Does VT ablation impact VF ?

Christian de Chillou, MD, PhD

Department of Cardiology – University Hospital Nancy, France

VT Symposium 2012
Seoul, 02-11-2019

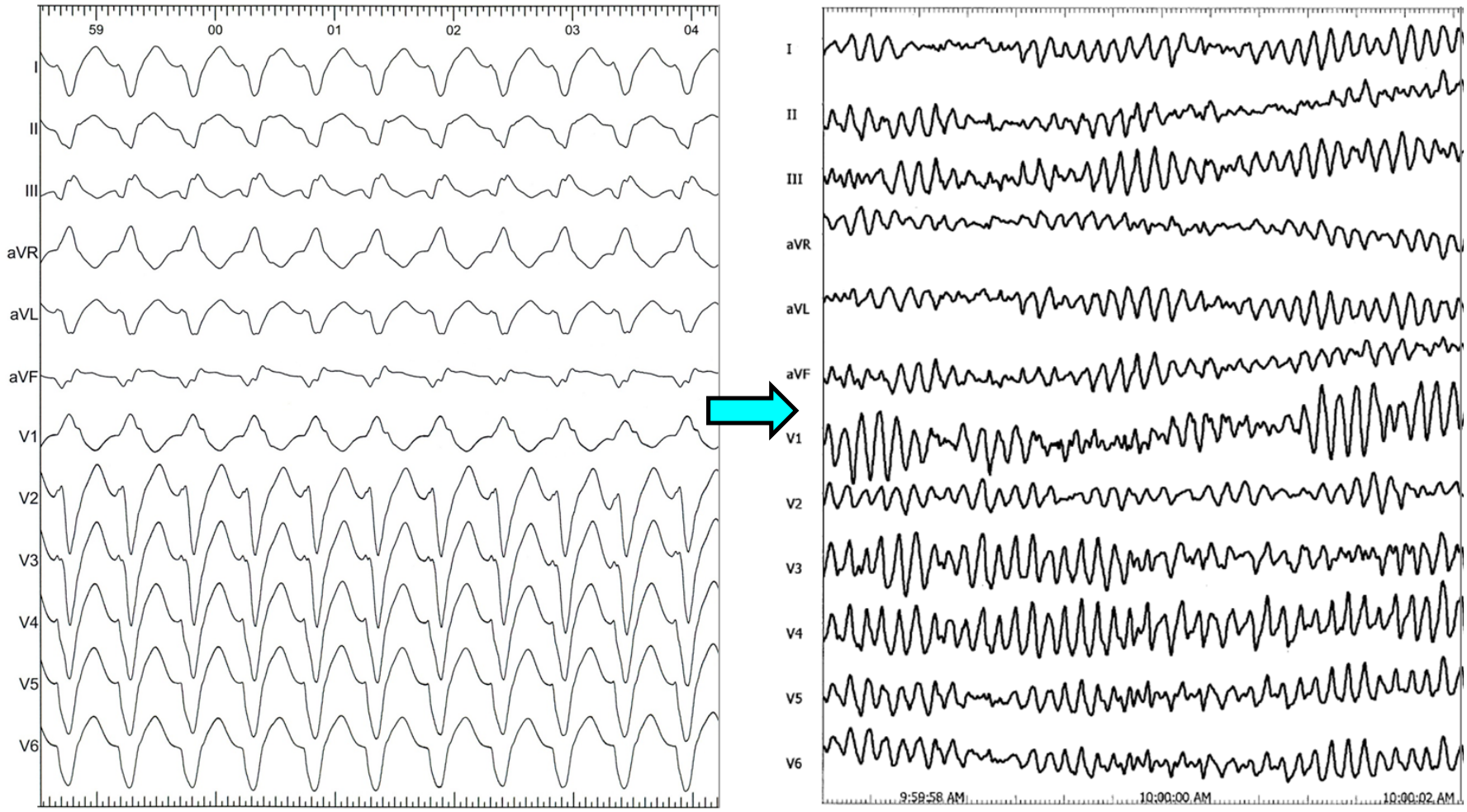
DISCLOSURES

FINANCIAL DISCLOSURES (all modest):

Consulting & Speaker: Abbott, Biosense Webster, Boston Scientific, Meda Pharma, Medtronic, MicroPort, Stereotaxis

Introduction - Background

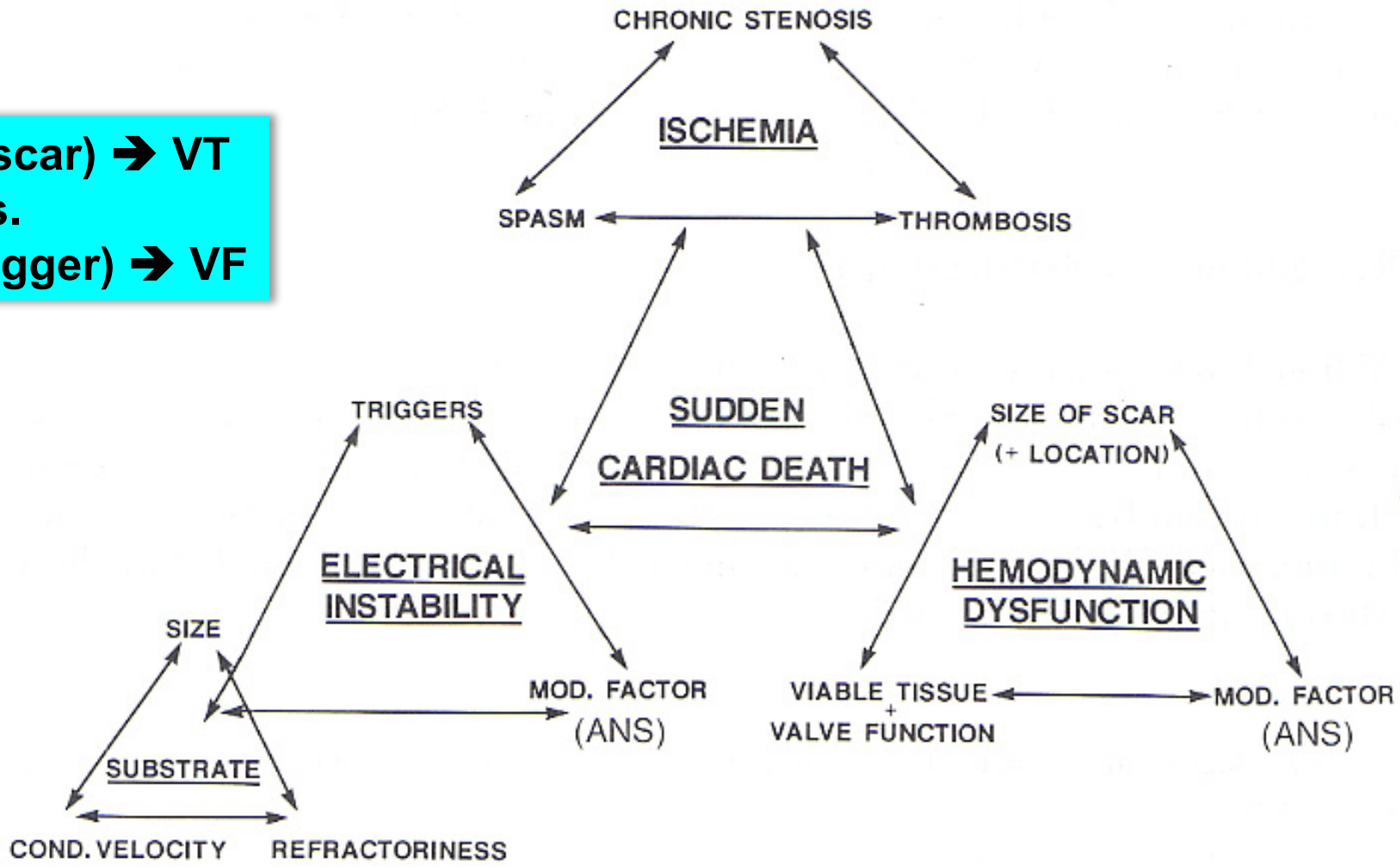
Ventricular Tachycardia & Ventricular Fibrillation



VF: may occur right away or may be triggered by a VT episode

Pathophysiology of Ventricular Arrhythmias

Substrate (scar) ➔ VT
vs.
Ischemia (trigger) ➔ VF



Wellens HJJ et al. In: Sudden Cardiac Death. Kluwer Academic Publishers. 1991. pp:285-96

IMMEDIATE CORONARY ANGIOGRAPHY IN SURVIVORS OF OUT-OF-HOSPITAL CARDIAC ARREST

TABLE 2. ANGIOGRAPHIC DATA IN THE 84 PATIENTS WHO UNDERWENT ANGIOGRAPHY.*

VARIABLE	VALUE
Normal coronary arteries — no. (%)	17 (20)
Clinically insignificant coronary artery disease (≤50 percent stenosis) — no. (%)	7 (8)
Clinically significant coronary artery disease — no. (%)	60 (71)
Single-vessel disease	22
Two-vessel disease	13
Three-vessel disease	24
Isolated left main coronary artery disease	1
Left ventricular ejection fraction — %	33.9±10.5
Left ventricular end-diastolic pressure — mm Hg	25.3±9.5

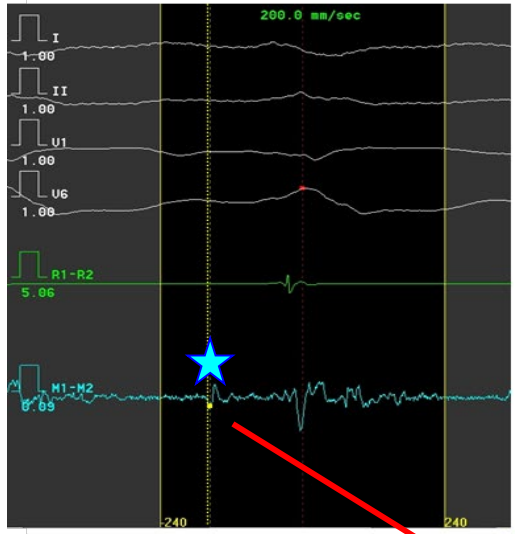
Acute coronary vessel occlusion = 48%

TABLE 3. TYPES OF CORONARY-ARTERY LESIONS AND RESULTS OF PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY (PTCA) IN THE 60 PATIENTS WITH CLINICALLY SIGNIFICANT CORONARY ARTERY DISEASE.

VARIABLE	VALUE
Type II lesion — no. (%)	18 (30)
IIA	7
IIB	11
Type I lesion — no. (%)	2 (3)
Recent coronary-artery occlusion — no. (%)	40 (67)
PTCA attempted — no.	37
Median interval between admission and PTCA — min (10th–90th percentile)	32 (18–55)
Median duration of procedure — min (10th–90th percentile)	62 (40–120)
PTCA successful — no.	28
Stent implanted — no.	5
Intraaortic balloon inserted — no.	9

Spaulding C. N Engl J Med 1997;336:1629-33

Post-infarct mappable VT



193ms

-180ms

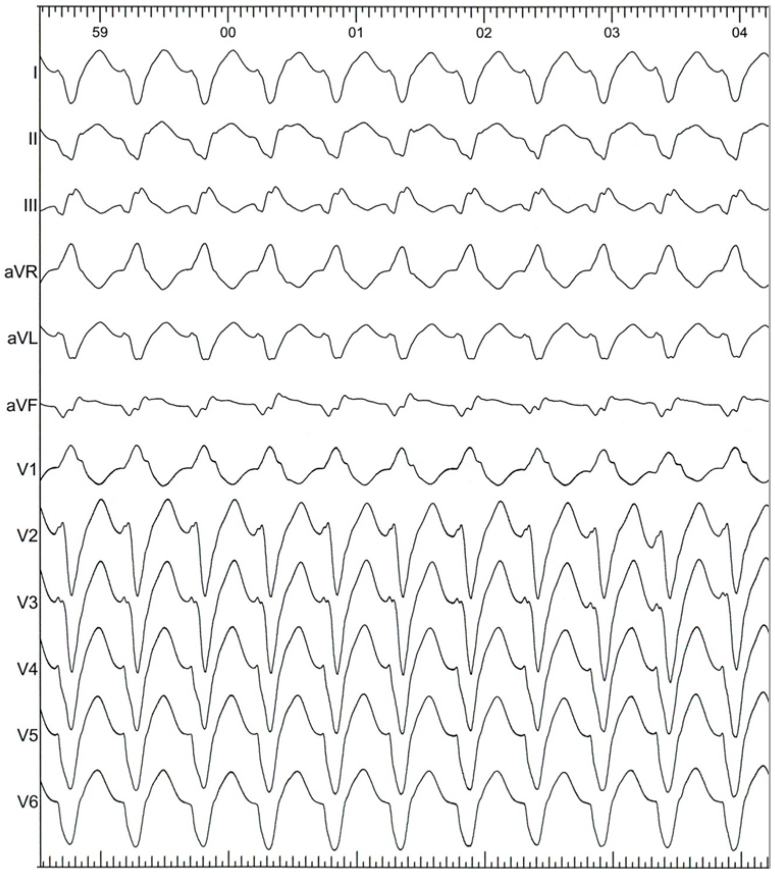
VT Isthmus

Mitral Annulus

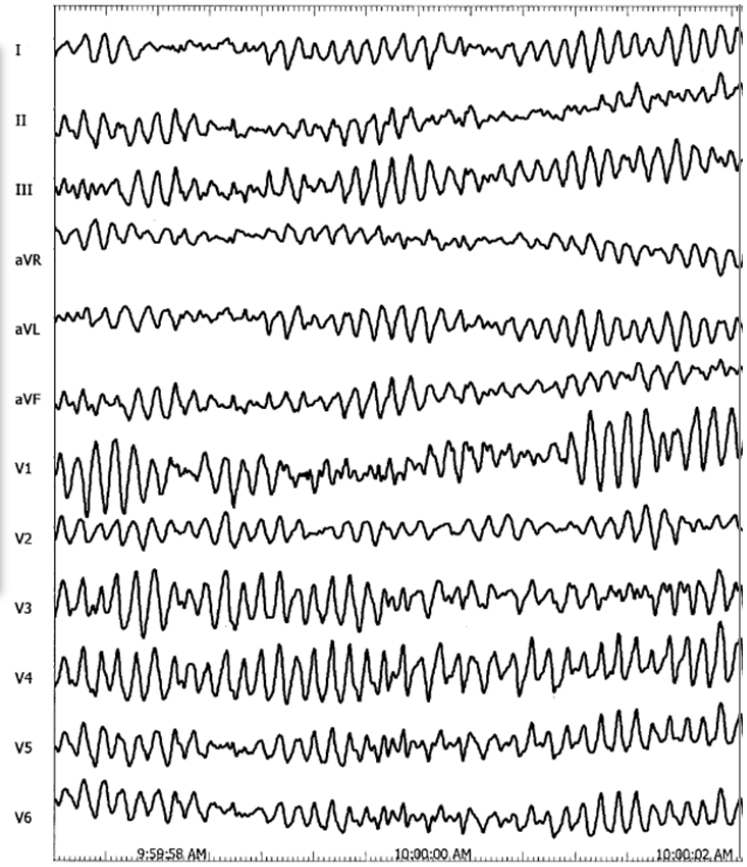
Slow conduction due to the presence of surviving myocytes surrounded by fibrous tissue in the scar

de Chillou C et al. Circulation 2002;102:726-31

Ventricular Tachycardia & Ventricular Fibrillation

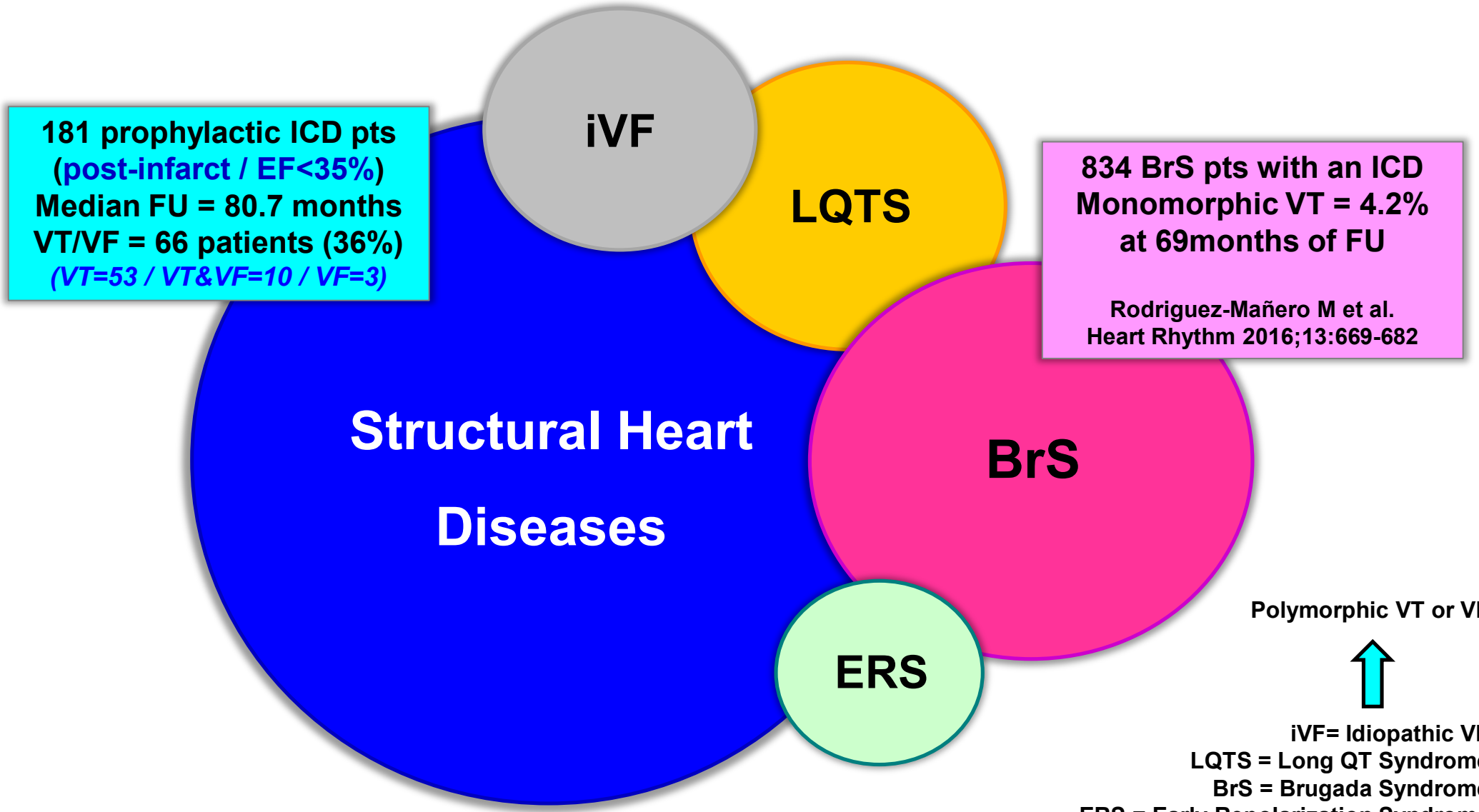


If VT ablation has a positive impact on the occurrence of VF, the explanation must be the presence of a common substrate for these two arrhythmias !



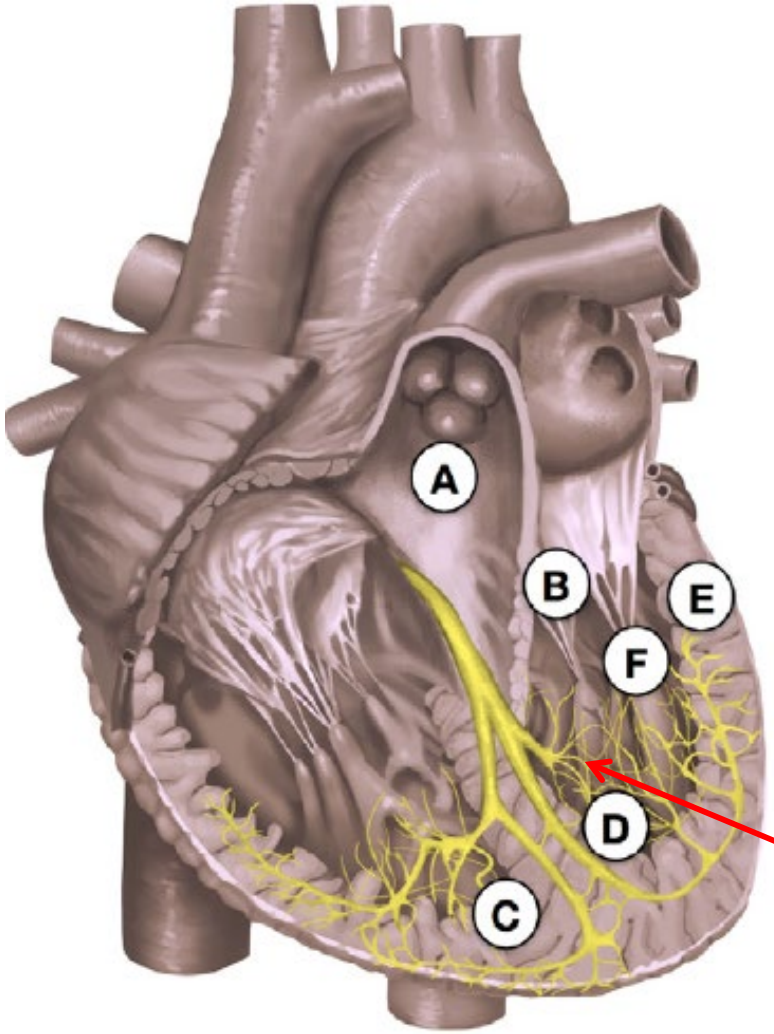
VT and VF: two different entities or the two sides of the same coin ?

Ventricular Tachycardia & Ventricular Fibrillation



VF Mapping and Ablation: Triggers & Mechanisms

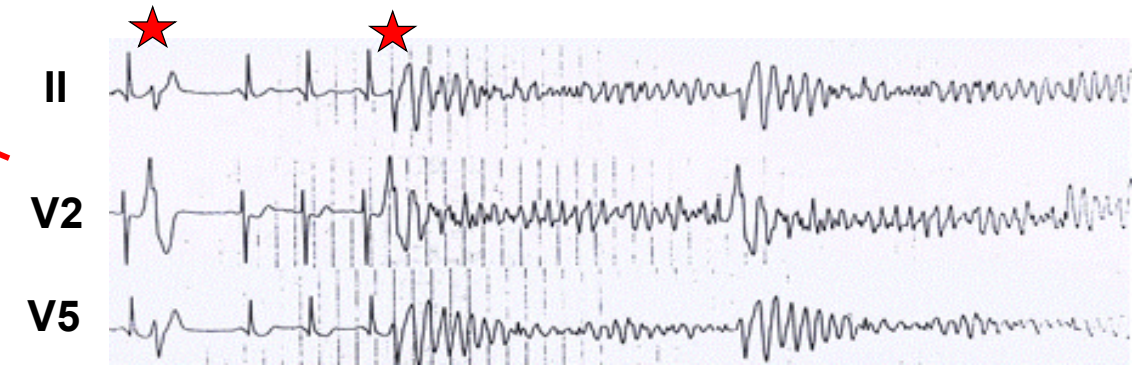
VF Ablation Targeting PVC Triggers



Location of PVC triggers

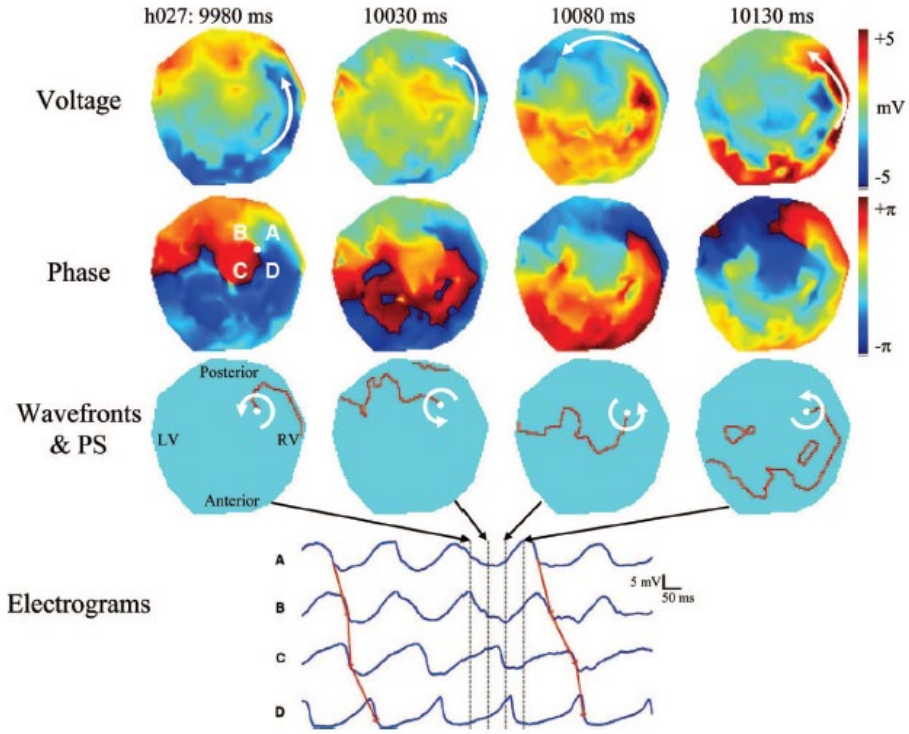
	Anatomical Site	n (%)	Conditions
A	RVOT	13 (10%)	IVF, BrS
B	LVOT	9 (7%)	IVF, DCM
C	Purkinje	73 (59%)	IVF, LQTS, ER, IHD, BrS, DCM
	RV-Purkinje	15	
D	*LV-Purkinje*	53	
	Both-Purkinje	5	
E	Myocardium	16 (14%)	LQTS, ER, IVF, DCM
F	Papillary Muscle	13 (10%)	IVF, DCM

Anderson RD et al. Heart, Lung and Circulation 2019;28:110-122



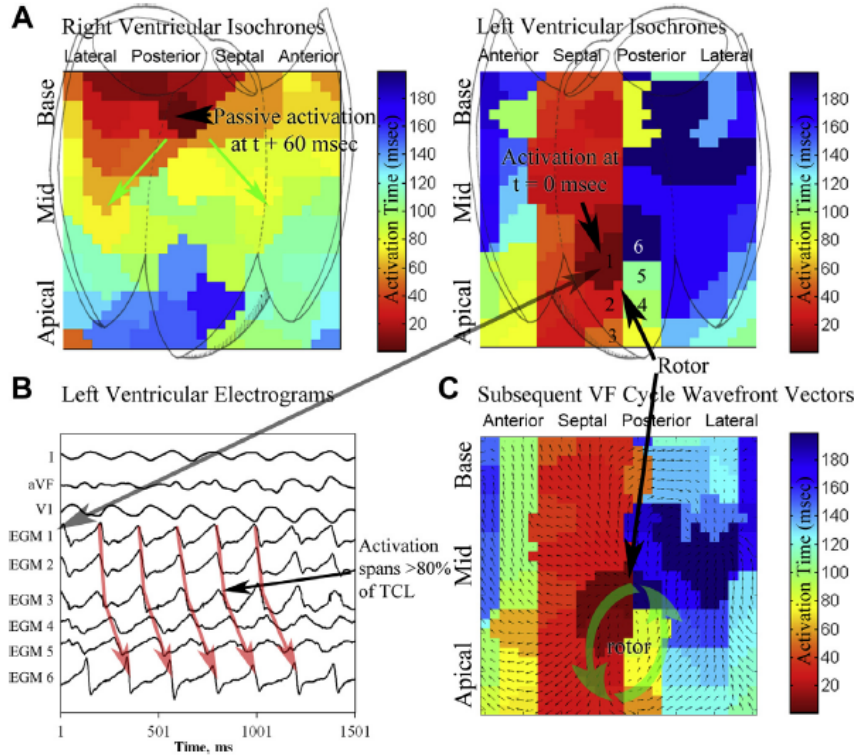
In vivo mechanistically-based VF mapping in man

Epicardial electrode array during open heart surgery in CAD (10 pts)
➔ Coexistence of a small number of rotors and multiple wavelets



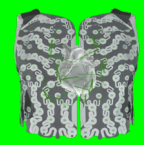
Nash MP et al. Circulation 2006;114:536-42

Endocardial 64-electrode basket catheter (26 pts)
➔ Stable rotors in sustained VF episodes requiring defibrillation vs. unstable rotor and foci in self-terminated VF episodes

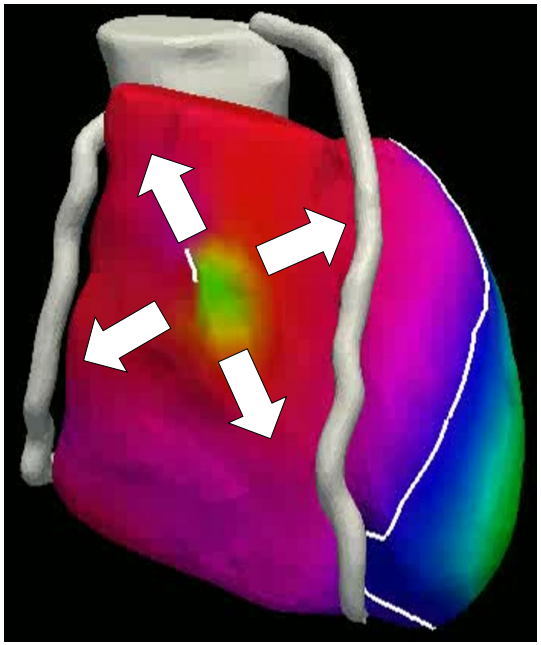


Krummen DE et al. Circulation 2014;63:2712-21

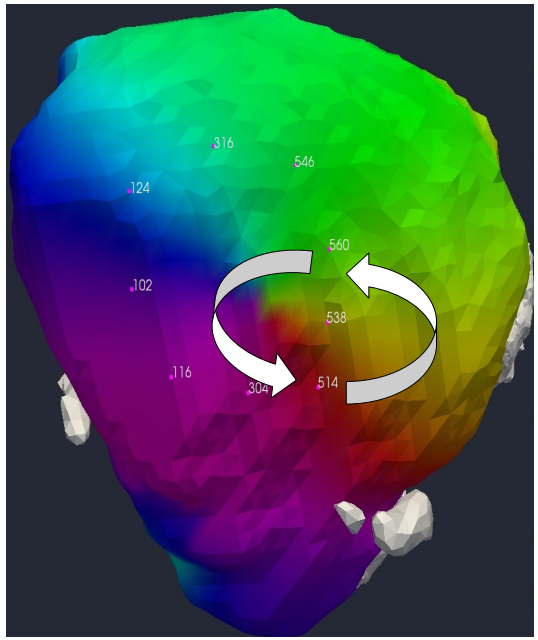
Drivers Maintaining Human VF ➔ BSM



Focal Breakthrough



‘Focal’ Reentry



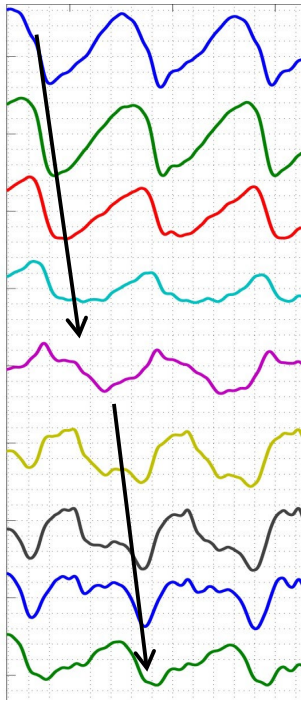
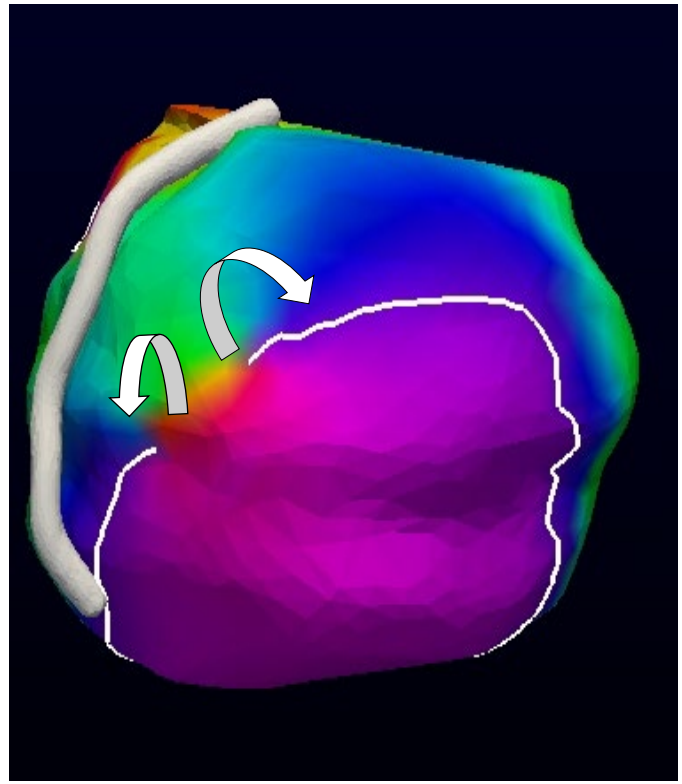


Figure of 8 Reentry

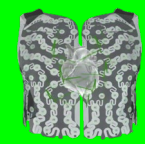


EGM covering >75% of VF cycle length
Gradient of VF Cycle Length (≥5ms) surrounding rotor areas ➔ confirm their driving role

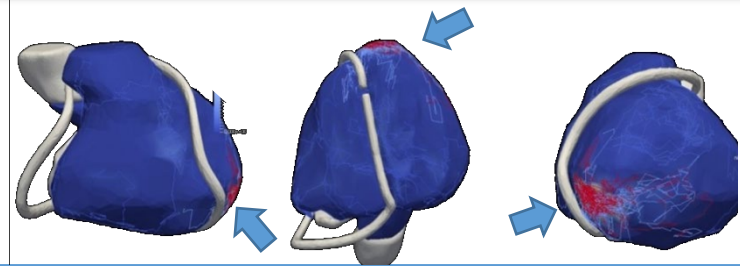
Courtesy : Pr. Michel Haïssaguerre

Post-infarct VF ➔ Figure of 8 reentry in most cases

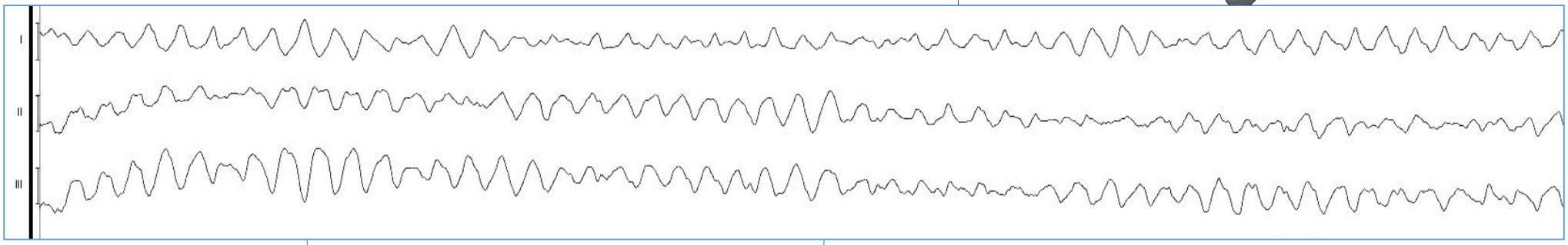
Drivers Maintaining Human VF ➔ BSM

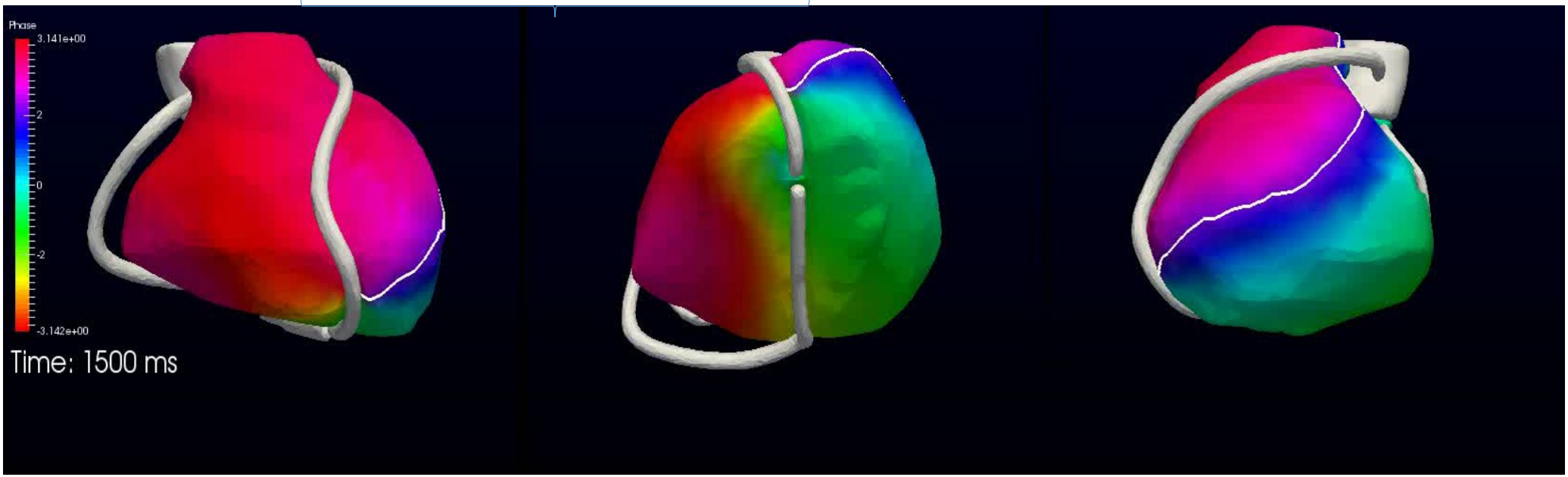


Courtesy : Pr. Michel Haïssaguerre



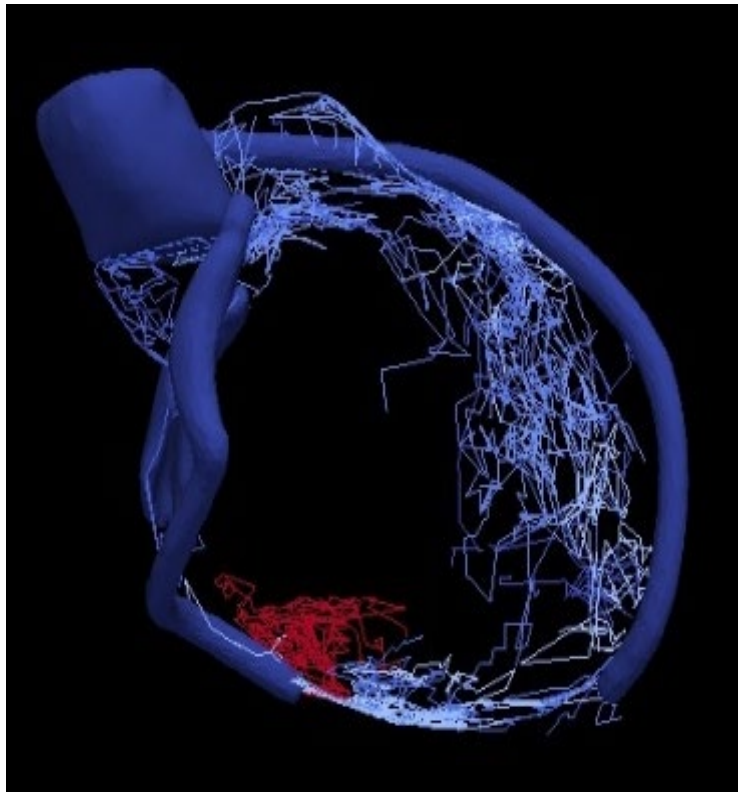
67 year old man / inferior MI / Induced VF 24sec

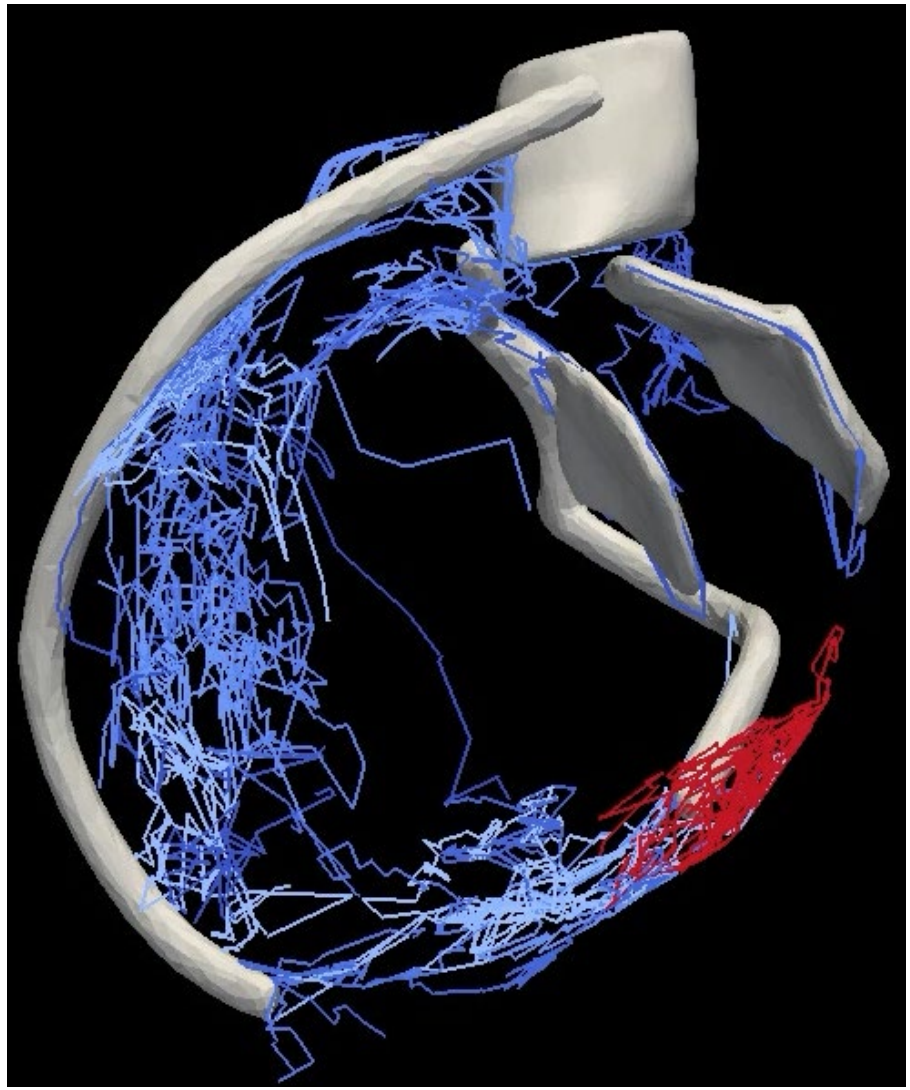




Drivers Maintaining Human VF ➔ BSM

Trajectory of VF reentry: all around LV scar

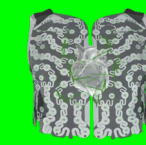


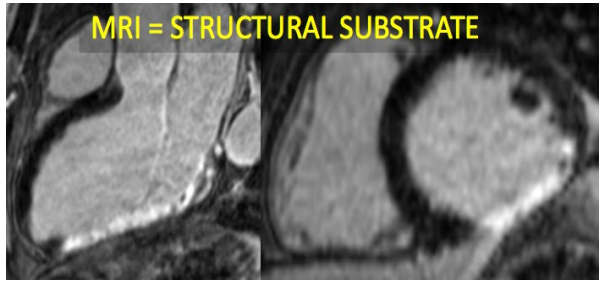


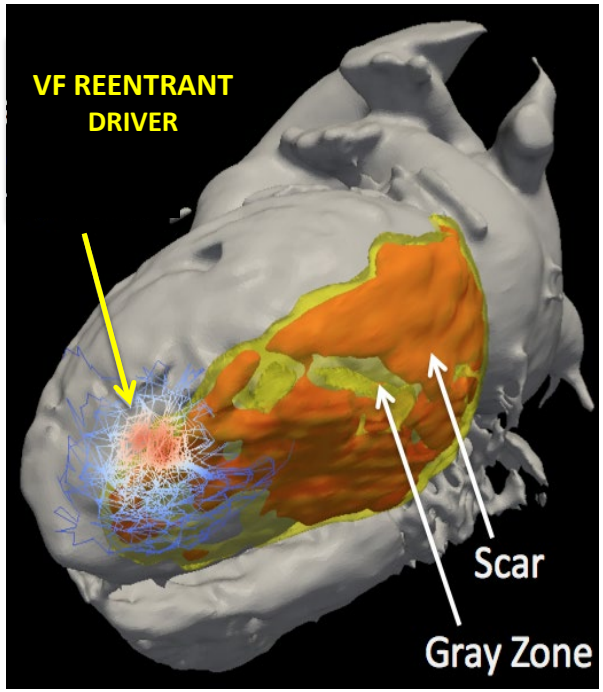
VF drivers share common pathways with coexisting mapped VT circuits

Courtesy : Pr. Michel Haïssaguerre

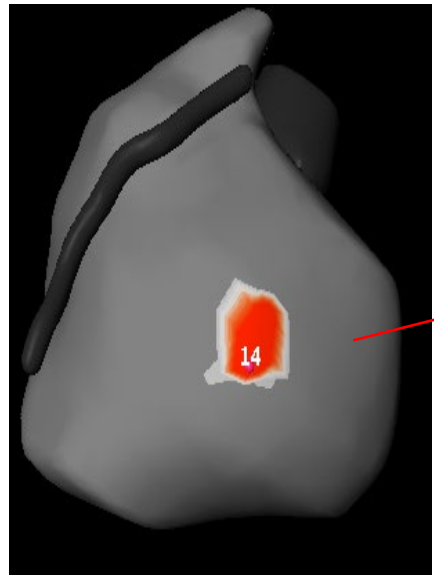
Drivers Maintaining Human VF ➔ BSM

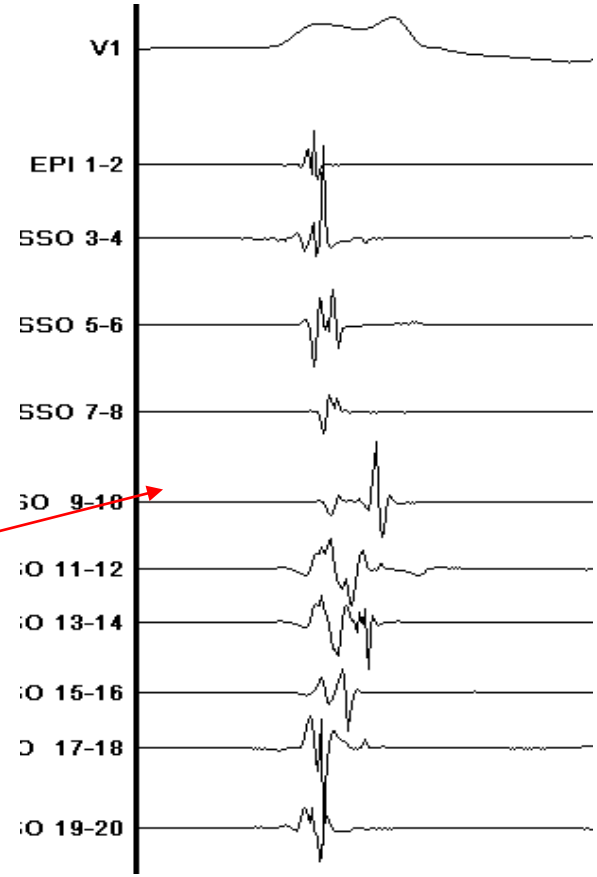






LV driver in Dilated Cardiomyopathy





Main VF driver co-locate with areas of abnormal fragmented EGM during SR

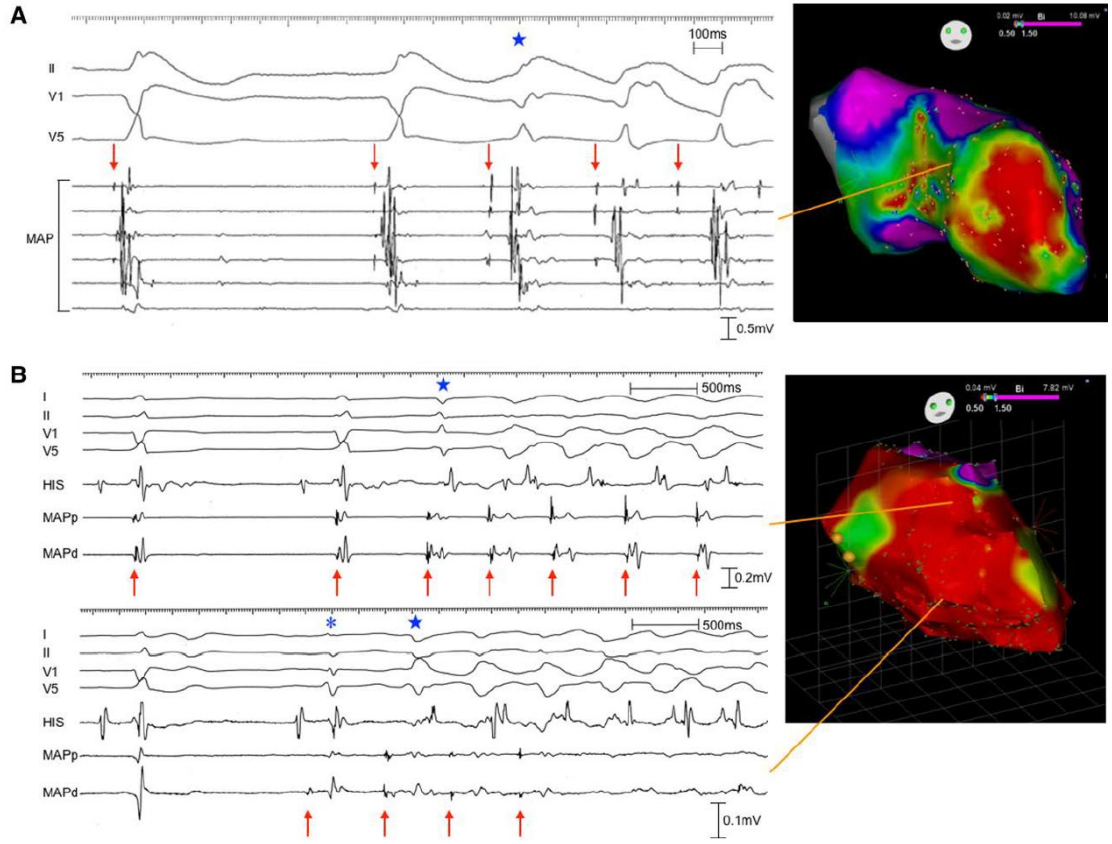
Courtesy : Dr. Mélèze Hocini

Does VT Ablation Impact VF ?
Literature Data

Catheter Ablation of Refractory VF Storm after MI

VT triggers originate from the scar border zone and from the dense scar

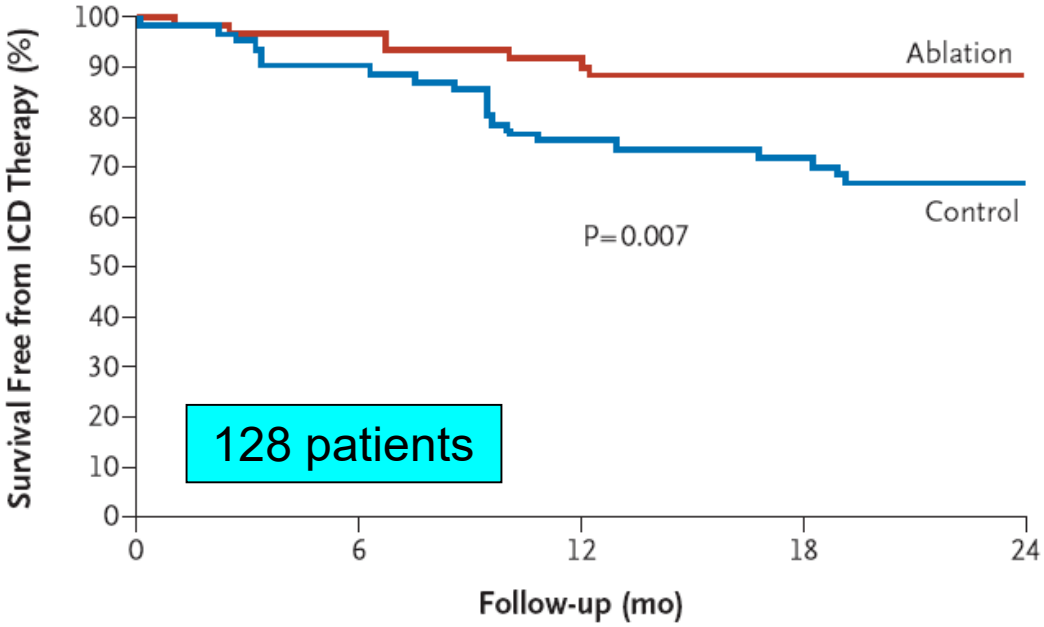
The triggering VPBs were found to originate from the surviving Purkinje tissue in the dense scar area (a bipolar voltage <0.5 mV) in 15 patients (14%) and from the scar border zone (a bipolar voltage of 0.5–1.5 mV) in 88 patients (80%; Figure 1). Although VPBs were found to originate from the normal voltage area (a bipolar voltage >1.5mV) in the remaining 7 patients (6%), these sites also correlated with the territory of infarction. The



Komatsu Y, Hocini M et al. Circulation 2019;139:2315-25

Randomized trials: ICD alone vs. ICD + VT ablation

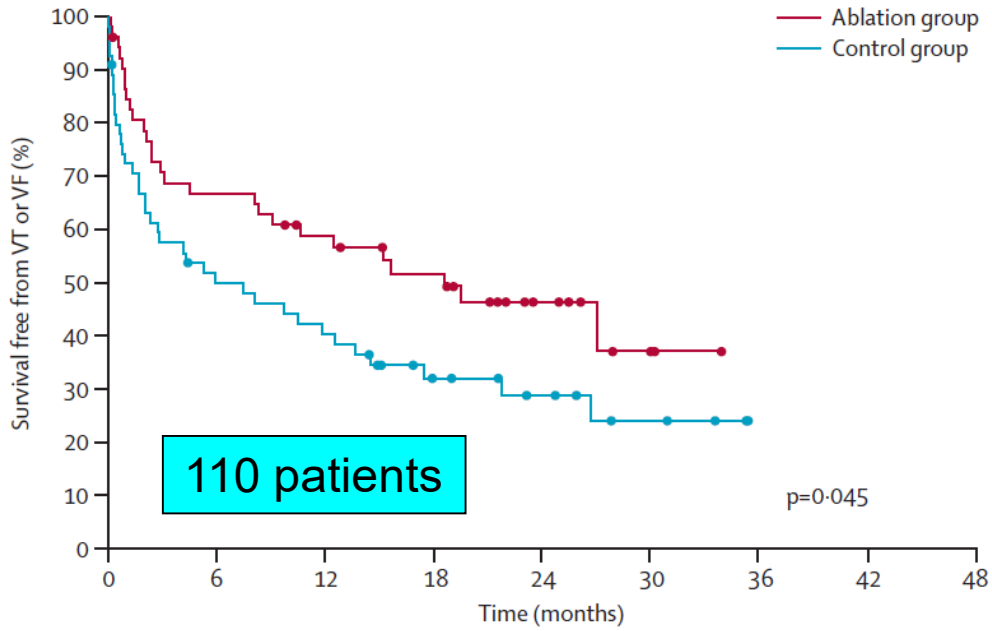
SMASH-VT



Decrease by 70% of the incidence of appropriate ICD shocks, p=0.003

Reddy V et al. N Engl J Med 2007;2:474-82

VTACH



Decrease by 46% of the incidence of appropriate ICD shocks, p=0.045

Kuck KH et al. Lancet 2010;375:31-40

Retrospective study – Impact of VT ablation on VF

Courtesy : Pr. Pierre Jaïs

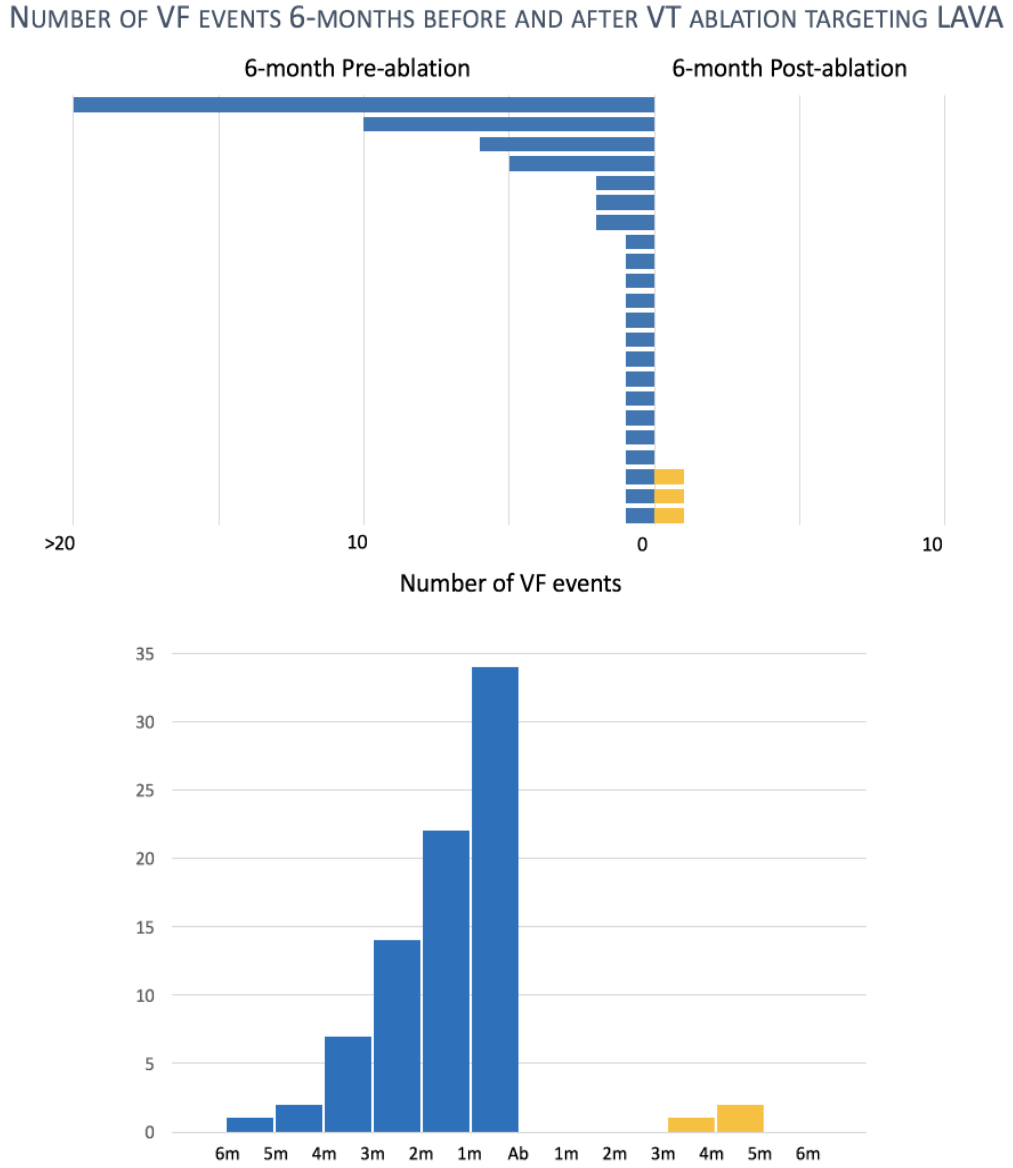
686 patients with a first VT ablation procedure (2010-2017)

21 patients met the following inclusion criteria: ICD + documented VT + VF episodes during the 6-month period preceding LAVA-guided ablation

- ➔ **Post-infarct =10/21 (48%)**
- ➔ **Dilated cardiomyopathy = 8/21 (38%)**
- ➔ **ARVD/C = 2/21 (9%)**
- ➔ **Myocarditis = 1/21 (5%)**

80 VF events in the preceding 6 months

Kitamura T, Jaïs P et al. CircA&E 2019 (in press)



Conclusions

- Several studies (randomized or observational) have reported a reduction of ICD shocks and/or a low incidence of SCD after VT ablation
- One retrospective dedicated study observed a significant reduction of VF burden after ablation of scar-related VT
- The most likely explanation for this favorable outcome is the following: VT and VF are sharing, at least in part, the same arrhythmogenic substrate
- This explanation is consistent with a number of VF mapping studies (endocardial / epicardial / BSM) in human