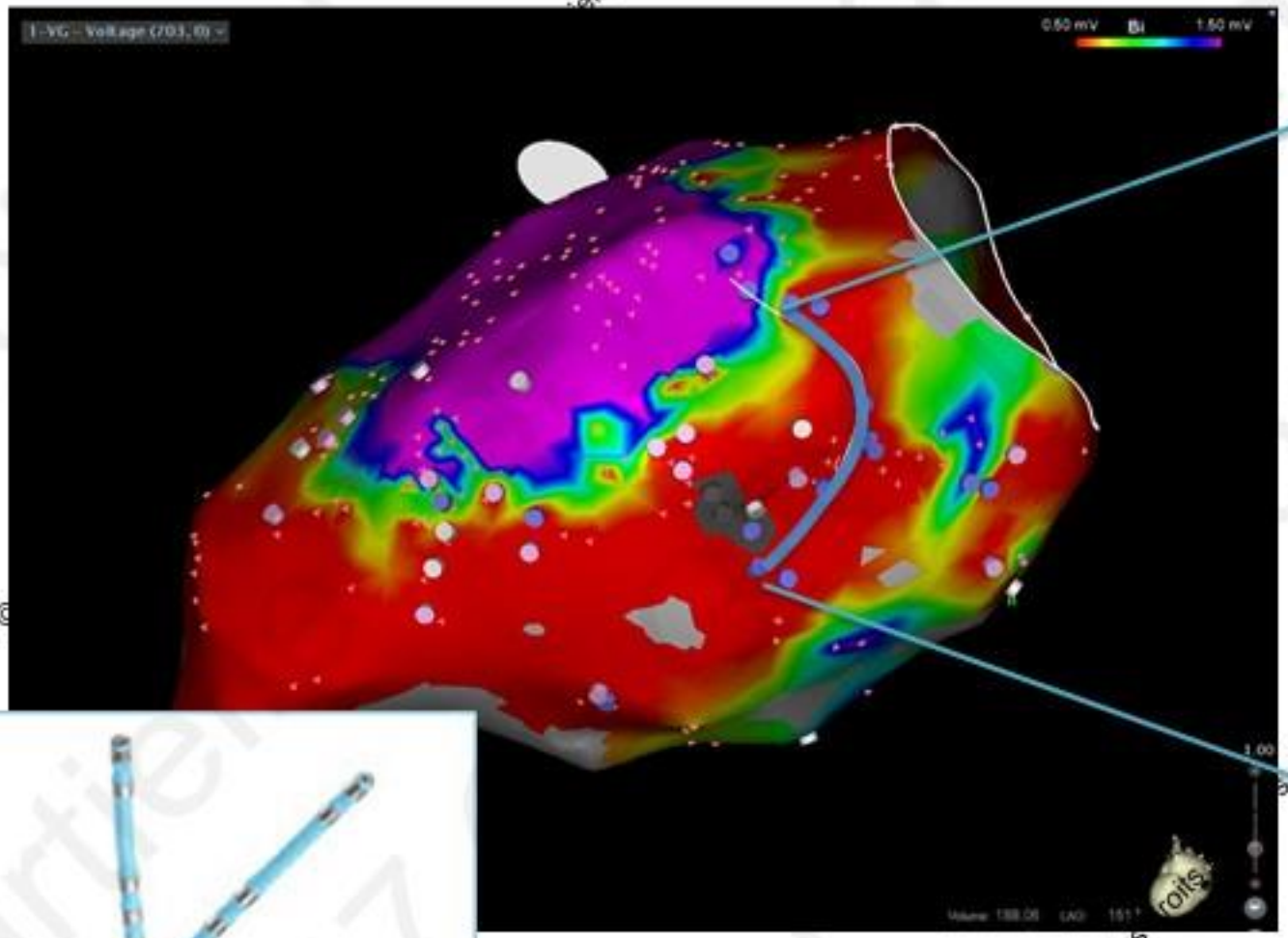
Importance of the clinical VT : 12 D ECG

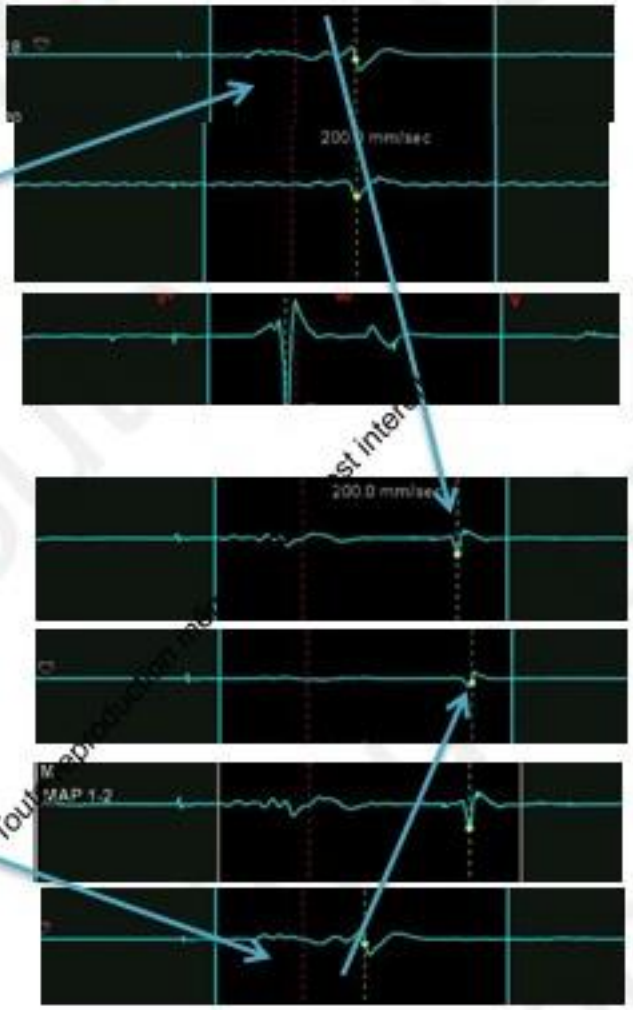
CRT pacing



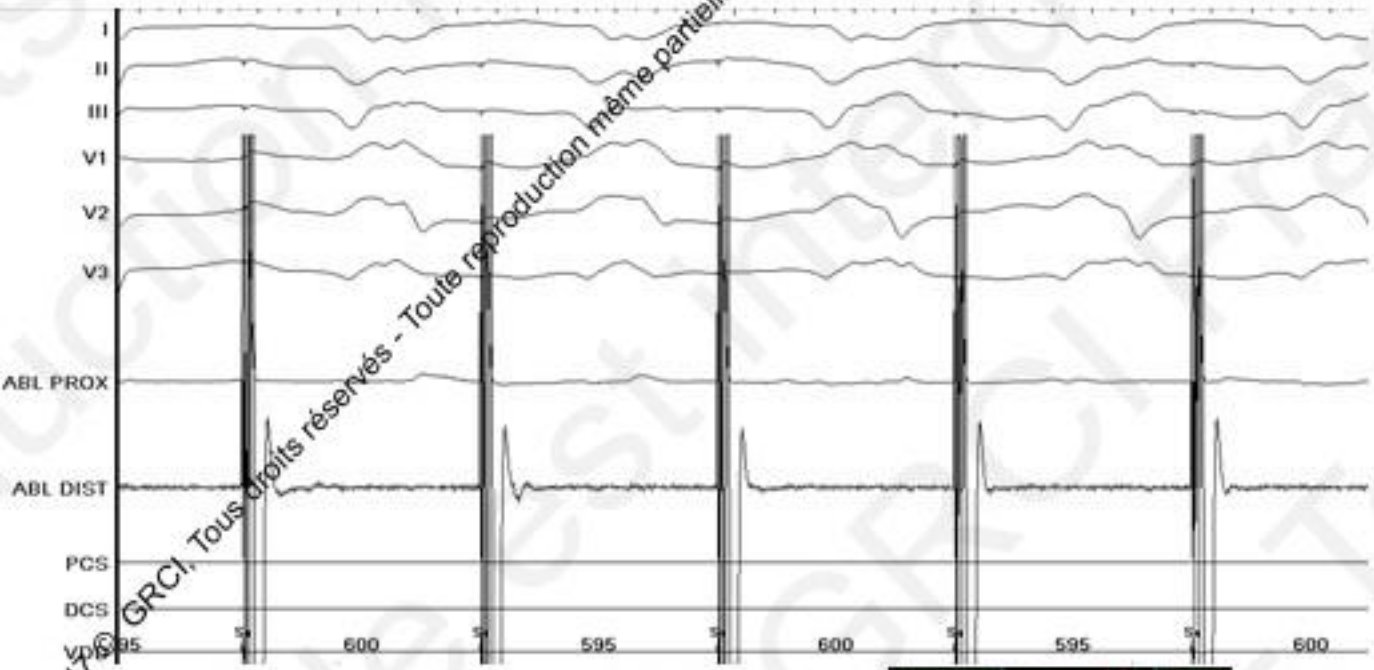
- *CRT pacing*
- *Mapping in pace rhythm*
- *Evaluation of the scar*
- *Target slow conduction isthmus*
- *Late potentials*

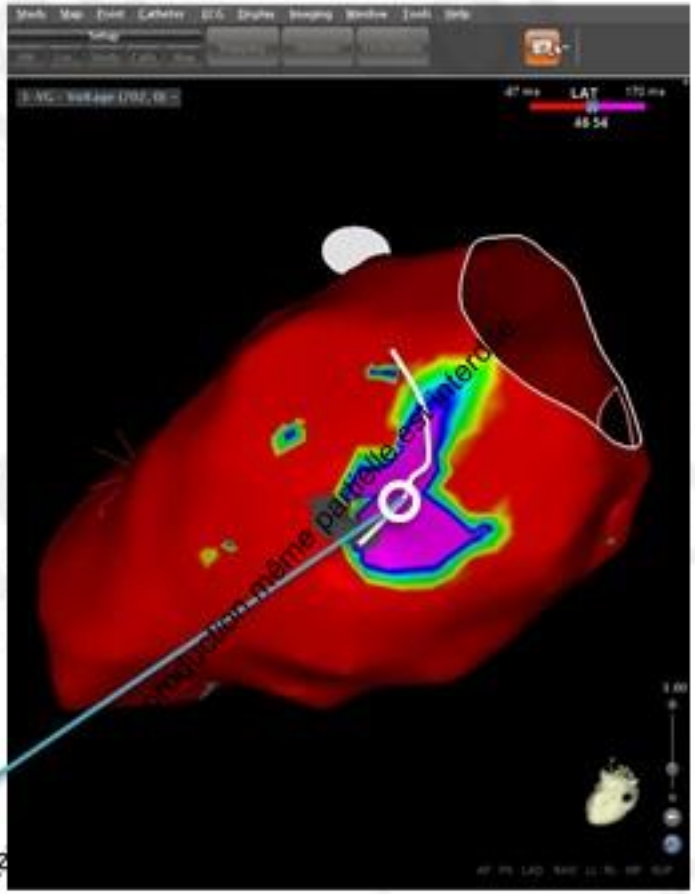
Voltage map LV in pacing rhythm + Late potential mapping

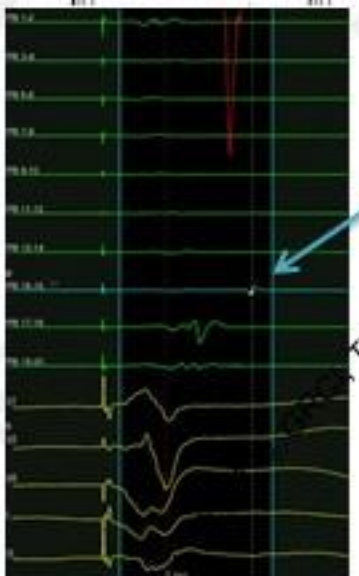


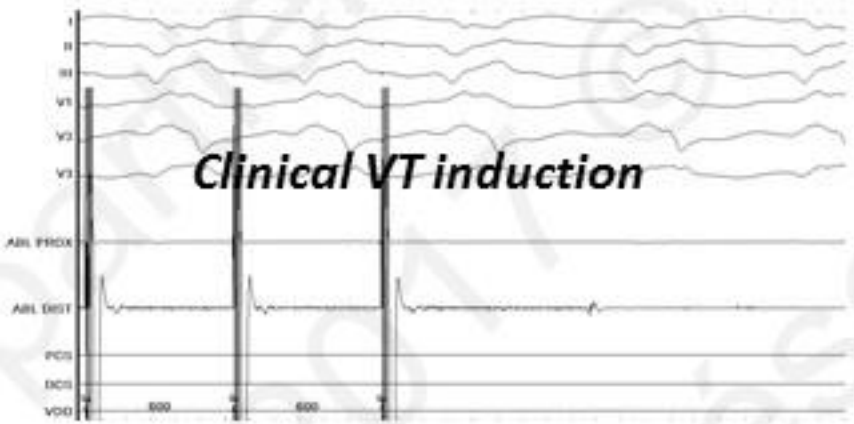


Pace mapping inside the conducting channel



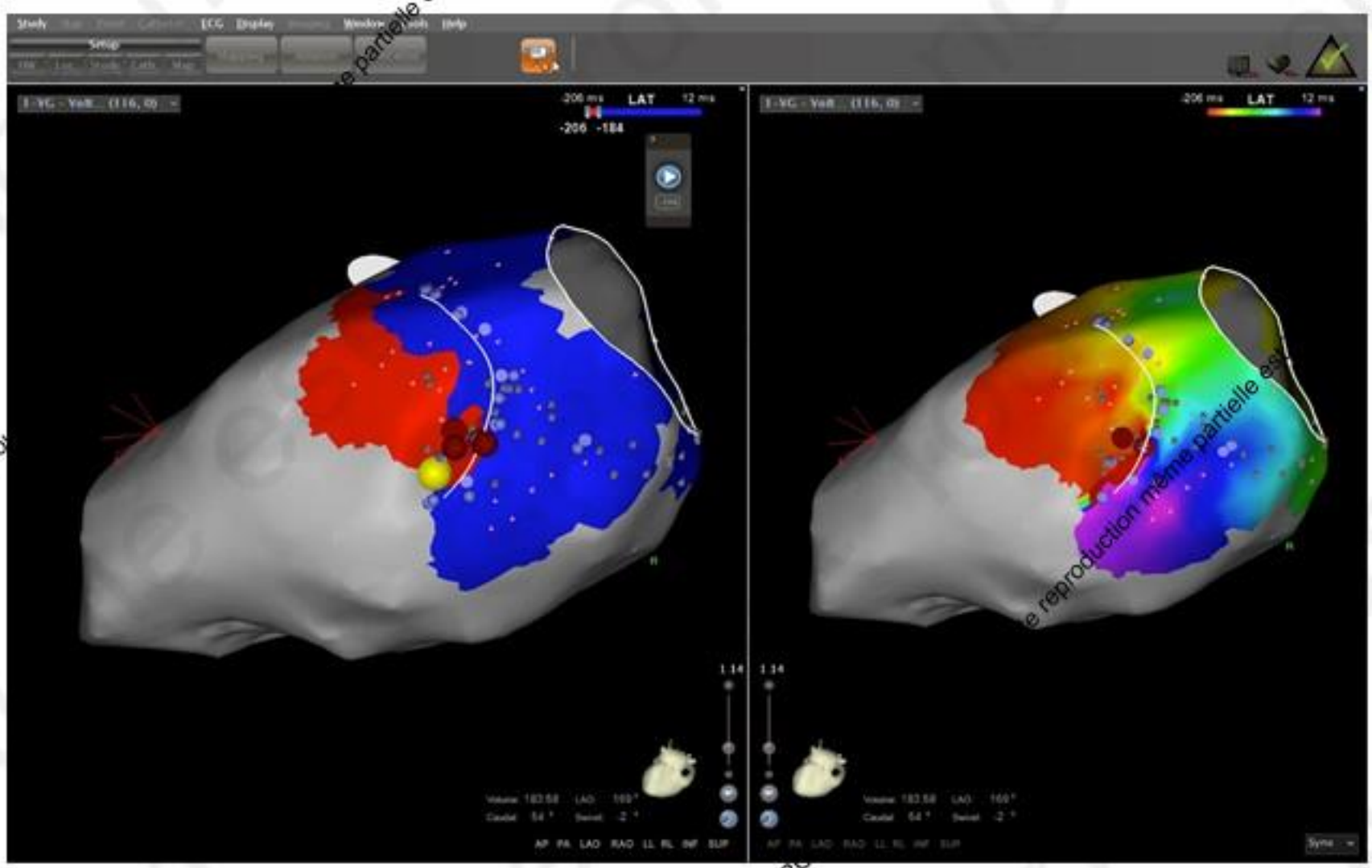


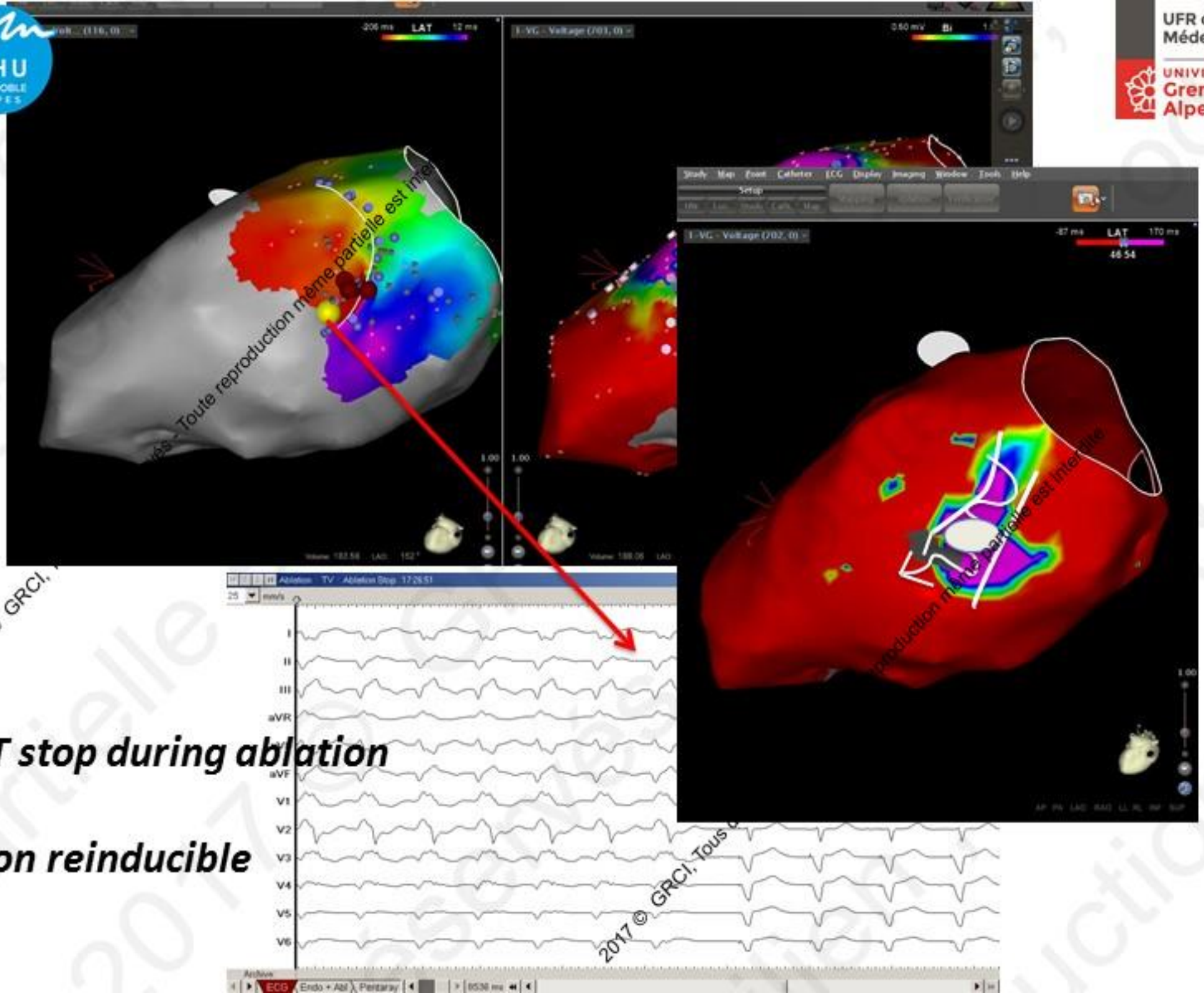




Clinical VT induction

Activation map in VT





VT stop during ablation

Non reinducible

Incidence of VT storm post ICD implantation : 10-28%
(I prevention : 4-5%/ II prevention : 28%)

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	Year	VT storm definition	Incidence(%)
Wood	1995	≥3VT in 24h	10
Villacastin	1996	≥2 shock for single VT	20
Fries	1997	≥2VT in 1h	60
Credner	1998	≥3VT in 24h	10
Greene	2000	≥3VT in 24h	18
Bansch	2000	≥3VT in 24h	28
Exner	2001	≥3VT in 24h	20
Verma	2004	≥2VT interruped by shock in 24h	10
Stuber	2005	≥3VT in 2weeks	24
Hohnloser	2006	≥3VT in 24h	23
Brigadeau	2006	≥2VT in 24h	40
Arya	2006	≥3VT in 24h	14
Sesselberg	2007	≥3VT in 24h	4
Gatzoluis	2008	≥3VT in 24h	19
Gasparini	2008	≥3VT in 24h	7

Successful ventricular tachycardia ablation in patients with electrical storm reduces recurrences and improves survival

Pasquale Vergara, MD, PhD,* Roderick Tung, MD,† Marmar Vaseghi, MD, PhD, FHRS,‡ Chiara Brombin, PhD,§ David Frankel, MD,‖ Luigi Di Biase, MD, PhD,¶ Koichi Nagashima, MD,# Usha Tedrow, MD, MS,# Wendy S. Tzou, MD,** William H. Sauer, MD,** Nilesh Mathuria, MD,†† Shiro Nakahara, MD, PhD,†† Kairav Vakil, MD,‡‡ Venkat Tholakanahalli, MD,‡‡ T. Jared Bunch, MD,‡‡ J. Peter Weiss, MD,‡‡ Timm Dickfeld, MD,§§ Rama Vunnam, MD,§§ Dhanunjaya Lakireddy, MD,‖‖ J. David Burkhardt, MD,*** Anna Correra, MD,* Pasquale Santangeli, MD,† David Callans, MD,† Andrea Natale, MD,*** Francis Marchlinski, MD.†

Electrical storm : life-threatening arrhythmic emergency characterized by 3 VT or VF episodes treated by the ICD within 24 hours

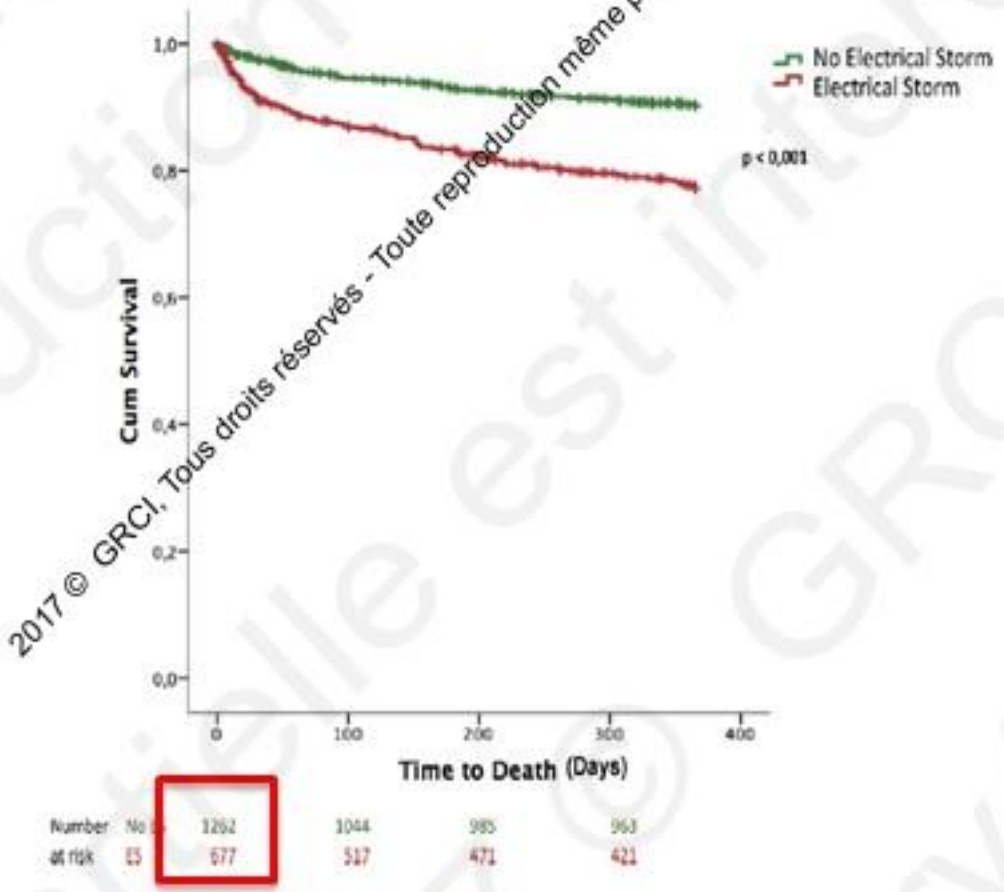

Figure 4 Kaplan-Meier curves of survival in patients with and without electrical storm (ES).

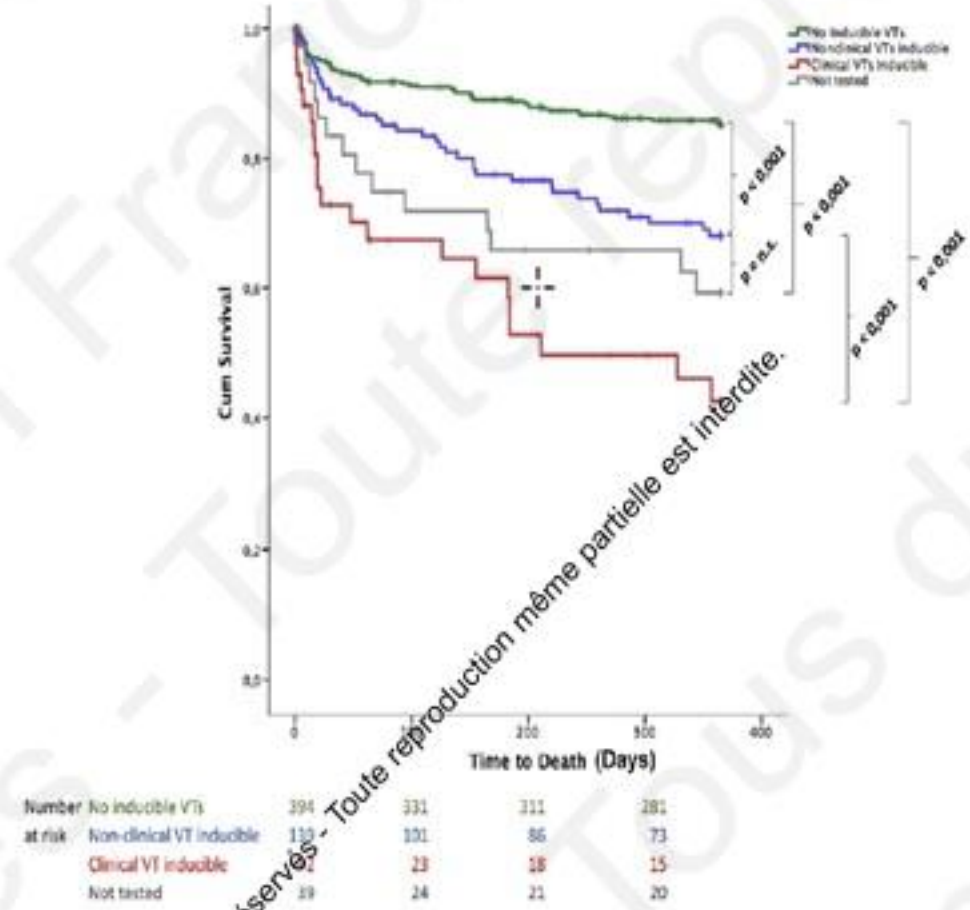

Figure 5 Kaplan-Meier curves of survival free from death in patients with electrical storm stratified by the results of acute programmed electrical stimulation after ablation. VT = ventricular tachycardia.

Heart Rhythm 2017/ http://dx.doi.org/10.1016/j.hrthm.2017.08.022

VT ablation without ICD back-up ??

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- ***Hemodynamically tolerated VT eligible for Catheter ablation in pts with CAD and preserved systolic LV EF occurs infrequently***

- ***Pauriah et al. Circ EP 2013; 351-356***

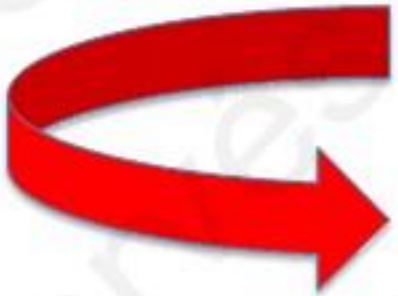
- 45 pts with CAD and stable VT with ablation as primary therapy, stepwise protocol for ablation and subsequent ICD implant
- 42% implanted with ICD, follow-up 4,5 y.
- 31% mortality/no difference in prognosis between ICD and no ICD pts

- ***Maury et al. Eur Heart J 2014***

- 166 pts with structural heart disease, EF>30% and tolerated VTs ablated and discharged without ICD : CAD : 55%/DCM: 19%/ARVC:12%/ other : 14%
- Follow-up 32±27 months
- 16% : non-fatal recurrences, 12% received ICD
- All cause mortality : 12%, sudden death : 2,4%

VT ablation without ICD back-up ??

- Ablation might offer "cure" in select patient with preserved EF
- Identification of these patients is difficult
- Scar burden, baseline LVEF, number of VT could play a role
- Large randomized studies evaluating survival vs ICD are needed



ICD implantation remains at this point the appropriate treatment

Safety of Ventricular Tachycardia Ablation in Clinical Practice

Findings from 9699 Hospital Discharge Records

David F. Katz, MD; Mintu P. Turakhia, MD, MAS; William H. Sauer, MD; Wendy S. Tzou, MD; Russell R. Heath, MD; Matthew M. Zipse, MD; Ryan G. Aleong, MD; Paul D. Varosy, MD; David P. Kao, MD

- **9699 hospitalizations with VT ablations (age, 56.5±17.6; 60.1% men),**
  - **AEs :8.5%,**
  - **Major AEs :3%**
  - **Death : 1.1%**
- **HF : strongest association with death (OR : 5.52) and major AE (OR: 2.99).**
- **Hospital volume >25 cases/y with fewer AEs compared with lower volume centers : 6,4%vs 8,8%, p=0,008**

Circ Arrhythm Electrophysiol. 2015;8:362-370.

2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

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Catheter ablation for the treatment of sustained monomorphic ventricular tachycardia

Recommendations	Class[a]	Level[b]
Urgent catheter ablation is recommended in patients with scar-related heart disease presenting with incessant VT or electrical storm.	I	B
Catheter ablation is recommended in patients with ischaemic heart disease and recurrent ICD shocks due to sustained VT.	I	B
Catheter ablation should be considered after a first episode of sustained VT in patients with ischaemic heart disease and an ICD.	IIa	B

- Scar-related VT-typically monomorphic
- 12-lead ECG recording of clinical VT aid ablation procedure
- VT related to post-myocardial scar –better outcome of CA than VT due to non-ischaemic CMP
  procedures-related mortality : 0-3%

European Heart Journal 2015 ; 36, 2793–2867

2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death

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Sustained ventricular tachycardia

Drug therapy

Treatment of patients with LV dysfunction and sustained recurrent monomorphic VT		
Recommendations	**Class[a]**	**Level[b]**
Optimization of HF medication according to current HF Guidelines is recommended in patients with LV dysfunction and sustained VT.	I	C
Amiodarone treatment should be considered, to prevent VT, in patients with or without an ICD.	IIa	C

Catheter Ablation

Prevention of VT recurrences in patients with LV dysfunction and sustained VT		
Recommendations	**Class[a]**	**Level[b]**
Urgent catheter ablation in specialized or experienced centres is recommended in patients presenting with incessant VT or electrical storm resulting in ICD shocks.	I	B
Amiodarone or catheter ablation is recommended in patients with recurrent ICD shocks due to sustained VT.	I	B
ICD implantation is recommended in patients undergoing catheter ablation whenever they satisfy eligibility criteria for ICD.	I	C
Amiodarone or catheter ablation should be considered after a first episode of sustained VT in patients with an ICD.	IIa	B

European Heart Journal 2015 ; 36, 2793–2867

Recommendations for Treatment of Recurrent VA in Patients With Ischemic Heart Disease

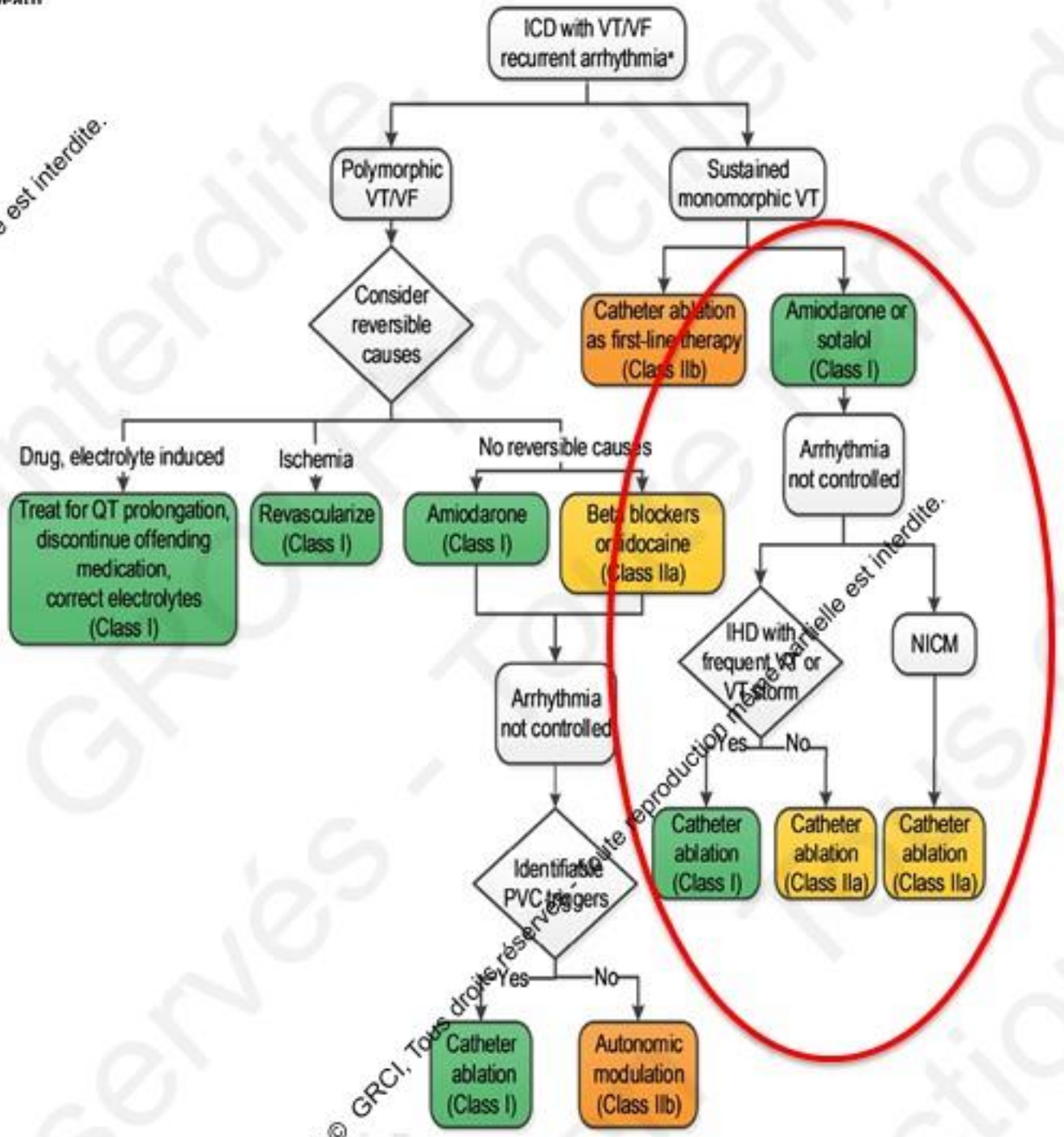
References that support the recommendations are summarized in Online Data Supplement 22 and 23.

COR	LOE	Recommendations
I	B-R	1. In patients with ischemic heart disease and recurrent VA, with significant symptoms or ICD shocks despite optimal device programming and ongoing treatment with a beta blocker, amiodarone or sotalol is useful to suppress recurrent VA (1-3).
I	B-R B-NR	2. In patients with prior MI and recurrent episodes of symptomatic sustained VT, or who present with VT or VF storm and have failed or are intolerant of amiodarone (LOE: B-R) (4) or other antiarrhythmic medications (LOE: B-NR) (5-9), catheter ablation is recommended (10-12).
IIb	C-LD	3. In patients with ischemic heart disease and ICD shocks for sustained monomorphic VT or symptomatic sustained monomorphic VT that is recurrent, or hemodynamically tolerated, catheter ablation as first-line therapy may be considered to reduce recurrent VA (10, 11).
III: Harm	B-R	4. In patients with prior MI, class IC antiarrhythmic medications (e.g., flecainide and propafenone) should not be used (13).
III: Harm	C-LD	5. In patients with incessant VT or VF, an ICD should not be implanted until sufficient control of the VA is achieved to prevent repeated ICD shocks (14).
III: No Benefit	C-LD	6. In patients with ischemic heart disease and sustained monomorphic VT, coronary revascularization alone is an ineffective therapy to prevent recurrent VT (15, 16).

2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death

A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society

Treatment of recurrent VA in pts with Ischemic Heart Disease Or NICM



Conclusion : VT ablation in ischemic CM

- VTs in pts with old MI are mostly related to a reentrant circuit
- Majority of these patients have an ICD as I or II prevention
- Necessity to perform MRI before ICD implantation to facilitate future CA
- Most of these VTs can be successfully treated by catheter ablation
- VT ablation should be offered early, especially in post MI pts
- Catheter ablation is very effective in ICD pts with Electrical Storm
- Future : - Reduce risks
  - Better mapping/ imaging/ablation tools

But don't forget that only ICDs prevent SC death and improve survival