

TACHICARDIE VENTRICOLARI

**TV nel paziente fragile e con
scompenso avanzato:
quando il beneficio supera il rischio?**

Schillaci Vincenzo

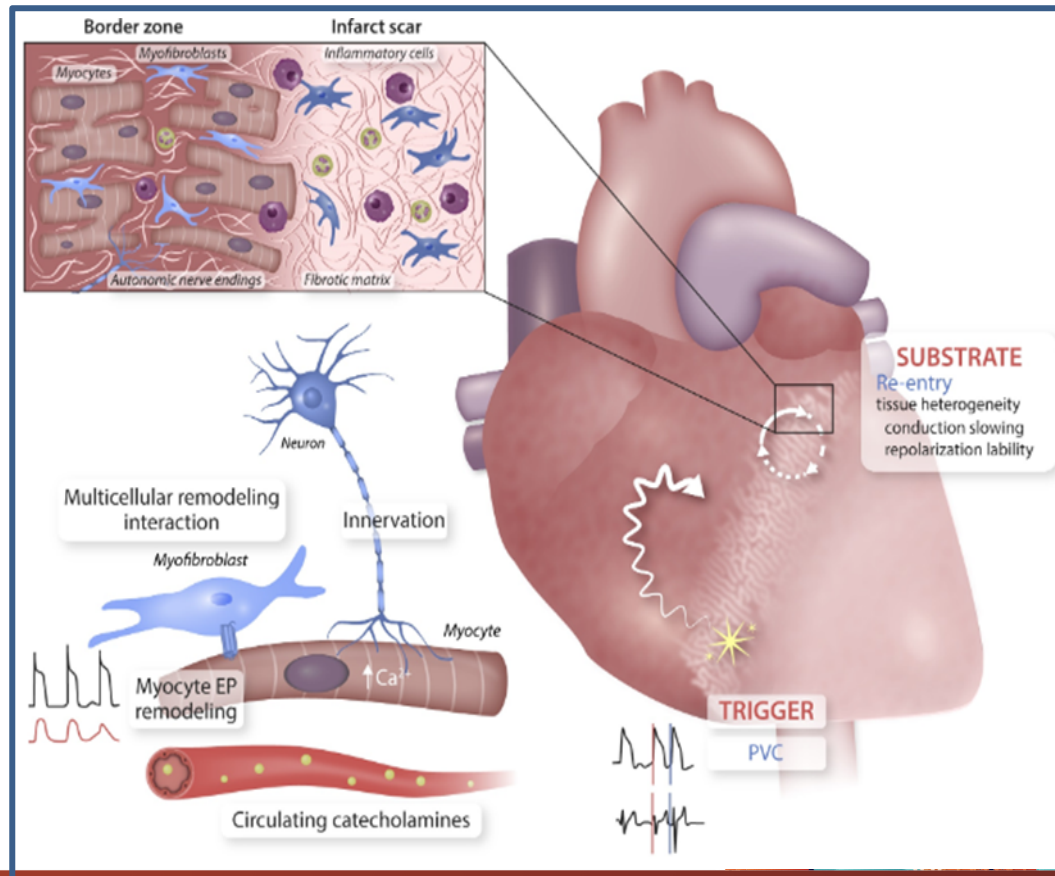


Management of Ventricular Arrhythmias in Patients With Advanced Heart Failure

Pasquale Santangeli, MD, PhD, J. Eduardo Rame, MD, Edo Y. Birati, MD, Francis E. Marchlinski, MD

La prevalenza delle TV negli scompensati varia tra il 33-45%

Il meccanismo alla base è la presenza di substrato associata a fibrosi, ipertrofia e cicatrici da rimodellamento



Management of Ventricular Arrhythmias in Patients With Advanced Heart Failure

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Predittori di VT negli scompensati

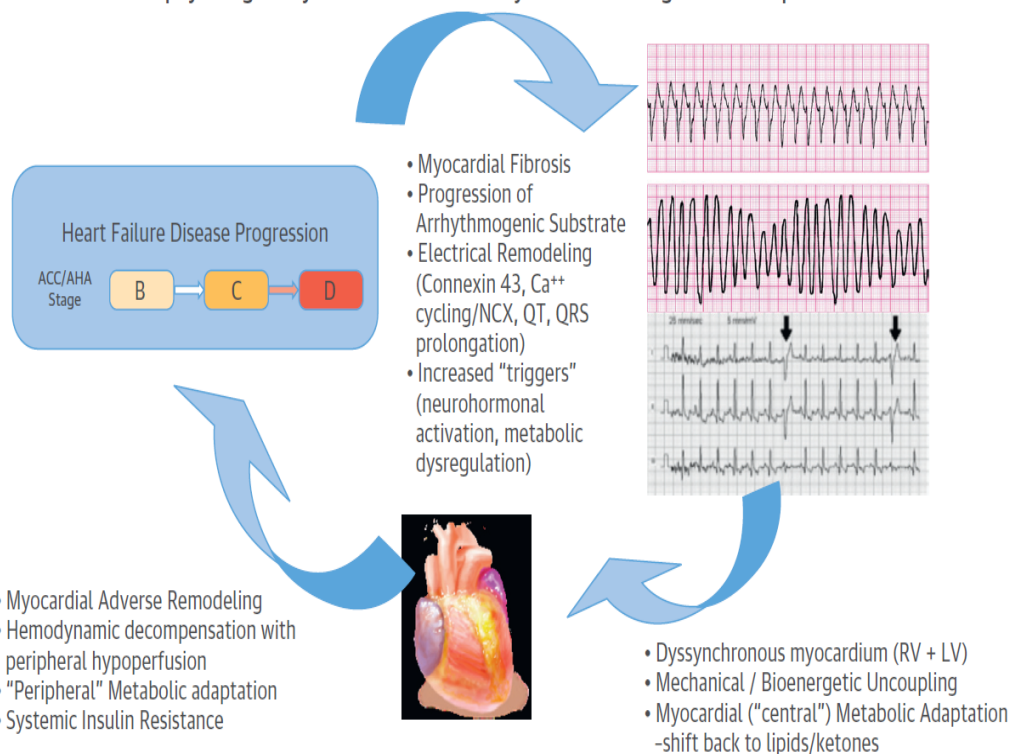
Classe NYHA avanzata

FE fortemente depressa

Funzione renale compromessa

Progressione dello stato di scompenso

Pathophysiological Cycle of Ventricular Arrhythmias and Progressive Pump Failure



COMPANION STUDY

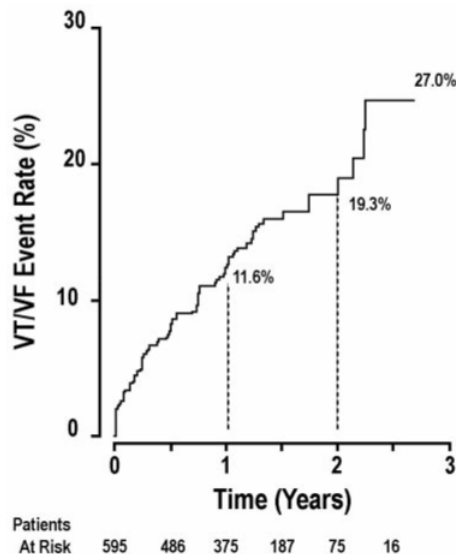
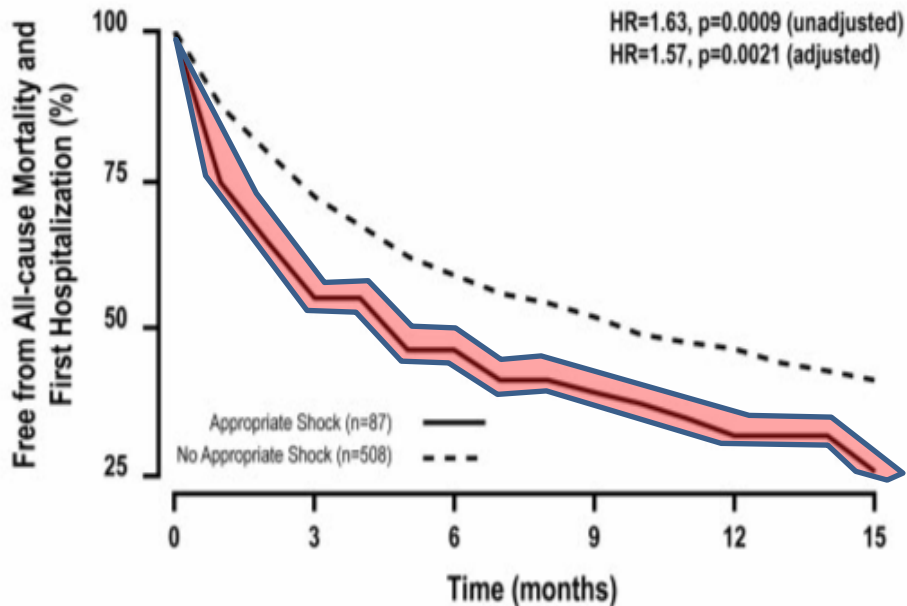


Figure 1. Risk of appropriate shock in CRT-D recipients.



LA MORTALITA' NEI PAZIENTI CON SCOMPENSO E SHOCK APPROPRIATI E' 50 % AD 1 ANNO!

Il paziente con storm aritmico è spesso uno scompensato avanzato

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

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PAZIENTI CON STORM:

- PIU' ANZIANI
- FE PIU' DEPRESSA
- SCOMPENSO AVANZATO
- MAGGIORI COMORBIDITA'
- PIU' TV INDUCIBILI, MAGGIORE TEMPO PROCEDURALE

Table 1 Baseline characteristics of patients with and without ES

Characteristic	No storm	ES	P
Patients (%)	1263 (65.1)	677 (34.9)	
Age (y)	61.3 ± 13.6	64.4 ± 12.5	<.001
Sex: male	1084 (85.9)	603 (89.1)	.048
Ischemic cardiomyopathy	641 (50.8)	370 (54.7)	.1
LVEF (%)	35.2 ± 13.2	30.4 ± 13.4	<.001
NYHA class			<.001
I	405 (33.0)	144 (21.8)	
II	473 (38.6)	226 (34.2)	
III	313 (25.5)	216 (32.7)	
IV	35 (2.9)	74 (11.2)	
CRT	294 (23.7)	211 (32.2)	<.001
≥1 previous ablation procedures	488 (38.6)	300 (40.6)	.015
No. of previous VT ablation procedures	0.5 ± 0.8	0.6 ± 0.9	.022
Syncope	102 (16.0)	74 (23.6)	.004
Prior heart surgery	358 (29.5)	209 (32.0)	.3
Hypertension	617 (45.4)	353 (40.2)	.038
Hyperlipidemia	634 (55.7)	368 (62.7)	.005
Atrial fibrillation	285 (25.3)	204 (33.2)	.001
Diabetes	227 (18.5)	177 (26.8)	<.001
Chronic kidney disease	328 (26.1)	252 (37.5)	<.001
Creatinine level	1.2 ± 0.6	1.4 ± 0.9	<.001

Ventricular Tachycardia Ablation in Severe Heart Failure An International Ventricular Tachycardia Ablation Center Collaboration Analysis

Wendy S. Tzou, MD; Roderick Tung, MD; David S. Frankel, MD; Marmar Vaseghi, MD, MS;

**111 pazienti con HF e NYHA IV,
1254 pazienti con HF e NYHA II e III**

59% Ischemici, 38 % con storm. NYHA IV richiede ECMO

Table 2. Procedural Characteristics by NYHA Classification

Variable	NYHA II and III (n=1254)	NYHA IV (n=111)	P Value
Use of hemodynamic support device	67 (7)	17 (22)	<0.001
Epicardial mapping	335 (29)	29 (27)	0.823
Surgical epicardial access	25 (2)	6 (6)	0.036
No. of VTs induced	2.2±2.0	2.6±2.3	0.057
No. with unmappable VT	497 (57)	56 (58)	0.764
Fastest VT cycle length, ms	351±87	376±90	0.016
Slowest VT cycle length, ms	420±110	458±110	0.005
Procedure time, min	285±116	280±120	0.691

Table 1. Baseline Characteristics by NYHA Classification

Variable	NYHA II and III (n=1254)	NYHA IV (n=111)	P Value
Age, y	64±12	65±11	0.317
Male sex	1113 (89)	95 (86)	0.350
Ischemic cardiomyopathy	741 (59)	68 (61)	0.688
LVEF	30±11	21±7	<0.001
Hypertension	663 (53)	57 (61)	0.132
Hyperlipidemia	695 (55)	59 (69)	0.018
Atrial fibrillation	357 (32)	39 (40)	0.116
Diabetes mellitus	280 (22)	45 (42)	<0.001
Chronic kidney disease	432 (34)	58 (52)	<0.001
ICD type			0.006
None	133 (11)	5 (5)	
Single or Dual Chamber	731 (58)	56 (51)	
CRT	390 (31)	49 (45)	
VT storm/incessant VT	447 (36)	74 (67)	<0.001
ICD shocks	750 (60)	75 (72)	0.016
Syncope	114 (9)	8 (19)	0.055
Previous ablation	478 (38)	40 (36)	0.685
Previous cardiothoracic surgery	409 (34)	36 (33)	0.916



Ventricular Tachycardia Ablation in Severe Heart Failure An International Ventricular Tachycardia Ablation Center Collaboration Analysis

Wendy S. Tzou, MD; Roderick Tung, MD; David S. Frankel, MD; Marmar Vaseghi, MD, MS;

Nessuna differenza nelle complicanze tra le varie classi NYHA

Gli scompensati avanzati non recidivano di più, ma se recidivano lo fanno prima

Mortalità ed ospedalizzazione superiore nella NYHA IV

Table 3. Outcomes After VT Ablation by NYHA Classification

Variable	NYHA II and III (n=1254)	NYHA IV (n=111)	P Value
In-hospital mortality	35 (3)	19 (17)	<0.001
Recurrent VT in 1 y	357 (29)	40 (36)	0.102
Time to VT recurrence, d	283±357	67±94	<0.001
Early (≤1 mo) VT recurrence	130 (10)	21 (19)	0.011
Cardiac transplantation in 1 y	50 (4)	12 (11)	0.003
One-y mortality	320 (26)	53 (48)	<0.001

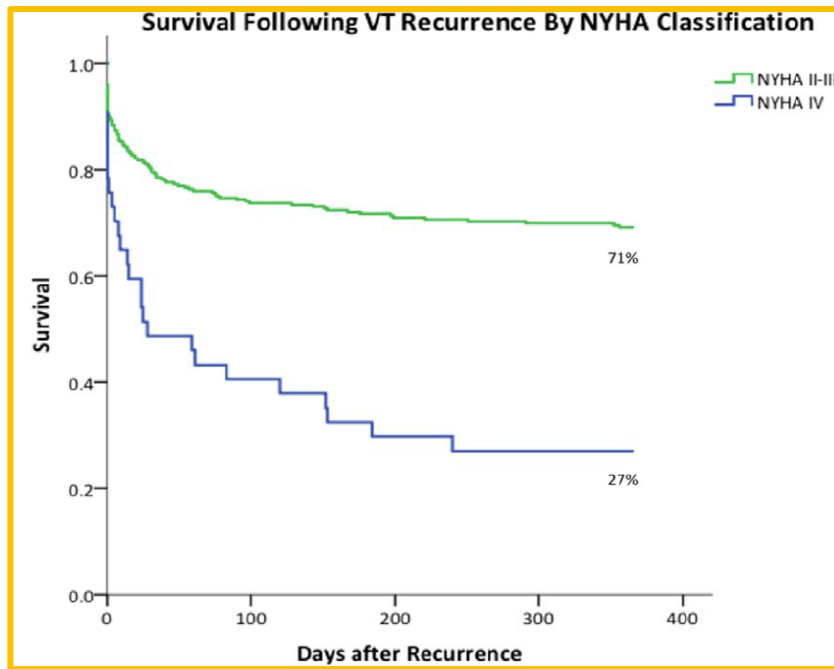


In caso di recidiva post ablazione, la mortalità peggiora fortemente negli scompensati avanzati

Ventricular Tachycardia Ablation in Severe Heart Failure An International Ventricular Tachycardia Ablation Center Collaboration Analysis

Wendy S. Tzou, MD; Roderick Tung, MD; David S. Frankel, MD; Marmar Vaseghi, MD, MS;

with reasonable intermediate-term outcomes. Freedom from recurrent VT was achieved in 64% of patients with NYHA IV HF, in whom significant morbidity was present at baseline. Compared with those with mild and moderate HF (NYHA II and III), patients with severe HF seemed to have a greater burden of VT and VT storm, as well as significantly greater comorbidities, and the threshold for performing the procedure may thus have been higher for the NYHA IV patients. Despite this higher expected morbidity, patients with severe HF and no VT recurrence had improved mortality compared with others in the same class but with recurrent VT after ablation. In fact, the survival among NYHA IV patients without recurrent VT was similar to that among patients with less severe HF



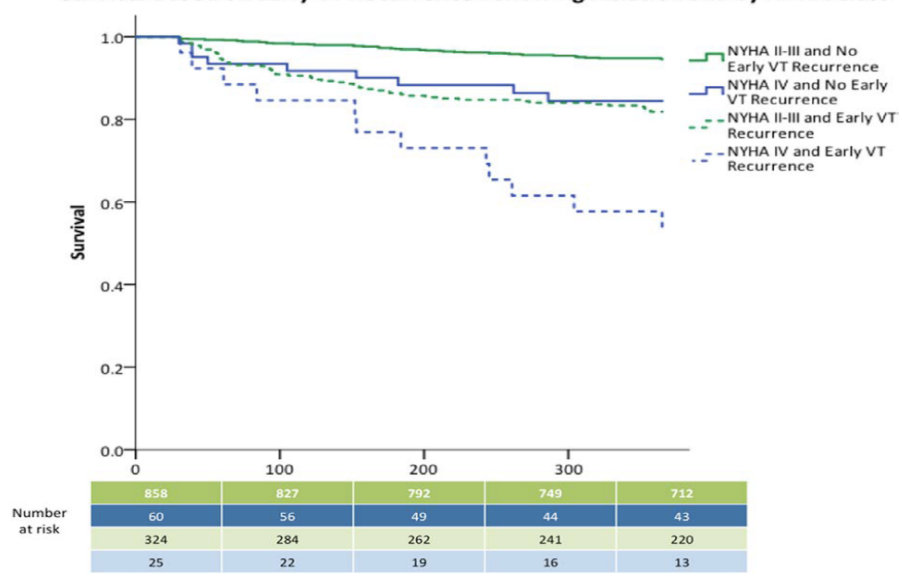
IN ASSENZA DI RECIDIVA POST ABLAZIONE, LA MORTALITA' E' SIMILE A CLASSE NYHA MODERATA CON RECIDIVA

La mortalità degli scompensati aumenta in tutte le classi NYHA se c'è recidiva

Table 4. Correlates of VT Recurrence Among NYHA IV Patients

Variable	Univariable Analyses		Multivariable Analysis	
	HR (95% CI)	PValue	HR (95% CI)	PValue
Age*	0.98 (0.94–1.01)	0.230	1.00 (0.96–1.05)	0.891
Ischemic cardiomyopathy	0.70 (0.37–1.33)	0.273		
LVEF*	0.93 (0.87–1.00)	0.050	0.90 (0.78–1.05)	0.176
Presence of CRT-D*	0.52 (0.27–0.98)	0.045	0.33 (0.13–0.84)	0.020
VT storm/incessant VT	1.03 (0.51–2.10)	0.935		
Hypertlipidemia*	3.46 (1.28–9.35)	0.014	2.76 (0.75–10.12)	0.126
Atrial fibrillation*	0.50 (0.24–1.02)	0.056	0.46 (0.13–1.66)	0.235
Diabetes mellitus	1.63 (0.83–3.21)	0.160		
Chronic kidney disease	0.63 (0.33–1.22)	0.172		
Antiarrhythmic drug use	0.71 (0.25–2.05)	0.530		
Use of hemodynamic support device*	2.98 (1.19–7.44)	0.020	4.23 (1.08–16.66)	0.039
Partial success on final PES*	0.52 (0.26–1.06)	0.070	0.72 (0.25–2.08)	0.539
Inducible at final PES	1.23 (0.93–1.63)	0.145		

Survival Based on Early VT Recurrence Following Ablation and by NYHA Class



L'outcome dell'ablazione è cruciale nei pazienti con scompenso



I pazienti con scompenso e TV traggono beneficio dall'ablazione ma l'outcome dipende fortemente dalla recidiva

Freedom from recurrent ventricular tachycardia after catheter ablation is associated with improved survival in patients with structural heart disease: An International VT Ablation Center Collaborative Group study ^e ^{CP}

Roderick Tung, MD, FHRS,^{*} Marmar Vaseghi, MD, MS, FHRS,^{*} David S. Frankel, MD, FHRS,[†]

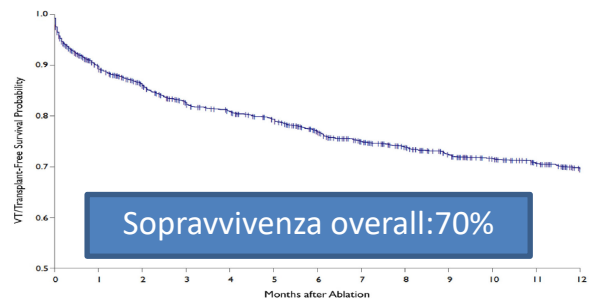


Figure 2 Kaplan-Meier estimate of ventricular tachycardia (VT) and transplant-free survival in the overall cohort.

CONCLUSION Catheter ablation of VT in patients with structural heart disease results in 70% freedom from VT recurrence, with an overall transplant and/or mortality rate of 15% at 1 year. Freedom from VT recurrence is associated with improved transplant-free survival, independent of heart failure severity.

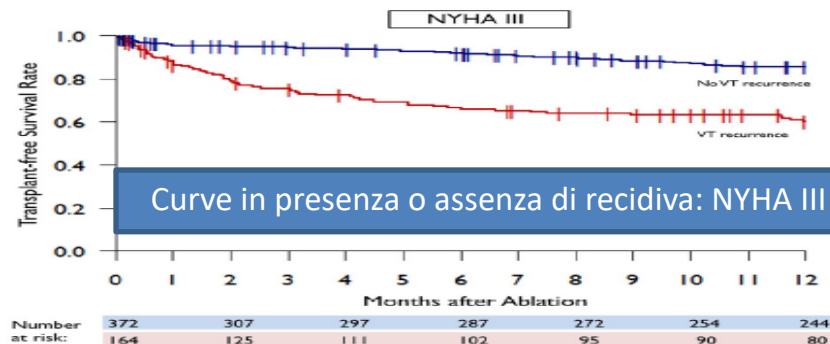
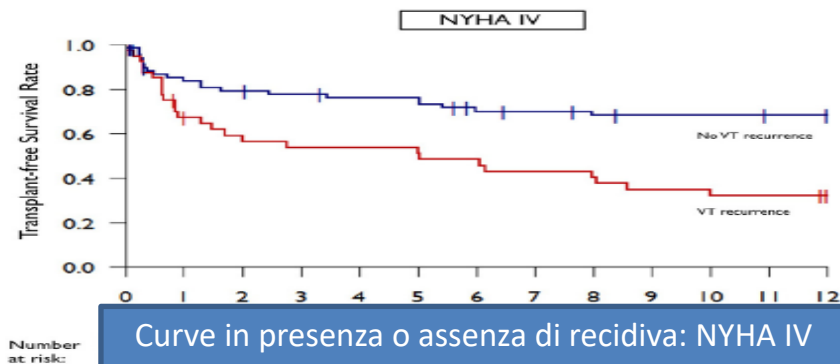


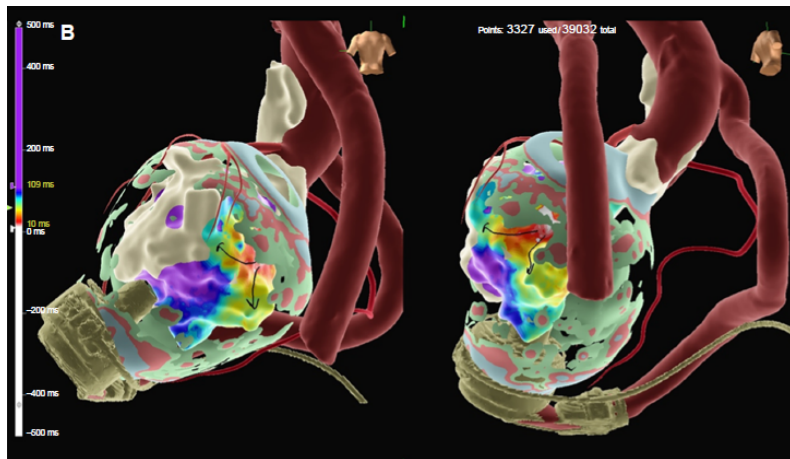
Figure 6 Kaplan-Meier display of transplant-free survival by ventricular tachycardia functional class.



I pazienti con scompenso e TV traggono beneficio dall'ablazione ma l'outcome dipende fortemente dall'outcome acuto

Characterization of ventricular tachycardia ablation in end-stage heart failure patients with left ventricular assist device (CHANNELED registry)

Jan-Hendrik van den Bruck ^{1*}, Felix Hohendanner ², Emanuel Heil ²,



Characterization of VT ablation in end-stage heart failure patients with LVAD (CHANNELED registry)



9 centres

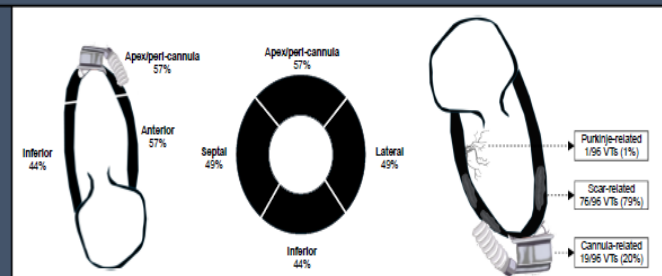


69 LVAD patients



72 VT ablation procedures

Arrhythmogenic substrate and VT mechanisms



Timing



- 18% scheduled after intensification of preexisting Amiodarone therapy
- 43% scheduled after a prior combination of ≥ 2 AADs

Outcome and follow-up



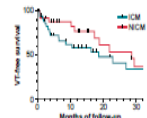
In 28/72 (39%) patients non-inducibility of any VT



26/69 (38%) patients died



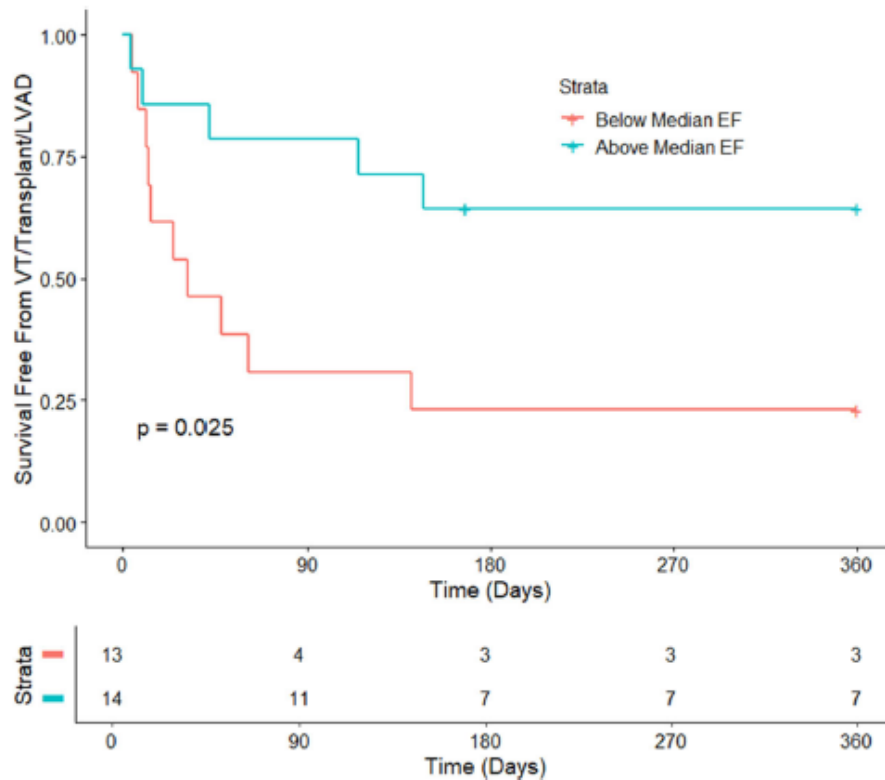
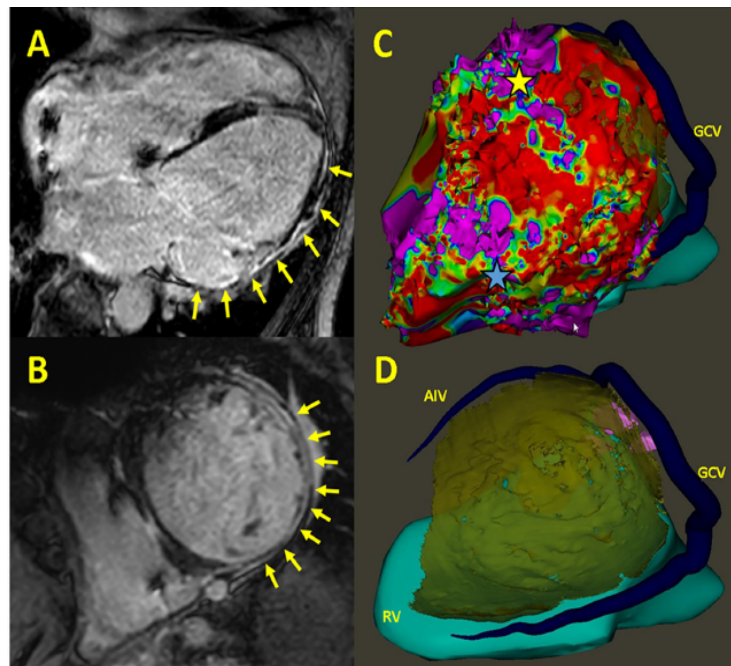
10/69 (14%) patients received cardiac transplant



16/69 (23%) patients were free from VT recurrence

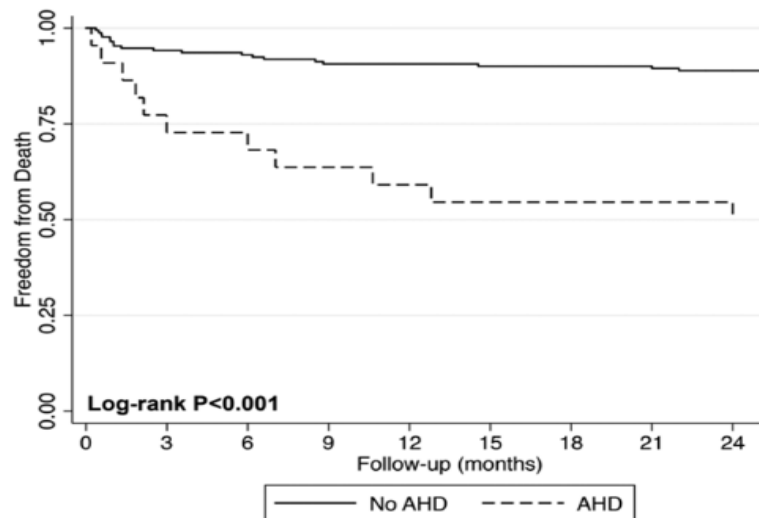
Ventricular Tachycardia Ablation in Patients With Severely Decreased Left Ventricular Ejection Fraction

Michael Ghannam  | Nathaniel Christian-Miller | Jackson Liang  | Amrish Deshmukh  | Kelly Arps  | Rakesh Latchamsetty | Thomas Crawford  | Krit Jongnarangsin | Hakan Oral | Fred Morady | Frank Bogun 



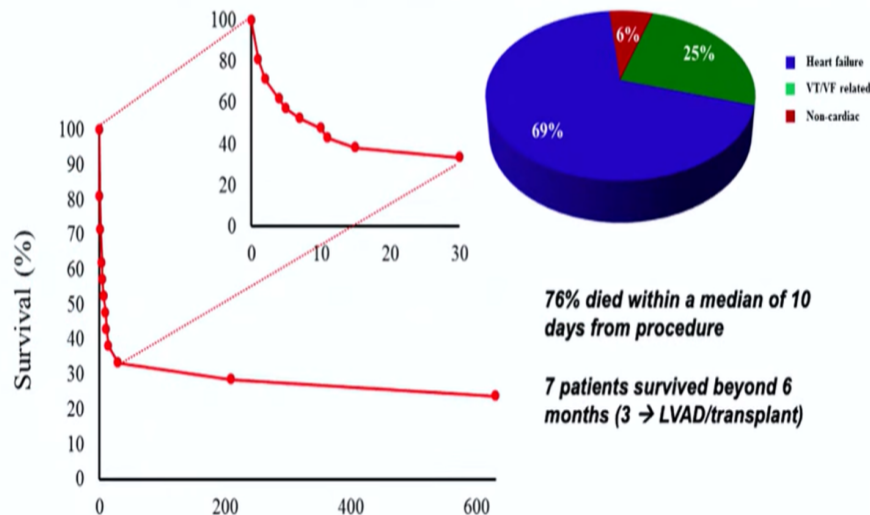
Acute Hemodynamic Decompensation During Catheter Ablation of Scar-Related Ventricular Tachycardia Incidence, Predictors, and Impact on Mortality

Pasquale Santangeli, MD; Daniele Muser, MD; Erica S. Zado, PA-C; Silvia Magnani, MD;



Outcomes w/ Rescue ECMO Support for Periprocedural Acute Hemodynamic Decompensation (AHD)

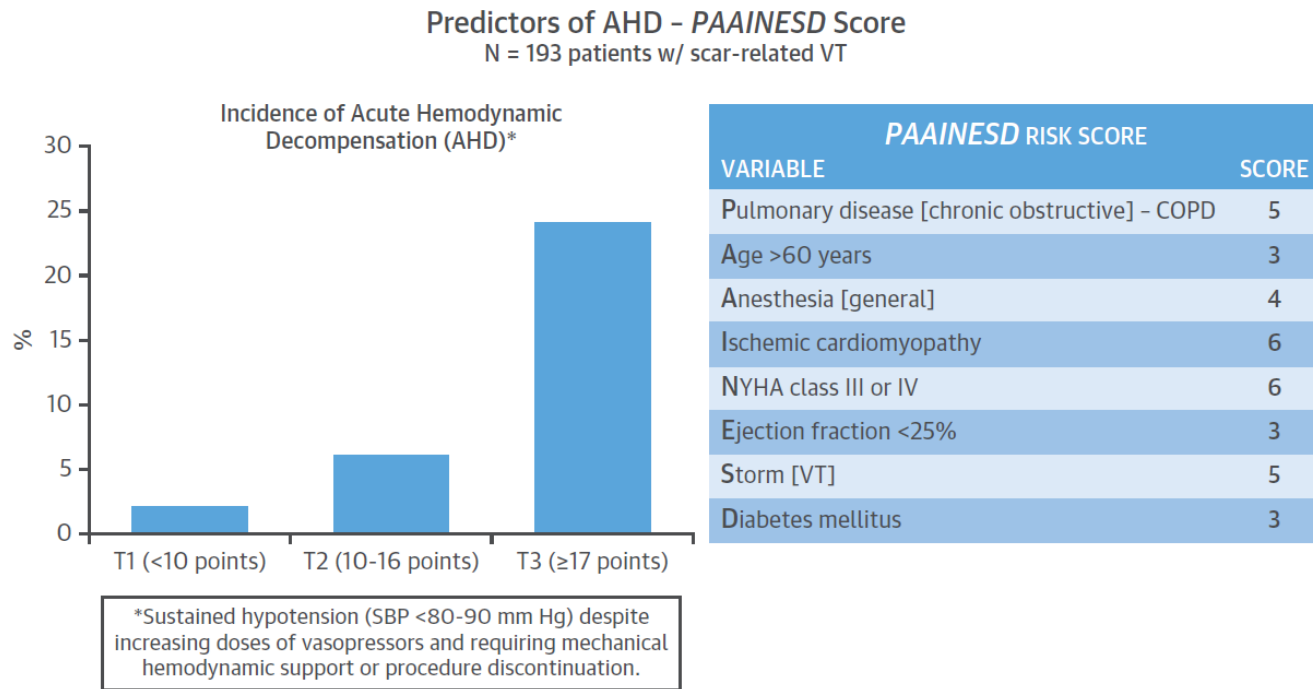
21 pts (LVEF $21 \pm 13\%$) with VT/VF storm



**L'UTILIZZO DELL'ECMO NON PROGRAMMATO COME STRATEGIA DI SALVATAGGIO A SEGUITO DI
SCOMPENSO PERIPROCEDURALE E' ASSOCIATO A MAGGIORE MORTALITA'**



FIGURE 2 Risk Score to Predict Periprocedural AHD



Outcomes of a PAINESD score-guided multidisciplinary management approach for patients with ventricular tachycardia storm and advanced heart failure: A pilot study

Naga Venkata K. Pothineni, MD,* Andres Enriquez, MD,*
Ramanan Kumareswaran, MD,* Fermin Garcia, MD,* Ronak Shah, MD,* Joyce Wald, DO,*
Christian Bermudez, MD,* Daniele Muser, MD,* Francis E. Marchlinski, MD,*
Pasquale Santangeli, MD, PhD*



Multidisciplinary Management Pathway for High-Risk VT Storm Patients (PAINESD>17) with Pre-Emptive ECMO

STEP 1 – A-HF Team

1. Admission to ICU
2. Hemodynamic optimization / inotropic support
3. Assess candidacy for advanced therapies

STEP 2 – CT Surgery

1. Evaluation of vascular access sites (CTA, US)
2. Elective initiation of VA-ECMO (FA-FV, Ax-FV if PAD)

STEP 3 – Cardiac EP

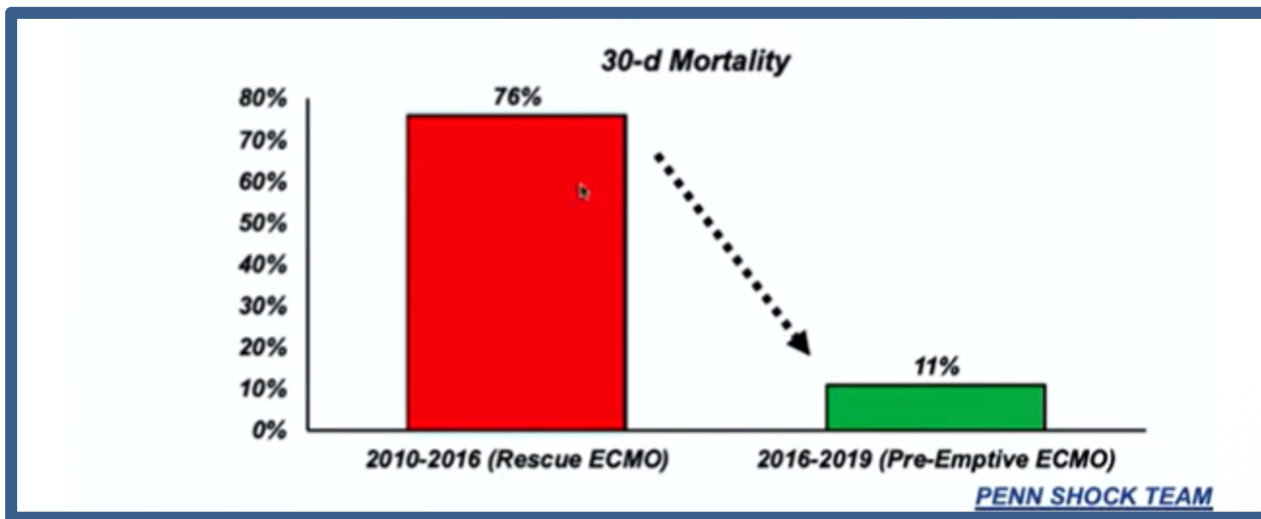
1. Catheter ablation on VA-ECMO support
2. Elective VA-ECMO decannulation

Nei pazienti ad alto rischio di scompenso emodinamico durante la procedura, l'utilizzo preventivo dell'ECMO è associato a migliori outcome e mortalità post-procedurali



Outcomes of a PAINESD score-guided multidisciplinary management approach for patients with ventricular tachycardia storm and advanced heart failure: A pilot study

Naga Venkata K. Pothineni, MD,* Andres Enriquez, MD,*
Ramanan Kumareswaran, MD,* Fermin Garcia, MD,* Ronak Shah, MD,§ Joyce Wald, DO,‡
Christian Bermudez, MD,† Daniele Muser, MD,* Francis E. Marchlinski, MD,*
Pasquale Santangeli, MD, PhD*



L'ablazione di TV nei pazienti scompensati va fatta in centri esperti in quanto spesso è necessario l'ECMO

Hemodynamic Support in Ventricular Tachycardia Ablation



An International VT Ablation Center Collaborative Group Study

Mohit K. Turagam, MD,^a Venkat Vuddanda, MD,^b Donita Atkins, RN, BSN,^b Pasquale Santangeli, MD, PhD,^c David S. Frankel, MD,^c Roderick Tung, MD,^d Marmar Vaseghi, MD,^e William H. Sauer, MD,^f Wendy Tzou, MD,^g Nilesh Mathuria, MD,^h Shiro Nakahara, MD,^h Timm M. Dickfeld, MD,ⁱ T. Jared Bunch, MD,^j Peter Weiss, MD,^j Luigi Di Biase, MD, PhD,^{k,l} Venkat Tholakanahalli, MD,^m Kairav Vakil, MD,^m Usha B. Tedrow, MD,ⁿ William G. Stevenson, MD,^o Paolo Della Bella, MD,^o Kalyanam Shivkumar, MD, PhD,^c Francis E. Marchlinski, MD,^c David J. Callans, MD,^c Andrea Natale, MD,^k Madhu Reddy, MD,^h Dhanunjaya Lakkireddy, MD^h

CONCLUSIONS

Patients receiving HS were sicker with multiple comorbidities and as expected, had a significantly higher 1-year mortality than did those not receiving HS. In patients with LVEF $\leq 20\%$ and NYHA functional class III to IV, there was also no significant difference in clinical outcomes between the 2 groups. Further prospective studies are needed to systematically evaluate patients undergoing VT ablation receiving HS.

Table 2. Procedural Characteristics by NYHA Classification

Variable	NYHA II and III (n=1254)	NYHA IV (n=111)	P Value
Use of hemodynamic support device	67 (7)	17 (22)	<0.001
Epicardial mapping	335 (29)	29 (27)	0.823
Surgical epicardial access	25 (2)	6 (6)	0.036
No. of VTs induced	2.2 $\pm$ 2.0	2.6 $\pm$ 2.3	0.057
No. with unmappable VT	497 (57)	56 (58)	0.764
Fastest VT cycle length, ms	351 $\pm$ 87	376 $\pm$ 90	0.016
Slowest VT cycle length, ms	420 $\pm$ 110	458 $\pm$ 110	0.005
Procedure time, min	285 $\pm$ 116	280 $\pm$ 120	0.691
Noninducible or inducible for nonclinical VT on final PES	1028 (82)	88 (79)	0.521
Final PES not performed	54 (5)	12 (11)	0.010
Complications	82 (7)	11 (10)	0.246

- **Male, 69 years**
- **Biventricular arrhythmogenic cardiomyopathy, EF=20%**
- **CRTD implant in 2015**
- **NYHA Class III**
- **Normal coronary arteries**
- **Incessant electrical storm with several ICD shocks**

PAINESD SCORE: 17

DRUGS

EUTIROX 100 mcg
Entresto 24/26 mg
AMIODARONE CLOR CP 200 MG

fl 1 g + 4 fl 4 ml
0 ml
G CPR
UI
CPR
PR 100 MG
MG

CONGESCOR 3,75 MG CPR
PANTOPRAZOLO 20 MG CP



Storia:

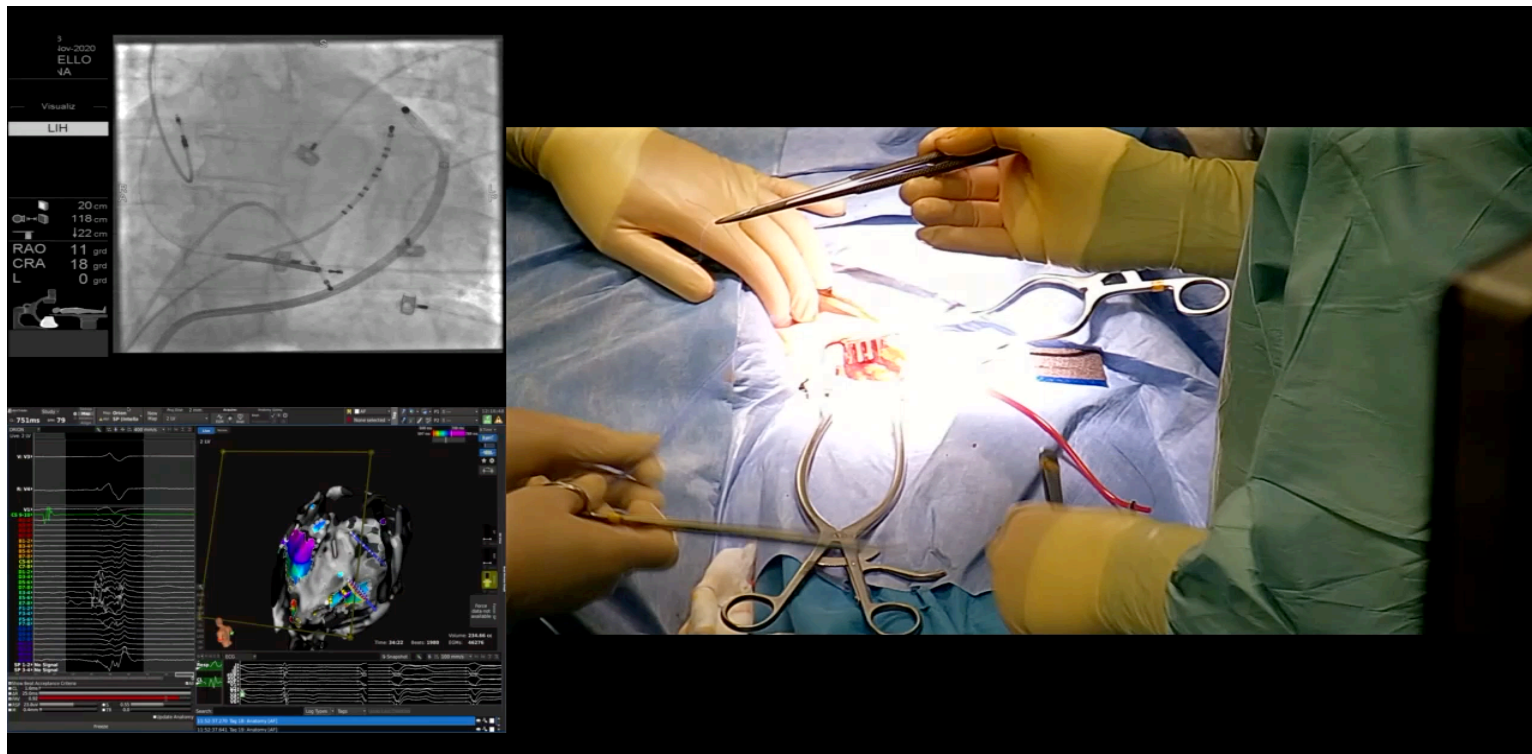
Paziente con cardiomiopatia aritmogena biventricolare con dilatazione ventricolare sinistra, severissima riduzione della funzione sistolica ventricolare sinistra ed innumerevoli scariche di defibrillatore interne ed esterne nel corso degli ultimi giorni. Coronarie epicardiche esenti da lesioni angiograficamente significative. Pregresso stenting di arteria iliaca sinistra. Eccesso ponderale. Attualmente in terapia vasopressoria con Noradrenalina in uptritation a dosi off-label per mantenimento dell' emodinamica in condizioni di shock cardiogeno non responsivo ad inotropi puri (Adrenalina e Dobutamina) che si sono dimostrati immediati trigger aritmogeni al tentativo di embricazione.

Decisioni prese:

In considerazione della procedura estremamente delicata e della scarsa funzione sistolica ventricolare sinistra, si prende in considerazione supporto meccanico in ECMO, mantenendone lo stand-by ma non iniziandolo ab-inizio. Questa decisione viene presa a causa della difficoltà tecnica ad incannulare l' asse arterioso sinistro per la presenza di pregresso stent con ipertrofia intimale all' edge distale (lume piccolo) e la necessità di iniziare la procedura di mappatura quanto prima, a causa delle aritmie recidivanti costanti. Si procede, pertanto, con decisione collegiale, all' avvio della procedura elettrofisiologica di mapping ed alla contemporanea esposizione chirurgica dell' asse iliaco-femorale sinistro per lo stand-by



Utilizzo ECMO in paziente con cardiomiopatia aritmogena e storm



Nell'80 % dei casi lo storm è innescato da una TV monomorfa

Catheter ablation of electrical storm in patients with arrhythmogenic right ventricular cardiomyopathy ^e

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Nicolas Lellouche, MD, PhD,§ Émilie Varlet, MD,|| Denis Amet, MD,||
Vincent Algalarrondo, MD, PhD,¶ Xavier Waintraub, MD,* Guillaume Duthoit, MD,*
Nicolas Badenco, MD,* Carole Maupain, MD,* Françoise Hidden-Lucet, MD,*
Philippe Maury, MD, PhD,# Estelle Gandjbakhch, MD, PhD,*
GPUR Groupe Parisien Universitaire en Rythmologie Investigators

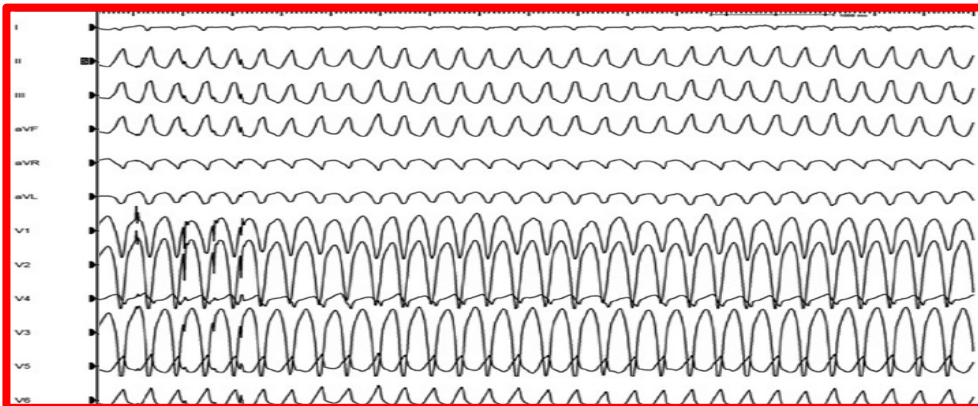
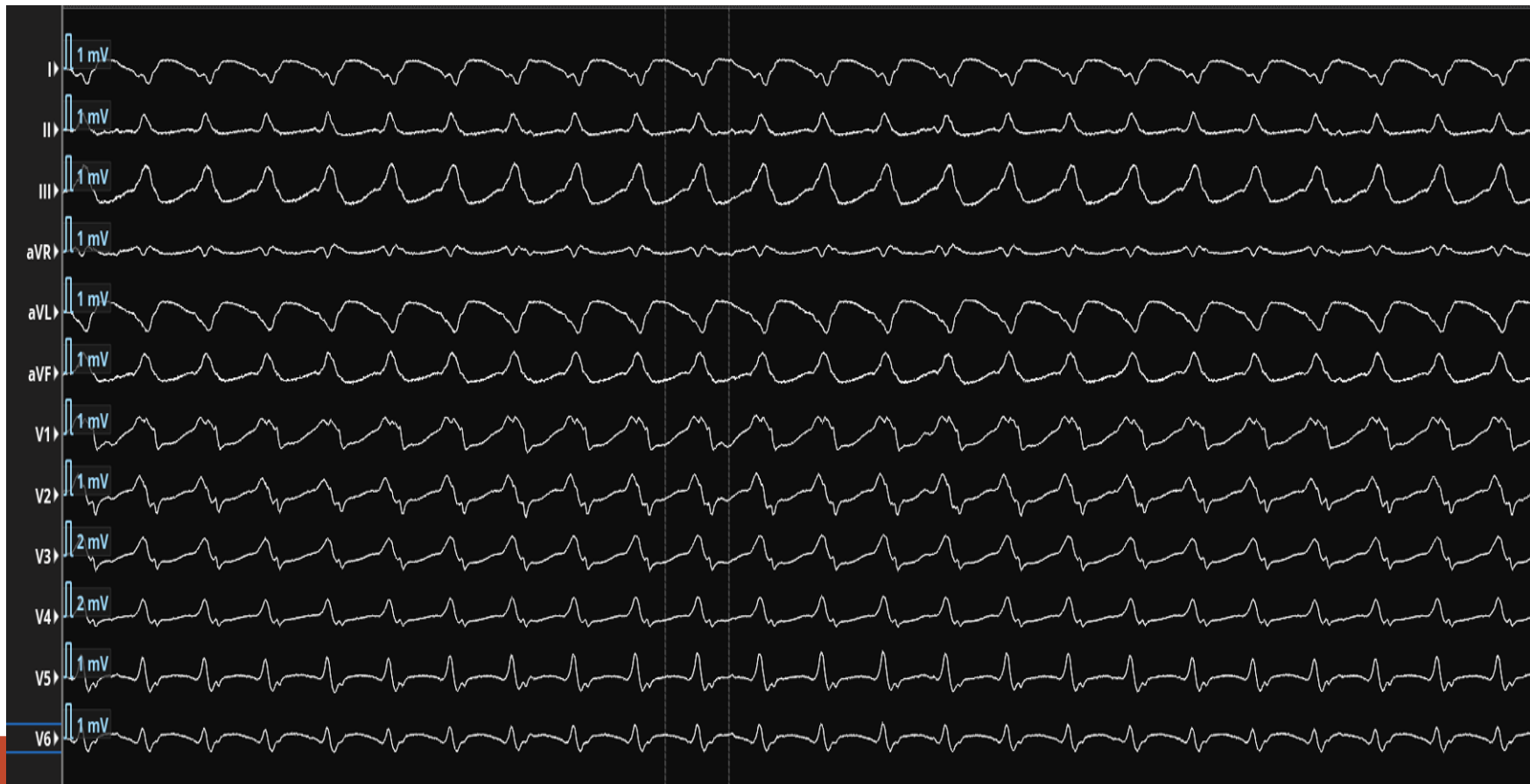


Table 2 Arrhythmia characteristics and results of the electrophysiology study for each ES catheter ablation procedure (N = 24)

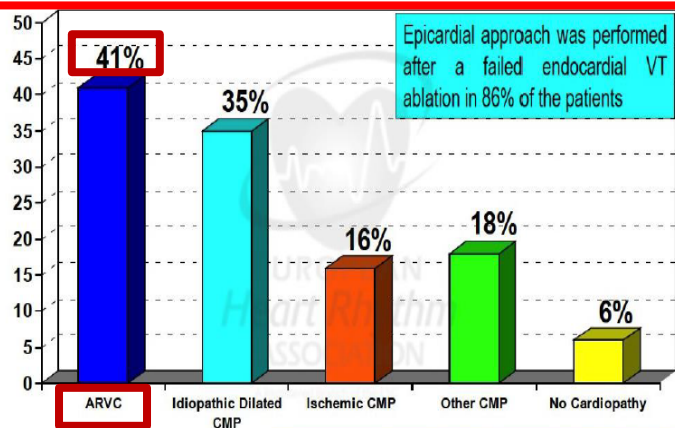
Characteristic	Value
Clinical VT	
Number of documented VTs	1 (1-2)
>1 documented VT	4 (17)
Clinical VT morphology	
LBBB, inferior axis	12
LBBB, superior axis	10
RBBB	2
Electrophysiology study and catheter ablation	
Clinical VT cycle length	348 ± 51
>1 induced VT	15 (63)
Use of a 3D electroanatomic mapping system	18 (75)
Number of induced VTs	2 ± 1.36
Number of targeted VTs	1 (1-6)
Number of targeted sites	1 (1-5)
Radiofrequency time (s)	790 (180-6150)
Procedure duration (min)	180 (120-360)



Necessità dell'approccio endo-epi

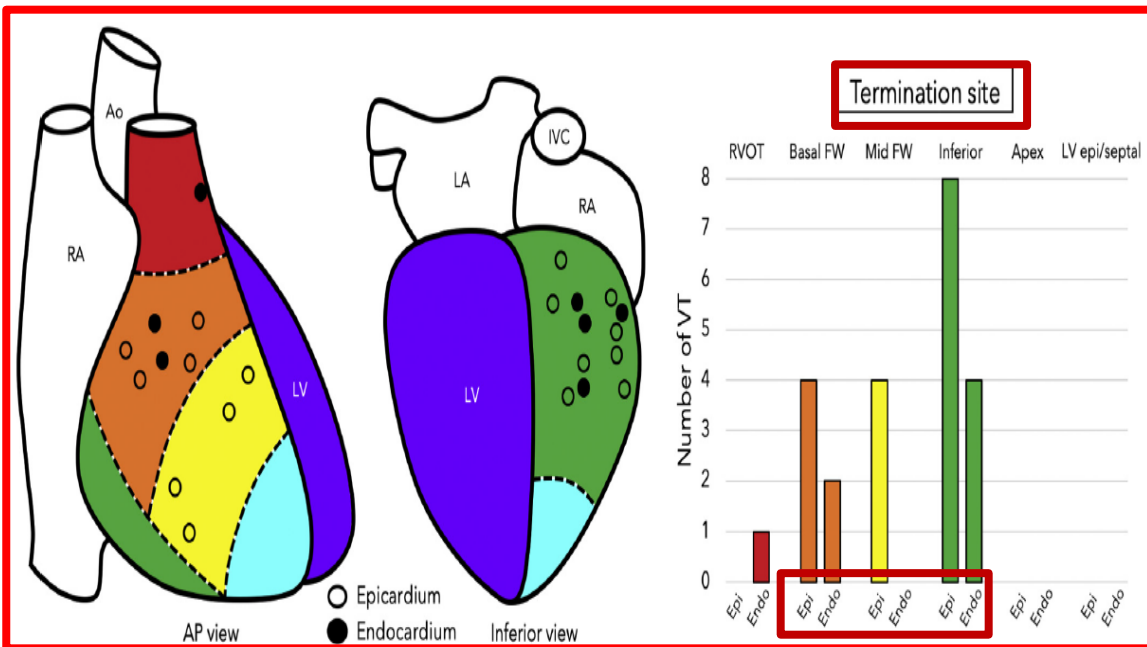
Spatial and transmural properties of the reentrant ventricular tachycardia circuit in arrhythmogenic right ventricular cardiomyopathy: Simultaneous epicardial and endocardial recordings ^②

Ruhong Jiang, MD, ^{*†1} Takuro Nishimura, MD, PhD, ^{*1} Andrew D. Beaser, MD, ^{*}

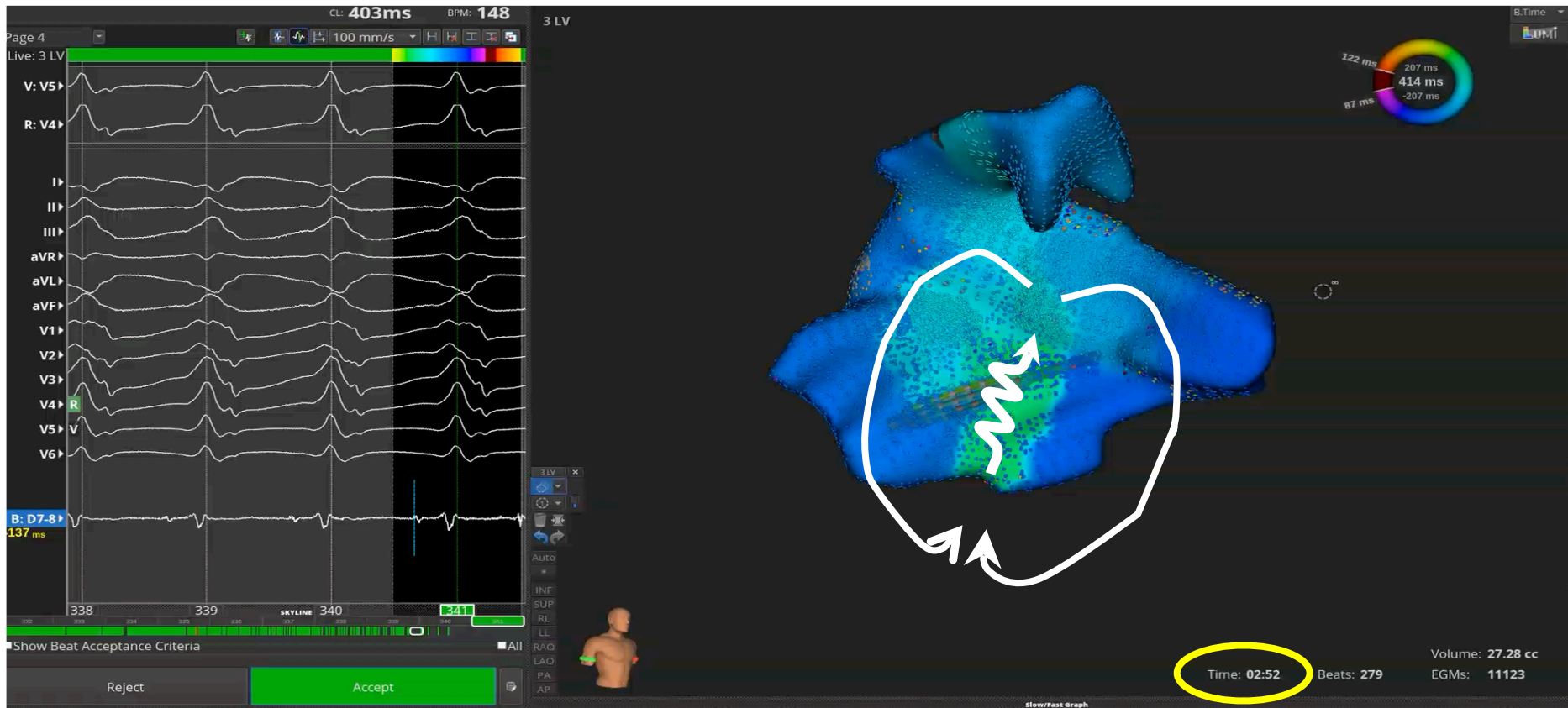


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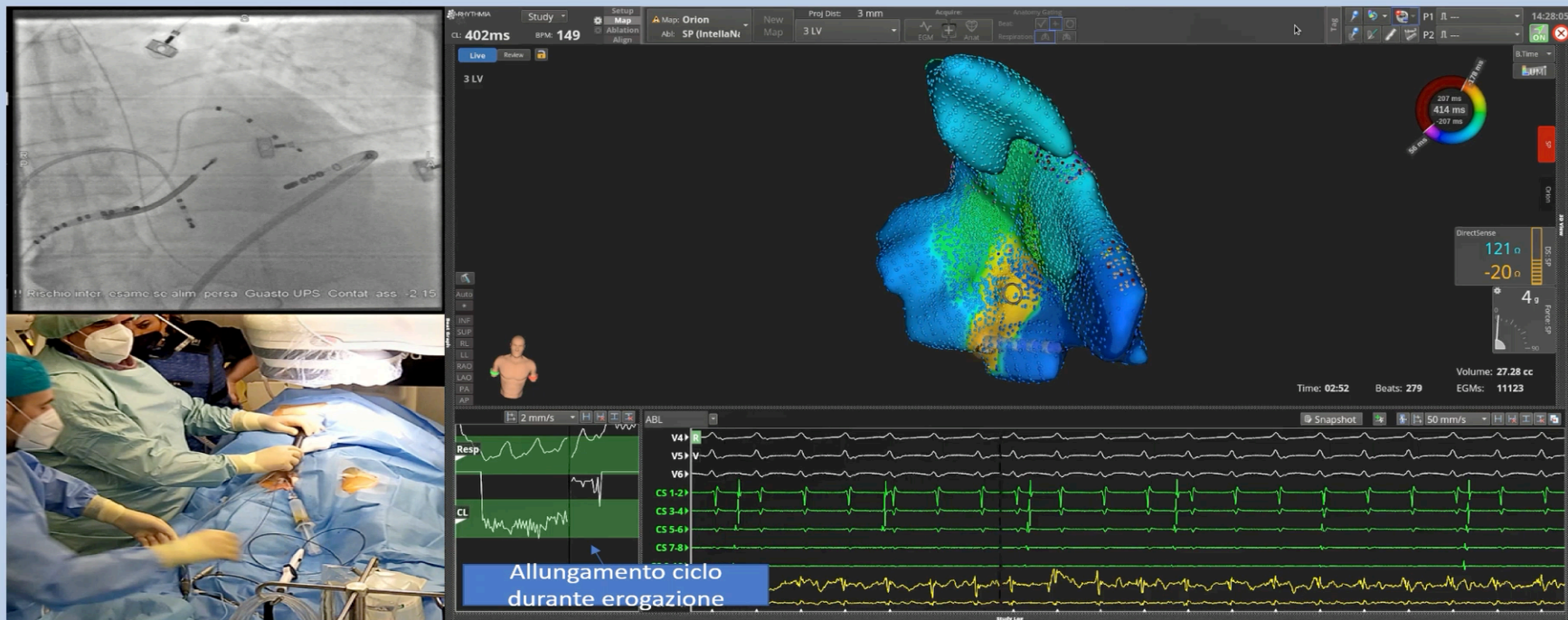
Percentage of an epicardial approach for VT ablation in relation to the underlying heart disease

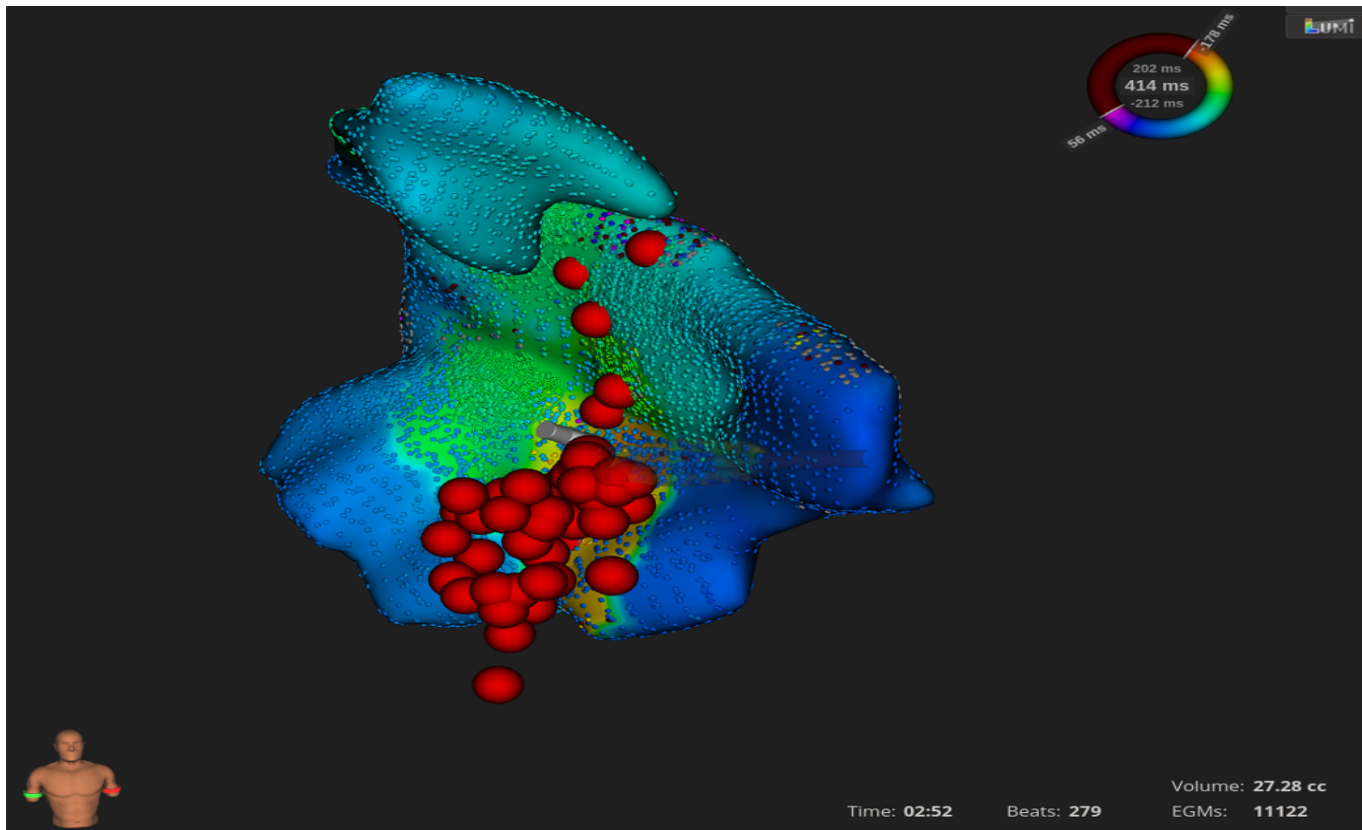


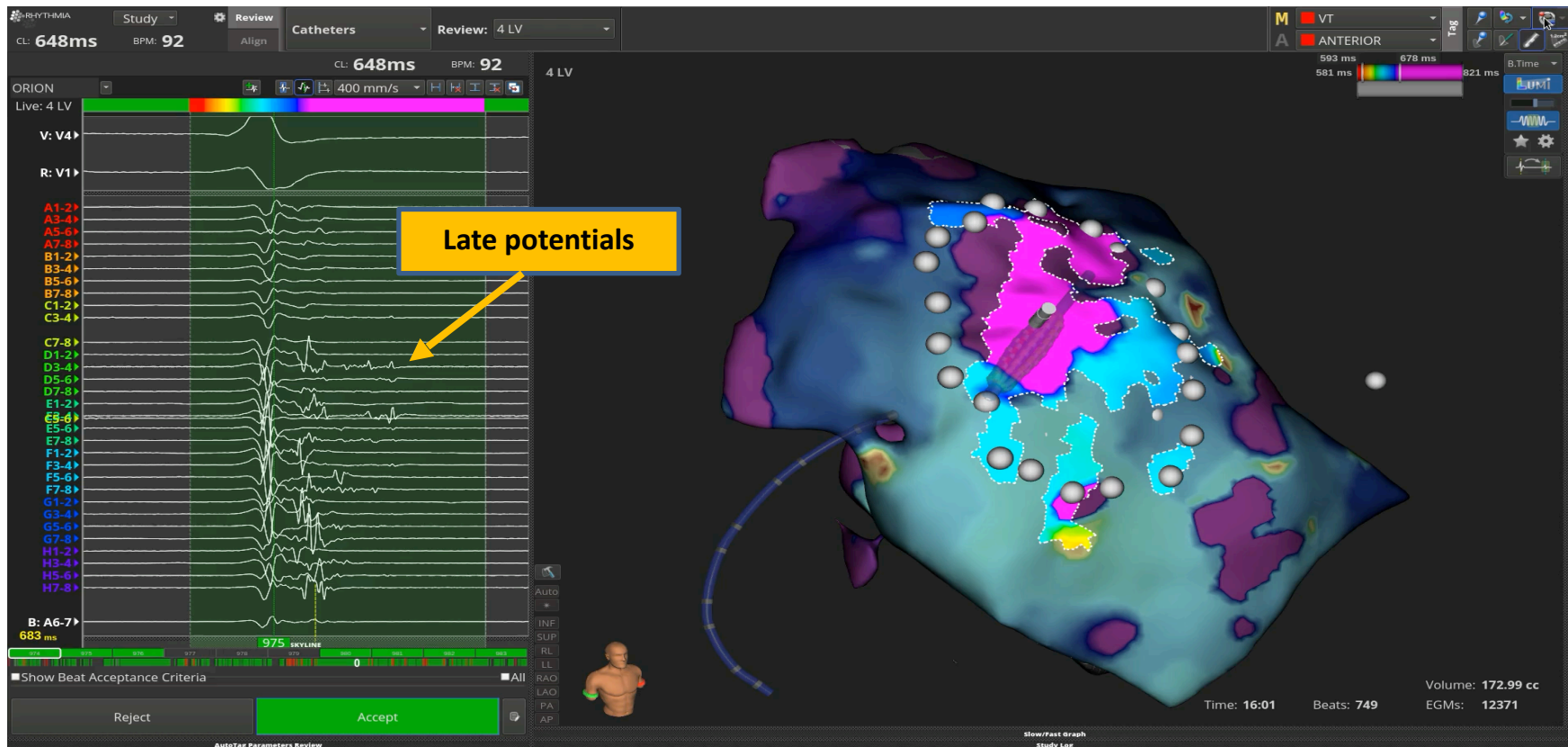
DOPO L'ACCESSO EPICARDICO VIENE EFFETTUATA UNA RAPIDA MAPPA DELLA TACHICARDIA

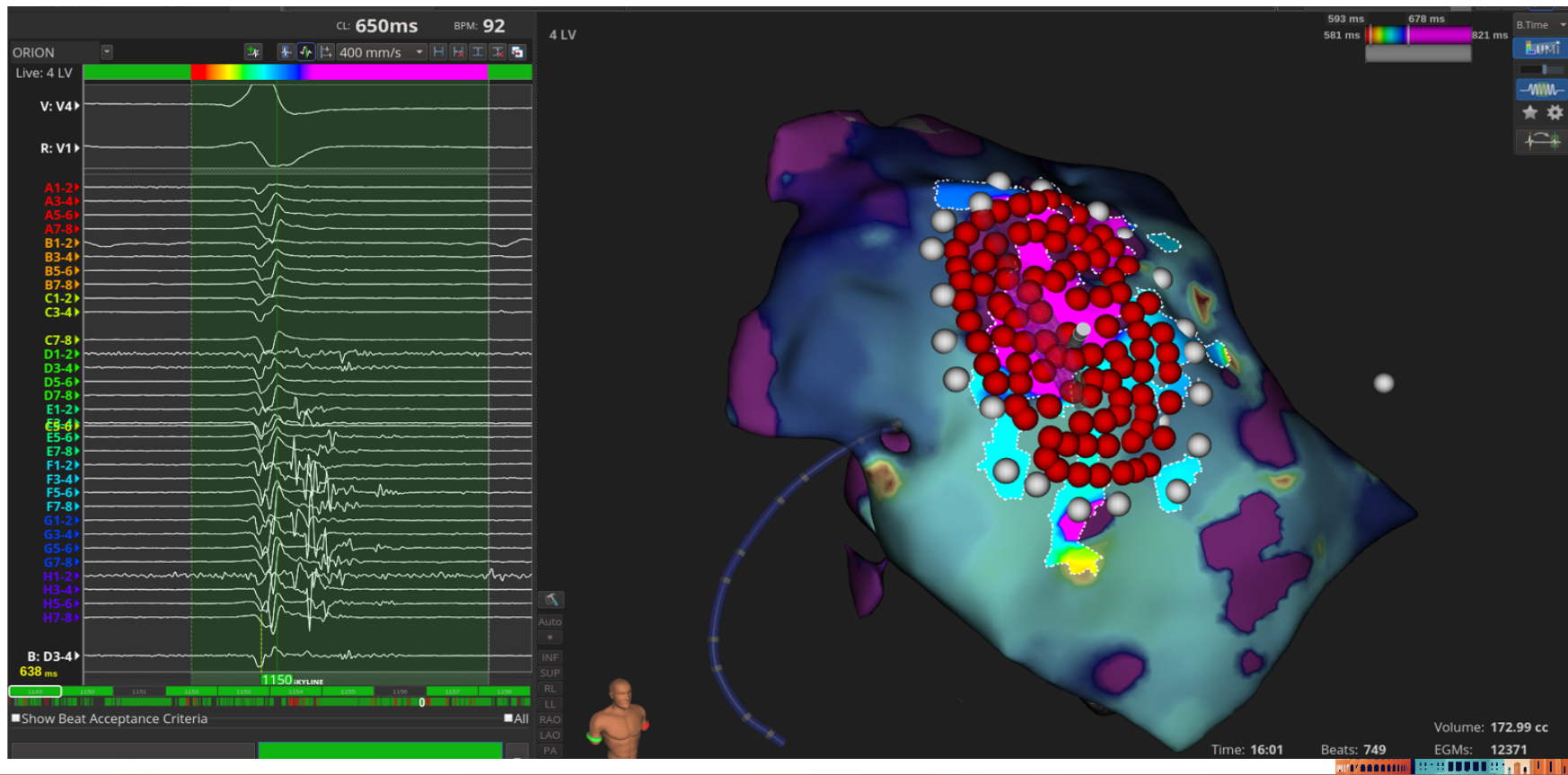


INTERRUZIONE TACHICARDIA

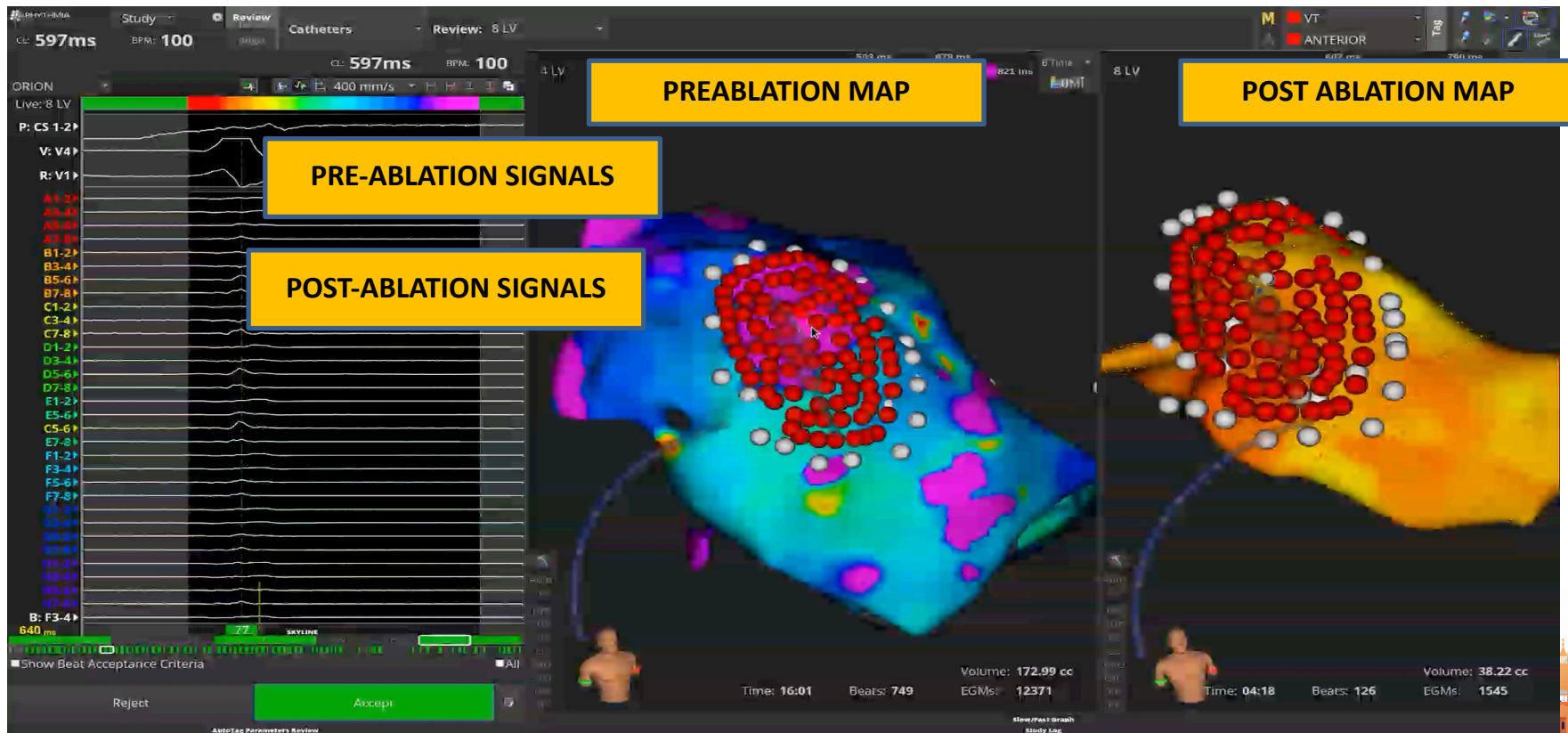




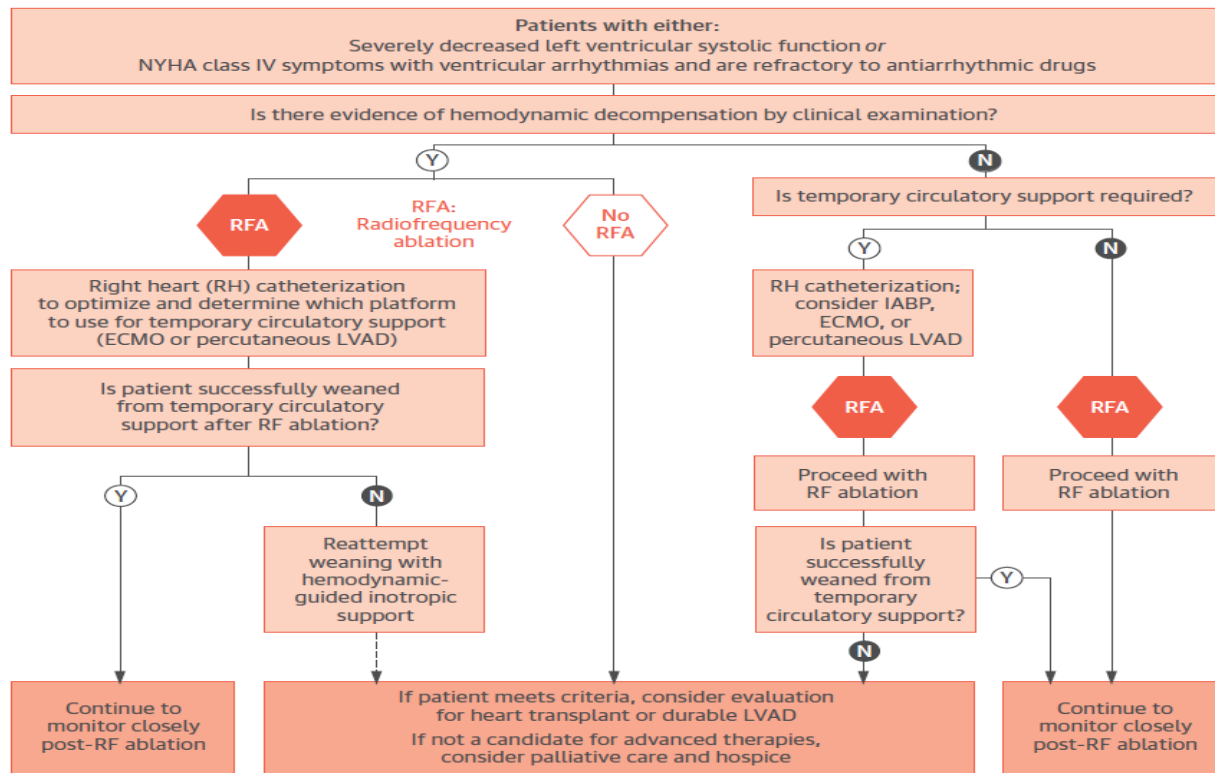




PRE AND POST ABLATION MAP







Santangeli, P. et al. J Am Coll Cardiol. 2017;69(14):1842-60.



