



UNIVERSITA' DI PADOVA  
DIPARTIMENTO DI SCIENZE CARDIOLOGICHE,  
TORACICHE, VASCOLARI E SANITA' PUBBLICA



# Cardiopatía Aritmogena: una malattia evolutiva S-ICD in quali pazienti ? Pacing quando e in quali siti ?

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## *Transvenous-ICD therapy provides the most effective life-saving protection for patients with ARVC*

Mean follow-up:

39 ± 27 months

(3.3 years)

Appropriate ICD

interventions:

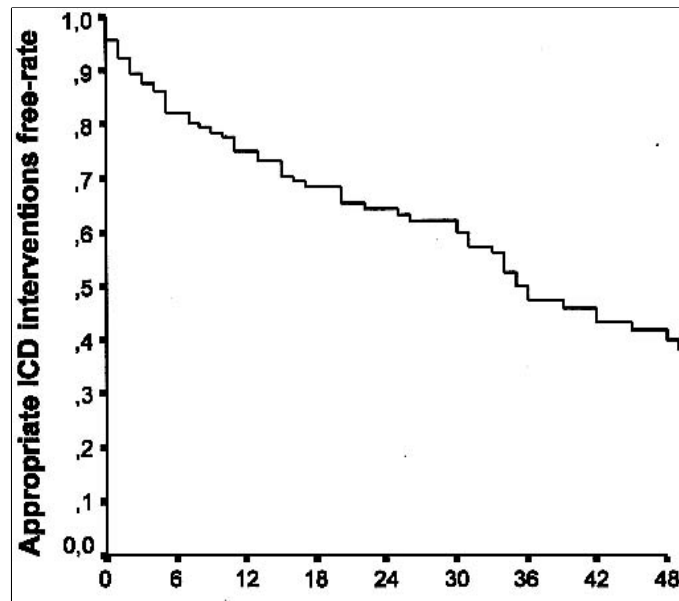
64/132 patients (48%)

\*Shocks (31)

\*ATP (13)

\*both (20)

(a total of 1271 discharges)



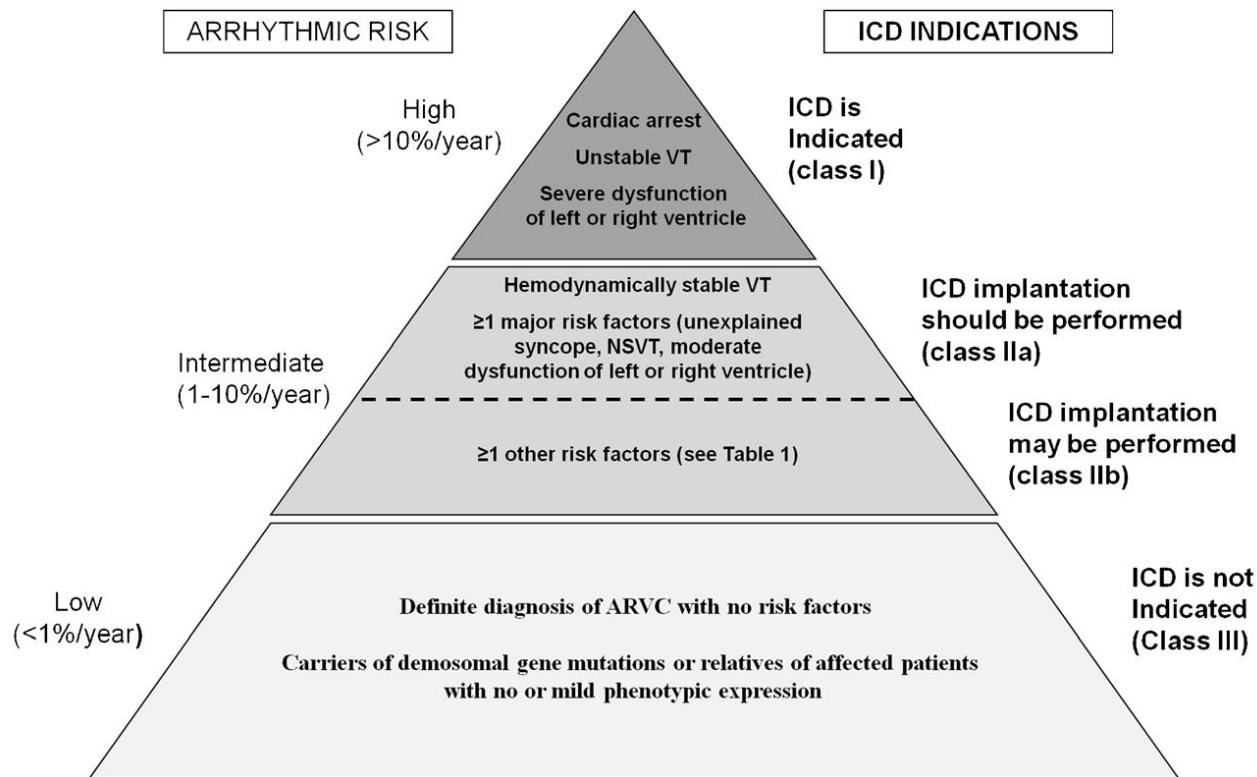
**ICD interventions in high-risk patients occurred despite concomitant AADs, a finding supporting the concept that AAD therapy may not confer adequate protection against SCD**

## *TV-ICD Appropriate therapies in ARVC patients*

First Author	Year	Patients (n)	Study design	Men (%)	Follow-up (months)	Primary prevention (%)	Mortality overall (%)	Appropriate interventions (%)	Life-saving interventions (%)	Inappropriate Interventions (%)	Complications (%)
Breithardt <sup>49</sup>	1994	18	SC	72	17±11	0	0	50	N/A	N/A	N/A
Link <sup>50</sup>	1997	12	SC	58	22±13	0	8	67	50	33	33
Tavernier <sup>51</sup>	2001	9	SC	89	32±24	0	0	78	44	44	N/A
Corrado <sup>52</sup>	2003	132	MC	70	39±25	22	3	48	24	16	14
Wichter <sup>53</sup>	2004	60	SC	82	80±43	7	13	68	40	23	45
Rougin <sup>54</sup>	2004	42	MC	52	42±26	40	2	78	N/A	24	14
Hodgkinson <sup>55</sup>	2005	48	MC	63	31	73	0	70*	30*	10	6
Piccini <sup>56</sup>	2005	67	SC	35	53±11	42	9	66	21	24	21
Boriani <sup>57</sup>	2007	15	SC	12	65±42	40	0	33	40	7	47
Corrado <sup>58</sup>	2010	106	MC	58	58±35	100	0	24	16	19	17
Bhonsale <sup>59</sup>	2011	84	SC	46	57±41	100	2.4	48	19	24	24
Schuler <sup>60</sup>	2012	26	SC	81	128	4	8	46	N/A	N/A	8

❑ ICD Appropriate therapies: **9.5%/yr**

Risk stratification and indications to ICD implantation according to 2015  
International Task Force consensus on ARVC treatment





## *TV-ICD complications AND inappropriate therapies in ARVC patients*

First Author	Year	Patients (n)	Study design	Men (%)	Follow-up (months)	Primary prevention (%)	Mortality overall (%)	Appropriate interventions (%)	Life-saving interventions (%)	Inappropriate Interventions (%)	Complications (%)
Breithardt <sup>49</sup>	1994	18	SC	72	17±11	0	0	50	N/A	N/A	N/A
Link <sup>50</sup>	1997	12	SC	58	22±13	0	8	67	50	33	33
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Piccini <sup>56</sup>	2005	67	SC	35	53±11	42	9	66	21	24	21
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Schuler <sup>60</sup>	2012	26	SC	81	128	4	8	46	N/A	N/A	8

❑ Lead/device related complications: **3.7%/yr**

❑ Inappropriate ICD therapies: **4.4%/yr**

# **Risk–benefit ratio of ICD therapy in young patients with cardiomyopathies and channelopathies should be carefully assessed**



Including Inappropriate ICD interventions (9.4%)  
Device-related complications requiring surgical revision 20.8%)

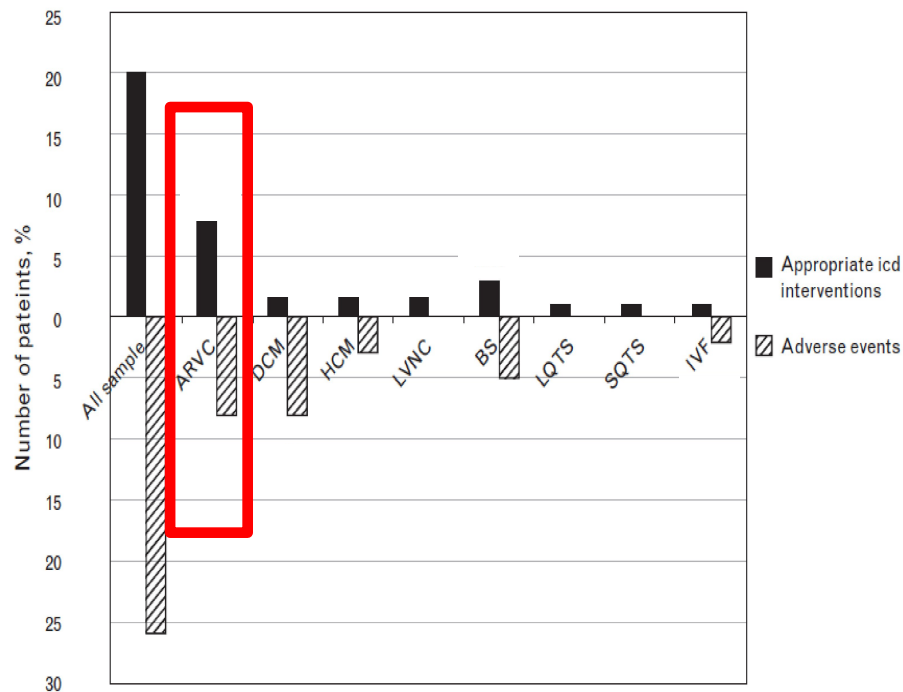
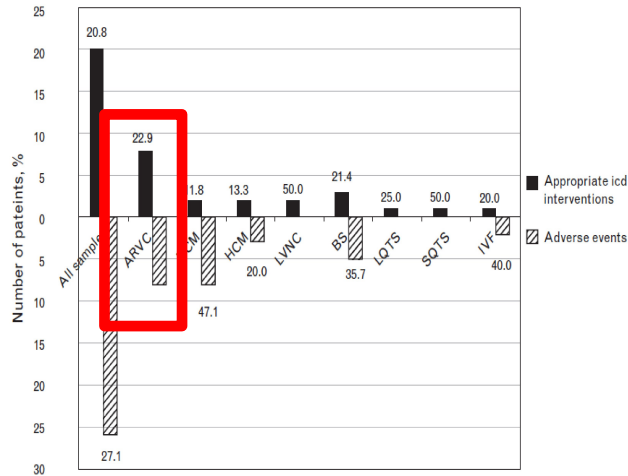


Table 5 Predictors of device-related complications during follow-up

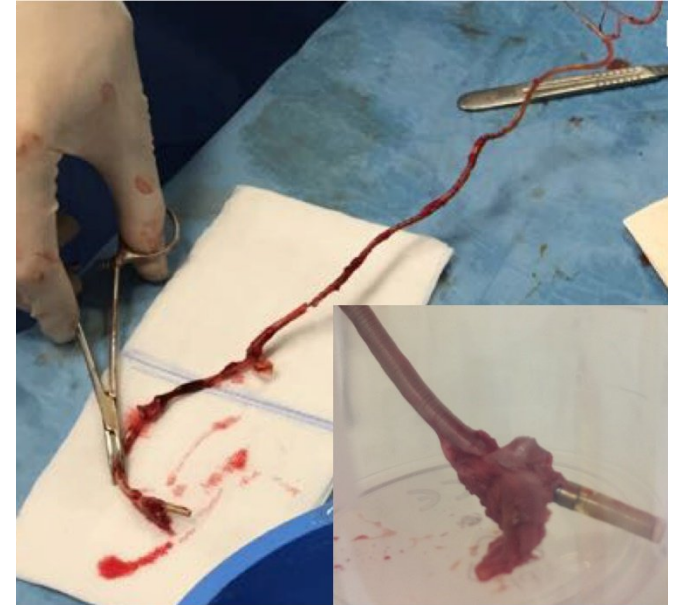
	Univariate analysis			Multivariate analysis		
	HR	CI	P	HR	CI	P
Age (years)	1.07	1.0–1.2	0.051	1.08	0.91–1.16	0.32
Sex (male)	0.66	0.3–1.7	0.374			
Primary prevention	1.99	0.7–6.0	0.219			
Structural cardiomyopathy	1.35	0.5–3.8	0.560			
Previous cardiac arrest	1.24	0.4–3.7	0.697			
Underweight	3.86	1.1–13.4	0.034	5.43	1.5–19.4	0.01
Single-lead ICD	1.83	0.4–7.9	0.417			
Right ventricular apical position	1.02	0.1–7.9	0.983			
Double coil	1.14	0.3–4.3	0.843			
Active fixation lead	2.63	0.9–7.6	0.072			
Antiarrhythmic drug therapy	0.87	0.3–2.3	0.770			

# Implantable cardioverter defibrillator therapy in young patients with cardiomyopathies and channelopathies: a single Italian centre experience

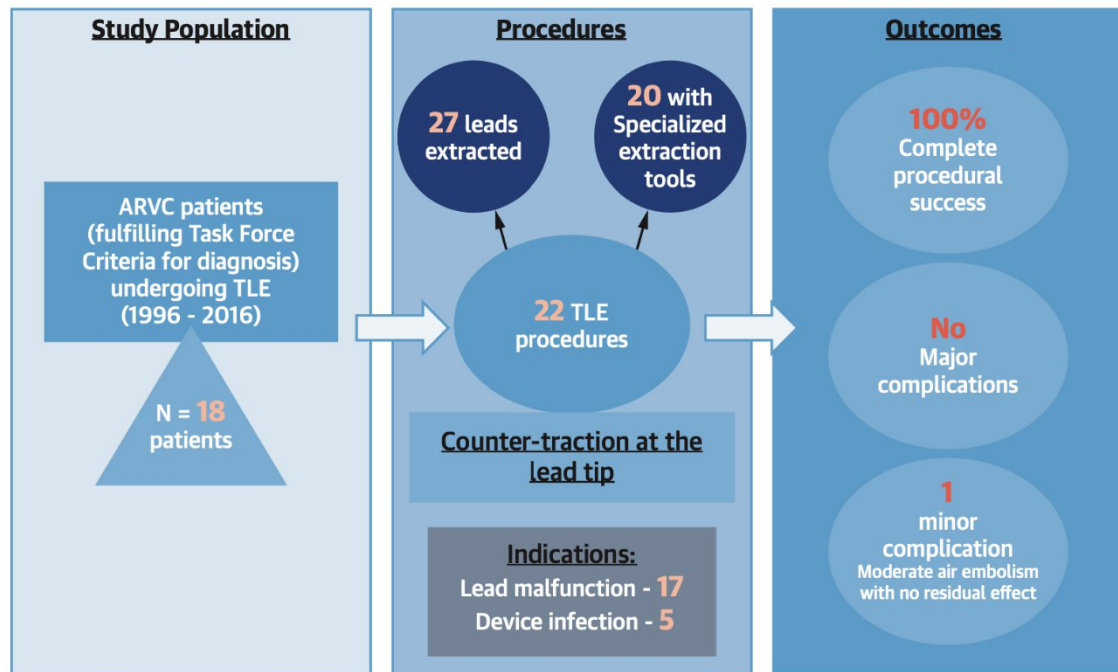
Federico Migliore, Maria Silvano, Alessandro Zorzi, Emanuele Bertaglia, Mariachiara Siciliano, Loira Leoni, Pietro De Franceschi, Sabino Iliceto and Domenico Corrado



Lead failure/fracture requiring lead extraction was the most common complication (9.4%)

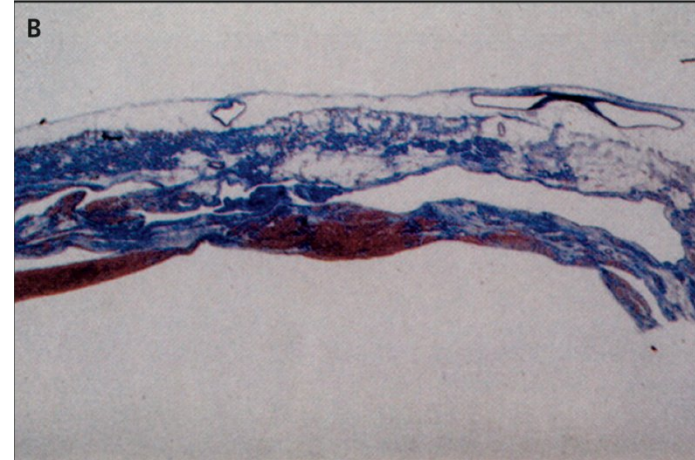


# Transvenous Lead Extraction in Patients With Arrhythmogenic Right Ventricular Cardiomyopathy



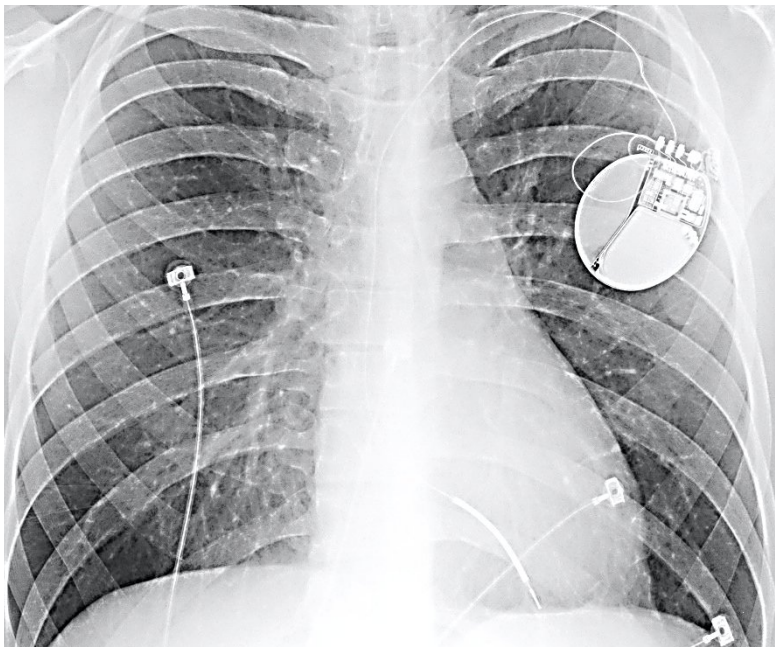
## *High rate of lead-related adverse events in ARVC Patients*

Complication	Number (n=98)
Lead-related complications (n=68)	
Lead fracture	19 (19)
Decreased sensing on the RV	6 (6)
Lead dislodgment	8 (8)
Lead recall	12 (12)
Subclavian/IJ vein thrombosis	2 (2)
Lead malfunction*	19 (19)
Tamponade	2 (2)



High rate of lead-related adverse events may be explained by the peculiar ARVC/D pathobiology which leads to progressive loss of myocardium with fibrofatty replacement, also affecting the site of RV lead implantation






## Elettrocatteteri ([Visualizza dettaglio](#))



Ampiezza intrinseca ventricolare destra o monocamerale fuori intervallo.

	Misurazione ambulatoriale più recente (22 lug 2019)	Misurazione giornaliera più recente (06 nov 2019)
■ <b>Ventricolare</b>		
Ampiezza intrinseca	1,2 mV	 2,3 mV (05 nov 2019)
Impedenza di pacing	934 $\Omega$	980 $\Omega$ (05 nov 2019)
Soglia di pacing	1,0 V @ 0,4 ms	<a href="#">N/R</a>

Vedi: 1 m 3 m 6 m **1a**

01 gen 2019

01 apr 2019

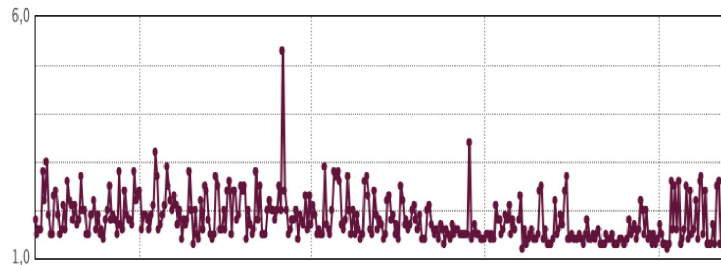
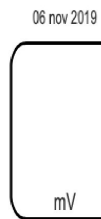
01 lug 2019

01 ott 2019

Grafici dei trend

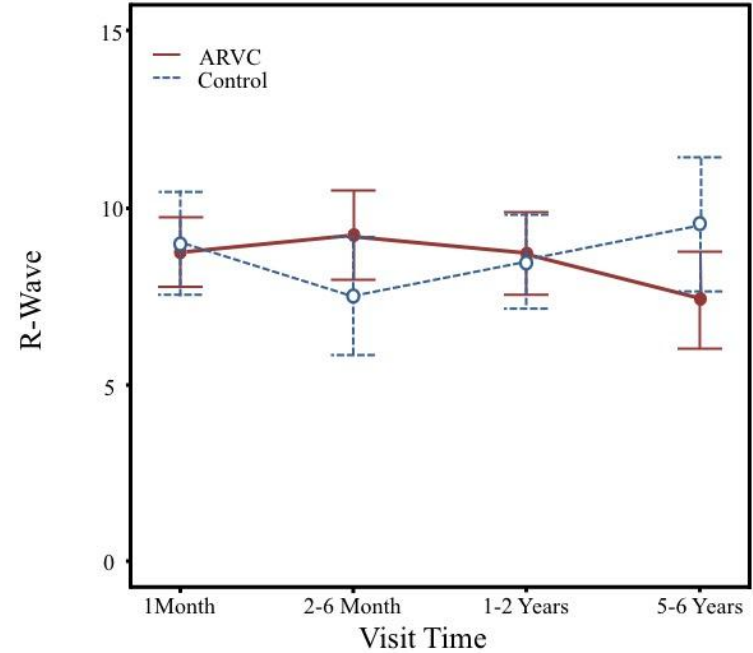
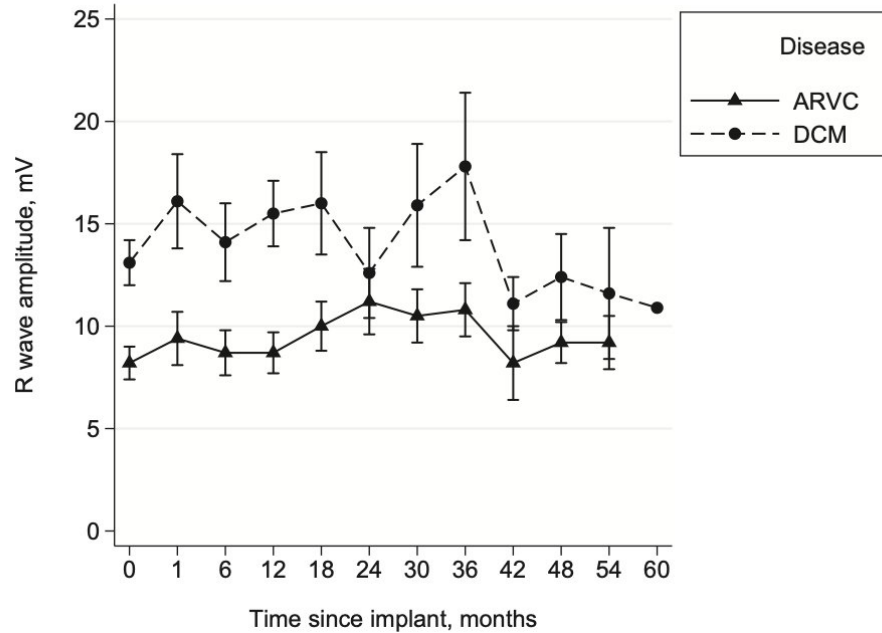
■ **Ventricolare**

Ampiezza intrinseca



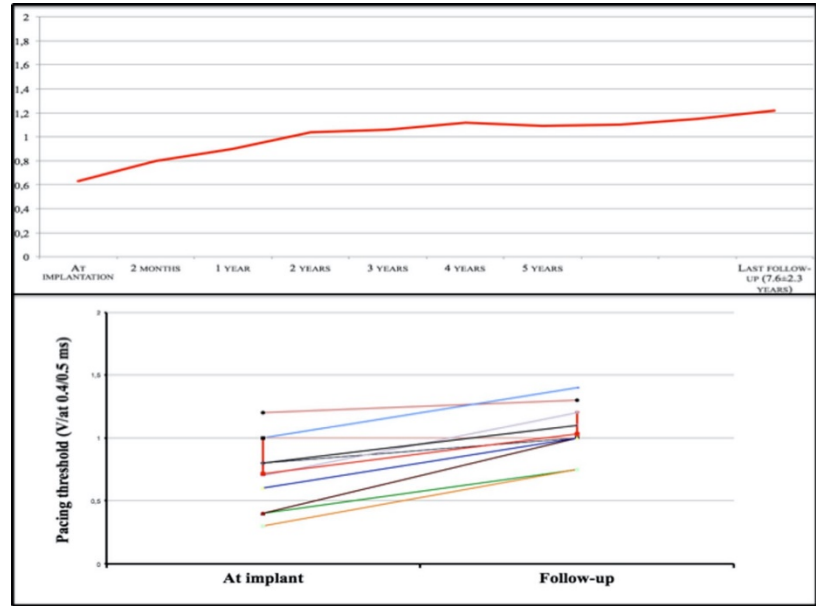
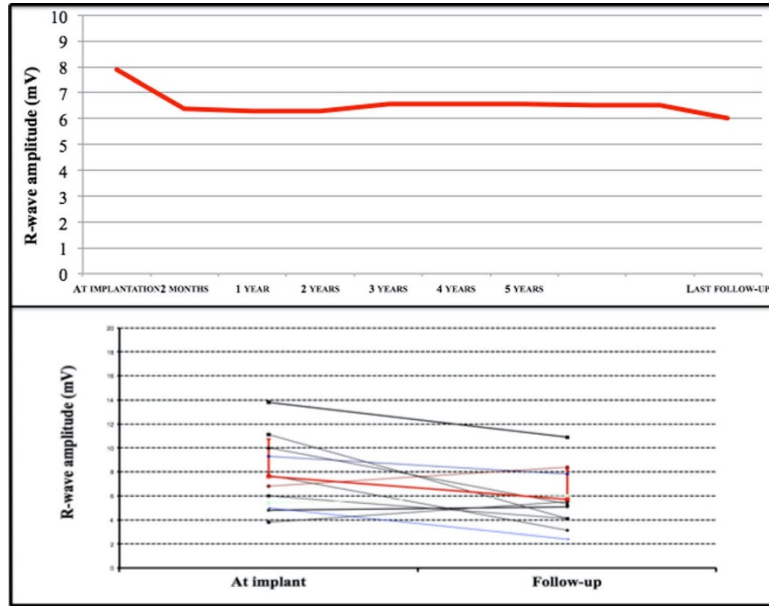
At the implant: sensing **4.2 mV**

## *R-wave amplitudes in ARVC patients vs control*





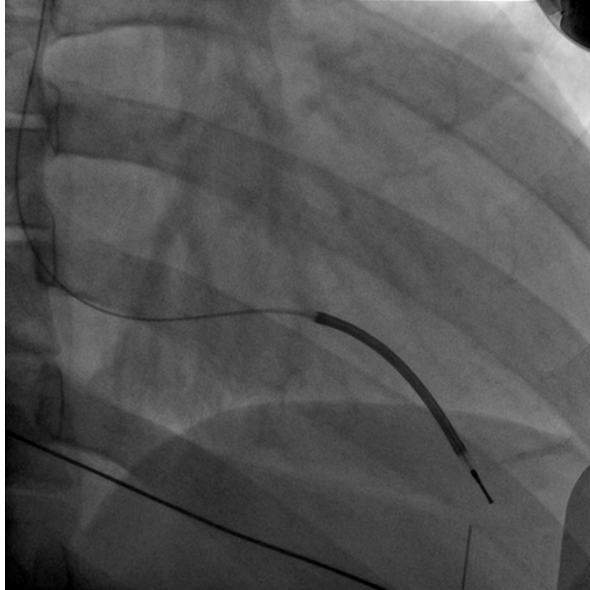
## *R-wave amplitudes AND pacing thresholds during follow- up in ARVC patients*



**A low R-wave** may result in:

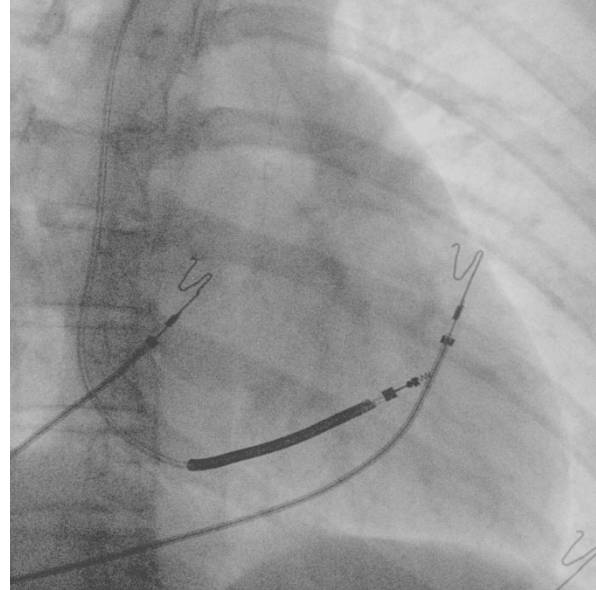
- ✓ **Undersensing of ventricular tachyarrhythmias**
- ✓ **Inappropriate ICD therapy** due to T-wave oversensing because of the automatic algorithm of ICD for sensing

*Where we have to implant the ICD lead in ARVC patients ?*



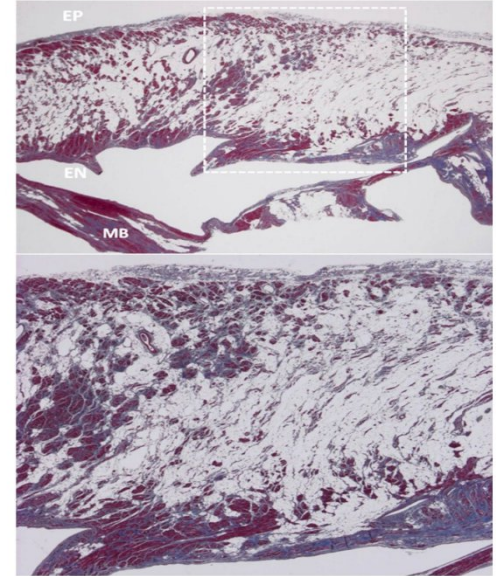
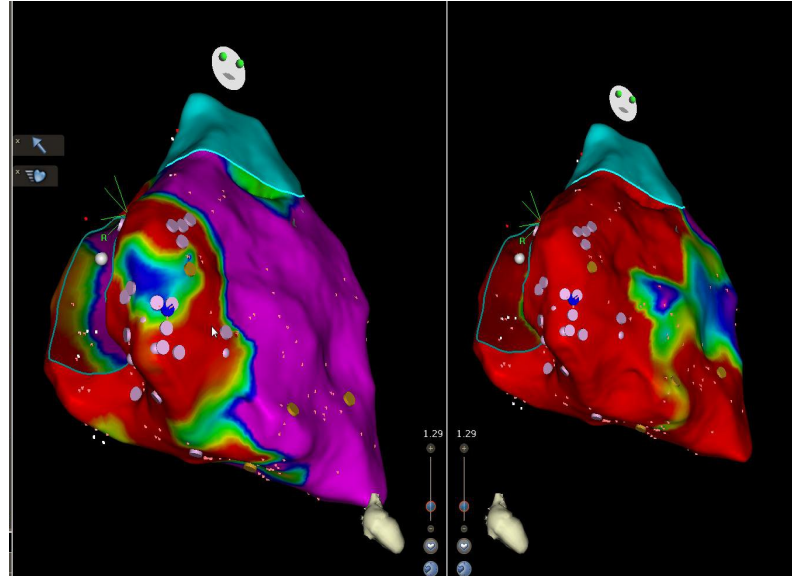
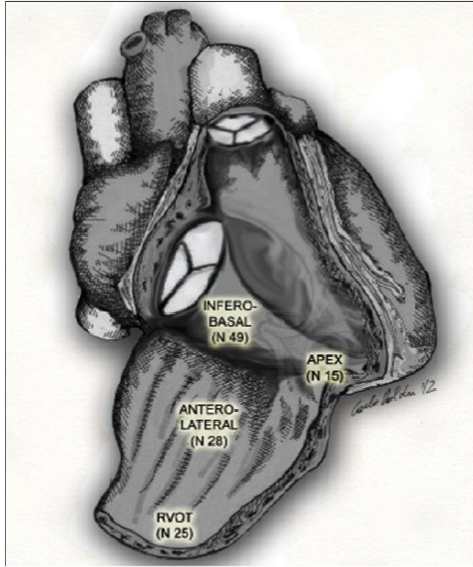
*In the RV Apex ?*

*OR*

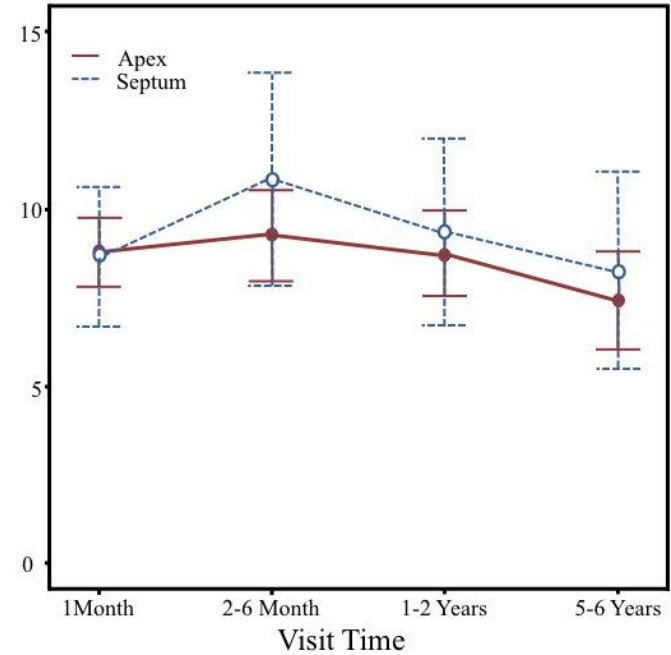
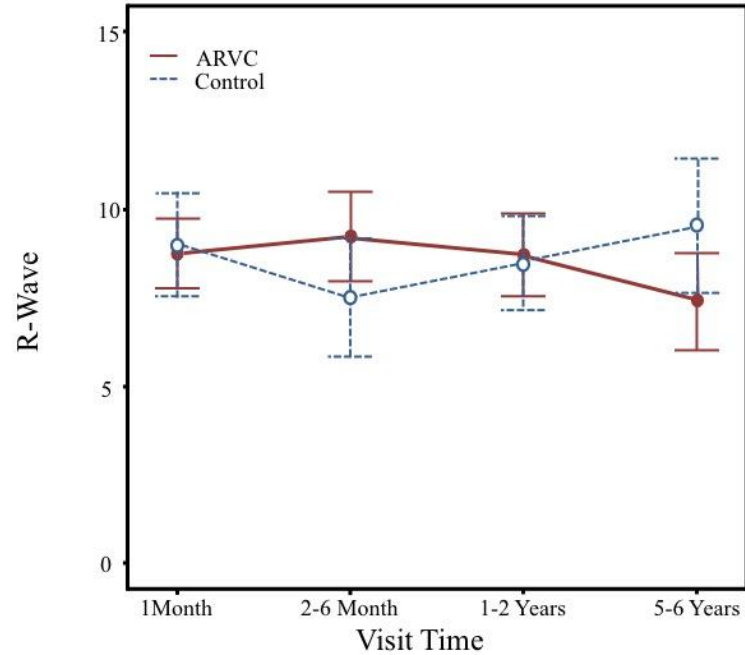


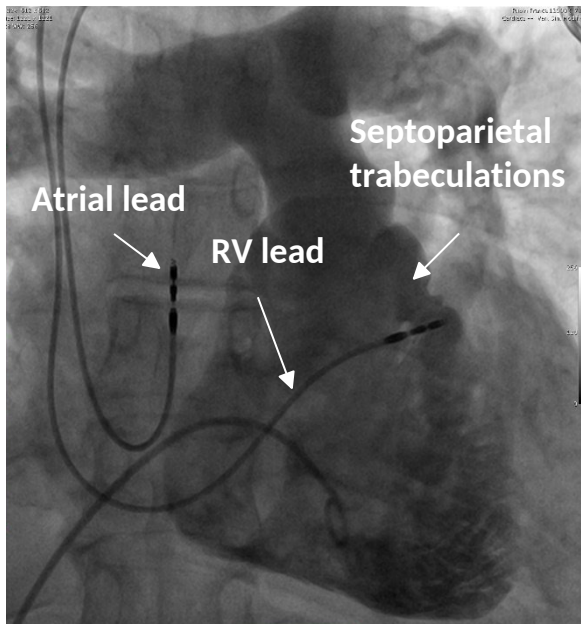
*In the septum ?*

# *“Triangle” of dysplasia*

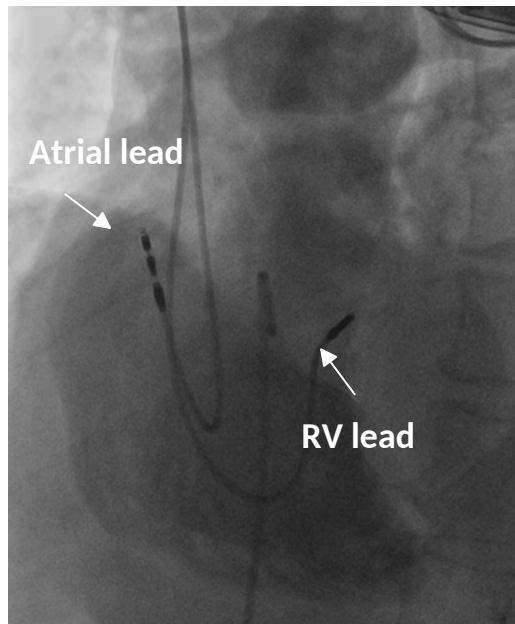


## *Where we have to implant the ICD lead in ARVC patients ?*

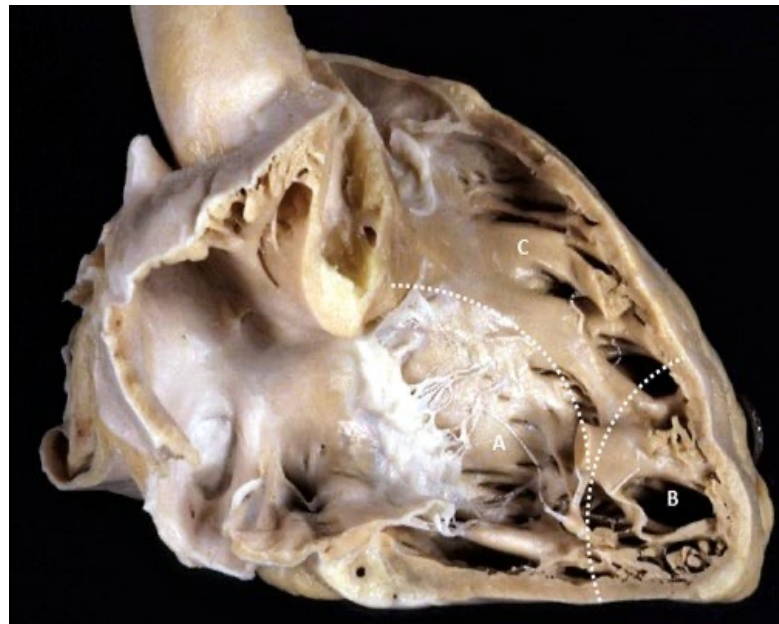




**RAO**



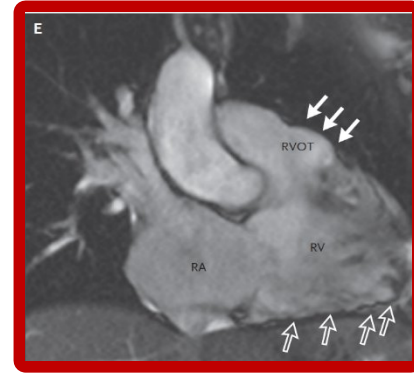
**LAO**



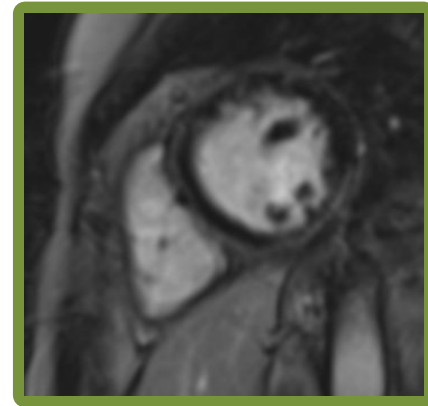
*Boukens, Basso, Migliore, Rizzo, Thiene  
Cardiac Mapping, Fifth Edition 2019*

# ARVC phenotypes

**RV phenotype:** either isolated or associated with some LV involvement



**Biventricular phenotype:** characterized by equal involvement of both ventricles

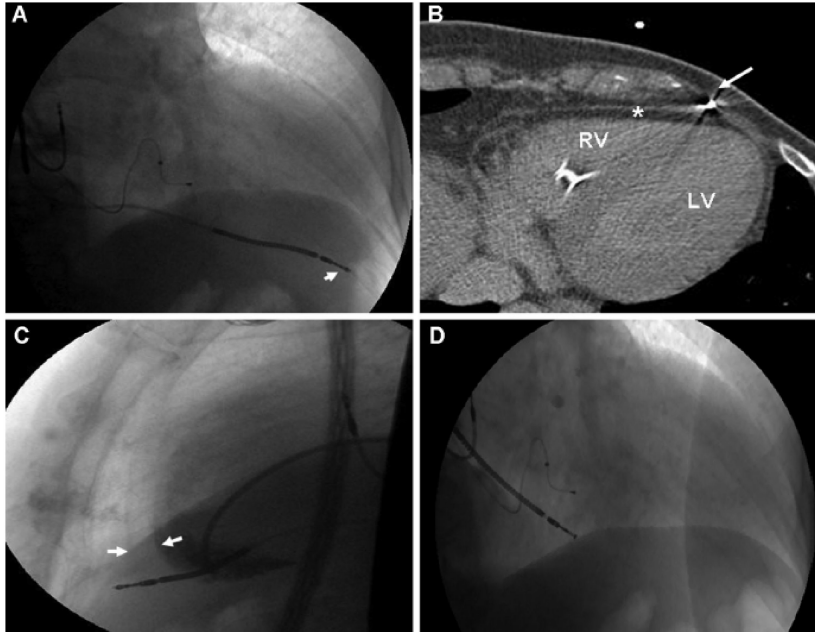


**Left dominant phenotype:** with early and prominent LV manifestations.



# Incidence, Management, and Prevention of Right Ventricular Perforation by Pacemaker and Implantable Cardioverter Defibrillator Leads

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EMANUELE BERTAGLIA, M.D.,\* LOIRA LEONI, M.D., PH.D.,\*  
MARIACHIARA SICILIANO, M.D.,\* MANUEL DE LAZZARI, M.D.,\*  
BARBARA IGNATIUK, M.D.,† MARTA VERONESE, M.D.,‡ ROBERTO VERLATO, M.D.,§  
GIUSEPPE TARANTINI, M.D., PH.D.,\* SABINO ILCETO, M.D.,\*  
and DOMENICO CORRADO, M.D., PH.D.\*



✓ *RV perforation is rare* complication regardless of the lead fixation mechanism

✓ *Avoid the true apex*

*A single or dual-chamber ICD in ARVC patients ?*



# Treatment of arrhythmogenic right ventricular cardiomyopathy/dysplasia: an international task force consensus statement

**Domenico Corrado<sup>1\*</sup>, Thomas Wichter<sup>2</sup>, Mark S. Link<sup>3</sup>, Richard Hauer<sup>4</sup>, Frank Marchlinski<sup>5</sup>, Aris Anastasakis<sup>6</sup>, Barbara Bauce<sup>1</sup>, Cristina Basso<sup>1</sup>, Corinna Brunckhorst<sup>7</sup>, Adalena Tsatsopoulou<sup>8</sup>, Harikrishna Tandri<sup>9</sup>, Matthias Paul<sup>10</sup>, Christian Schmied<sup>7</sup>, Antonio Pelliccia<sup>11</sup>, Firat Duru<sup>7</sup>, Nikos Protonotarios<sup>8</sup>, NA Mark Estes III<sup>3</sup>, William J. McKenna<sup>12</sup>, Gaetano Thiene<sup>1</sup>, Frank I. Marcus<sup>13</sup>, and Hugh Calkins<sup>9</sup>**

## Device selection

A single-chamber ICD system is recommended in order to minimize the incidence of long-term lead-related complications, mostly in young patients.

# Association of Single- vs Dual-Chamber ICDs With Mortality, Readmissions, and Complications Among Patients Receiving an ICD for Primary Prevention

	No. (%) of Patients			Difference (single-dual), % (95% CI)	P Value
	Overall (n = 23 238)	Chamber ICD			
		Single (n = 11 619)	Dual (n = 11 619)		
<b>30-Day results</b>					
Pneumothorax requiring chest tube	122 (0.53)	51 (0.44)	71 (0.61)	-0.17 (-0.36 to 0.01)	.07
Hematoma requiring blood transfusion or evacuation	52 (0.22)	24 (0.21)	28 (0.24)	-0.03 (-0.16 to 0.09)	.58
Cardiac tamponade	158 (0.68)	51 (0.44)	107 (0.92)	-0.48 (-0.69 to -0.27)	<.001
<b>90-Day results</b>					
Mechanical complications requiring system revision	396 (1.70)	166 (1.43)	230 (1.98)	-0.55 (-0.88 to -0.22)	.001
Device-related infection	151 (0.65)	68 (0.59)	83 (0.71)	-0.13 (-0.34 to 0.08)	.22
ICD replacement	175 (0.75)	85 (0.73)	90 (0.77)	-0.04 (-0.27 to 0.18)	.70
Any complication	956 (4.11)	408 (3.51)	548 (4.72)	-1.20 (-1.72 to -0.69)	<.001
<b>Outcomes at 1 y after implant</b>					
All-cause mortality	2280 (9.81)	1145 (9.85)	1135 (9.77)	0.09 (-0.68 to 0.85)	.83
All-cause hospitalization	10189 (43.85)	5096 (43.86)	5093 (44.83)	0.03 (-1.25 to 1.30)	.97
Heart failure hospitalization	3498 (15.05)	1711 (14.73)	1787 (15.38)	-0.65 (-1.57 to 0.27)	.16

## Conclusions and Relevance

Dual-chamber device:

✓ Higher risk of device-related complications

✓ Similar 1-year mortality

*The decision to implant a dual-chamber ICD for primary prevention should be considered carefully*

# Reduction in Inappropriate Therapy and Mortality through ICD Programming

Arthur J. Moss, M.D., Claudio Schuger, M.D., Christopher A. Beck, Ph.D., Mary W. Brown, M.S., David S. Cannom, M.D., James P. Daubert, M.D., N.A. Mark Estes III, M.D., Henry Greenberg, M.D., W. Jackson Hall, Ph.D.,\* David T. Huang, M.D., Josef Kautzner, M.D., Ph.D., Helmut Klein, M.D., Scott McNitt, M.S., Brian Olshansky, M.D., Morio Shoda, M.D., David Wilber, M.D., and Wojciech Zareba, M.D., Ph.D., for the MADIT-RIT Trial Investigators†

**Conventional programming ( $\geq 170$  bpm )**

**High-rate programming ( $\geq 200$  bpm)**

**Delayed programming (60-second delay,  $\geq 170$  bpm)**

✓ “aggressive” ICD programming may overestimate the real incidence of appropriate therapies

✓ “unnecessary therapies” VT/VF episodes self-terminated

✓ reduction in inappropriate therapy

Variable	Conventional Therapy (N=514)	High-Rate Therapy (N=500)	Delayed Therapy (N=486)	P Value for High-Rate Therapy vs. Conventional Therapy	P Value for Delayed Therapy vs. Conventional Therapy
<b>First occurrence of therapy — no. of patients (%)</b>					
Appropriate therapy	114 (22)	45 (9)	27 (6)	<0.001	<0.001
Shock	20 (4)	22 (4)	17 (3)	0.68	0.74
Antitachycardia pacing	94 (18)	23 (5)	10 (2)	<0.001	<0.001
Inappropriate therapy	105 (20)	21 (4)	26 (5)	<0.001	<0.001
Shock	20 (4)	11 (2)	13 (3)	0.12	0.28
Antitachycardia pacing	85 (17)	10 (2)	13 (3)	<0.001	<0.001
<b>Any occurrence of therapy — no. of patients (%)</b>					
Appropriate therapy					
Shock	28 (5)	26 (5)	19 (4)	0.86	0.25
Antitachycardia pacing	111 (22)	38 (8)	20 (4)	<0.001	<0.001
Inappropriate therapy					
Shock	31 (6)	14 (3)	15 (3)	0.01	0.03
Antitachycardia pacing	104 (20)	20 (4)	25 (5)	<0.001	<0.001

# *Tip and tricks for TV-ICD implantation in ARVC patients*

- ✓ Avoid subclavian vein puncture and prefer axillary vein
- ✓ At lead implantation, multiple endocardial sites should be tested if sensing or pacing values are not optimal
- ✓ It may be preferable to avoid implanting ICD leads at the true apex AND free wall
- ✓ Avoid dual-coil
- ✓ Longer term follow-up
- ✓ A single-chamber ICD system is recommended in order to minimize the incidence of long-term lead-related complications, mostly in young patients
- Optimal ICD programming: High-rate programming ( $\geq 200$  bpm); Delayed programming (60-second delay,  $\geq 170$  bpm); favoring more ATP

## S-ICD in young with Cardiomyopathies/Channelopathies



- ✓ The lack of transvenous and intracardiac components
- ✓ No pacing indication
- ✓ SCD is precipitated by polymorphic VT/VF

*.....make it an attractive choice for these patients !*

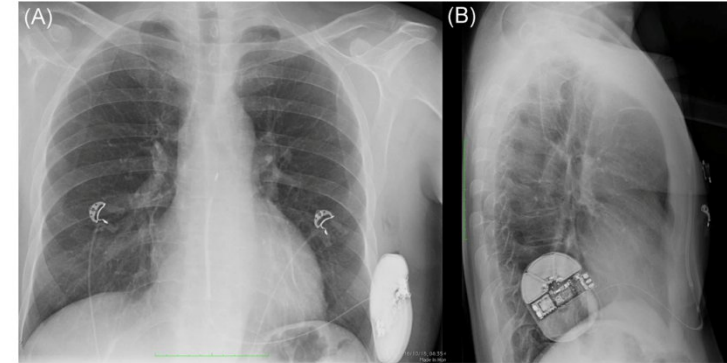
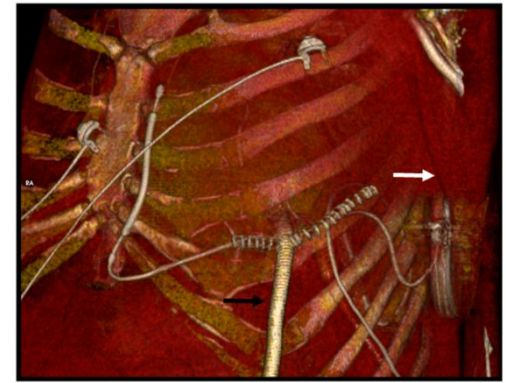
# Multicentre experience with the second-generation subcutaneous implantable cardioverter defibrillator and the intermuscular two-incision implantation technique

Federico Migliore MD, PhD<sup>1</sup>  | Giulia Mattesi MD<sup>1</sup> | Pietro De Franceschi MD<sup>1</sup> |  
Giuseppe Allocca MD<sup>2</sup> | Martino Crosato MD<sup>3</sup> | Vittorio Calzolari MD<sup>3</sup> |  
Mauro Fantinel MD<sup>4</sup> | Benedetta Ortis MD<sup>5</sup> | Domenico Facchin MD<sup>6</sup> |  
Elisabetta Daleffe MD<sup>6</sup> | Tommaso Fabris MD<sup>1</sup> | Elena Marras MD<sup>7</sup> |  
Manuel De Lazzari MD<sup>1</sup> | Francesco Zanon MD<sup>8</sup>  | Lina Marcantoni MD<sup>8</sup> |  
Mariachiara Siciliano MD<sup>9</sup> | Domenico Corrado MD, PhD<sup>1</sup> | Sabino Iliceto MD<sup>1</sup> |  
Emanuele Bertaglia MD, PhD<sup>1</sup> | Massimo Zecchin MD<sup>5</sup>

✓ **Successfull DT at  $\leq 65$  J: 98.75%**  
(without pulse generator adjustments)

✓ **Appropriate shocks: 9.9%**

✓ **Inappropriate shocks: 2.9%**





# Il defibrillatore sottocutaneo nella pratica clinica

Federico Migliore<sup>1\*</sup>, Giulia Mattesi<sup>1\*</sup>, Alessandro Zorzi<sup>1</sup>, Stefano Viani<sup>2</sup>, Maria Grazia Bongiorno<sup>2</sup>,  
Pietro Francia<sup>3</sup>, Antonio Curcio<sup>4</sup>, Igor Diemberger<sup>5</sup>, Emanuele Bertaglia<sup>1</sup>

<sup>1</sup>Dipartimento Cardio-Toraco-Vascolare, Università degli Studi, Padova

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<sup>3</sup>U.O.C. Cardiologia, Sapienza Università di Roma, A.O. Sant'Andrea, Roma

<sup>4</sup>U.O. Cardiologia, Dipartimento di Scienze Mediche e Chirurgiche, Università degli Studi Magna Graecia, Campus di Germaneto, Catanzaro

<sup>5</sup>Istituto di Cardiologia, Dipartimento di Medicina Specialistica Diagnostica e Sperimentale, Università degli Studi, Bologna

## Terza generazione S-ICD EMBLEM (Boston Scientific)



## QUALI SONO I POSSIBILI VANTAGGI DI S-ICD?

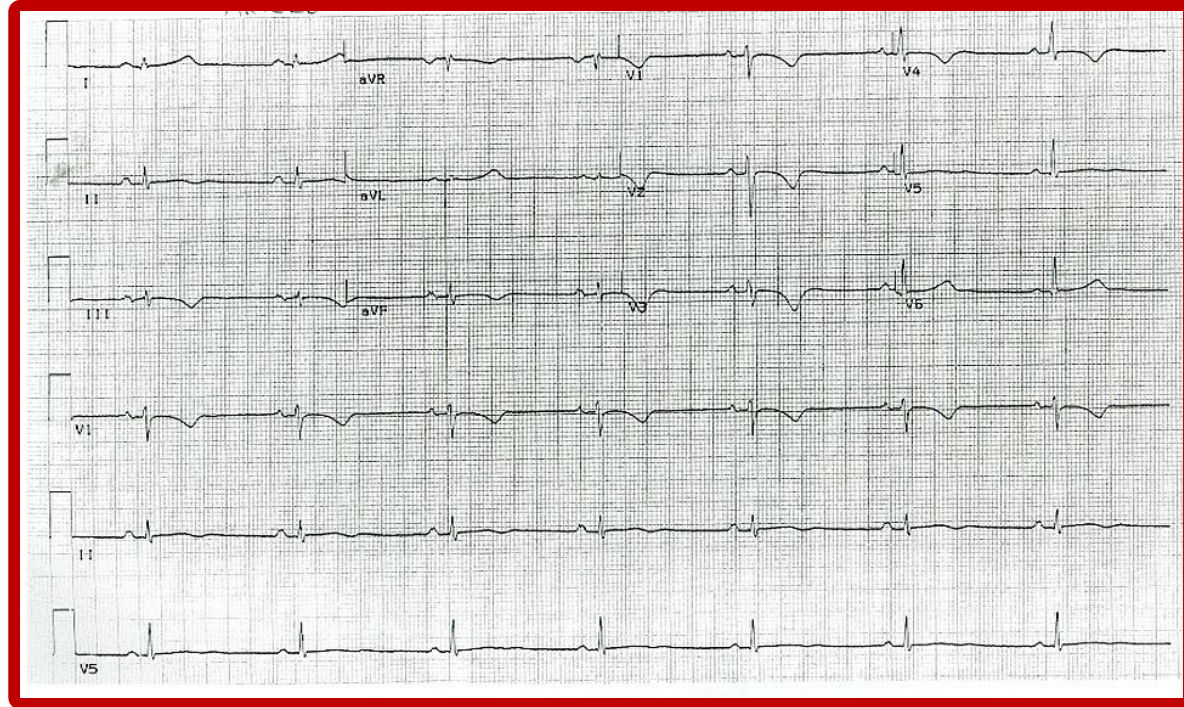
- Riduce e potenzialmente annulla il rischio di infezioni sistemiche
- Assenza di danni vascolari
- Preserva gli accessi vascolari
- Riduce l'esposizione radiologica per il paziente e per il medico
- Riduce il rischio di danni del catetere dovuto a stress biomeccanico
- Potenziale minore interferenza con la risonanza magnetica cardiaca per l'assenza dell'elettrocattetere in sede intravascolare

## QUALI SONO I POTENZIALI LIMITI DI S-ICD?

- Necessità di eseguire uno screening pre-impianto
- Incapacità di erogare pacing per il trattamento di bradicardia clinicamente rilevanti o per la terapia di resincronizzazione cardiaca
- Incapacità di erogare ATP per la potenziale interruzione (*pain-free*) di tachicardie ventricolari monomorfe sostenute
- Durata della batteria (nei nuovi dispositivi ~7 anni)
- Popolazione pediatrica (dimensioni del dispositivo)

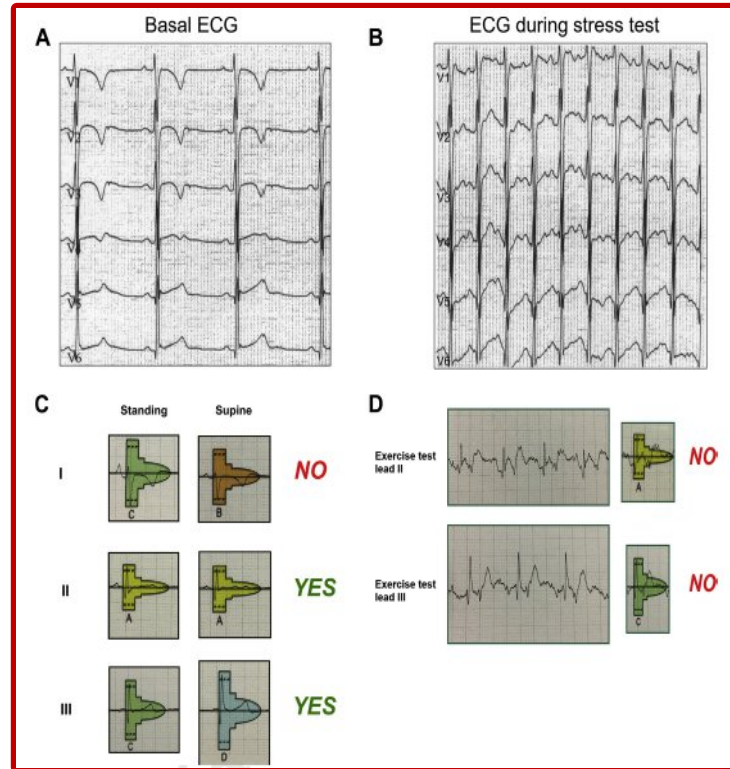
Spessore	12.7 mm
Volume	595 cc
Peso	130 g
Longevità	7.3 anni
Monitoraggio remoto	LATITUDE
Risonanza compatibile	Sì
SMART Pass	Sì

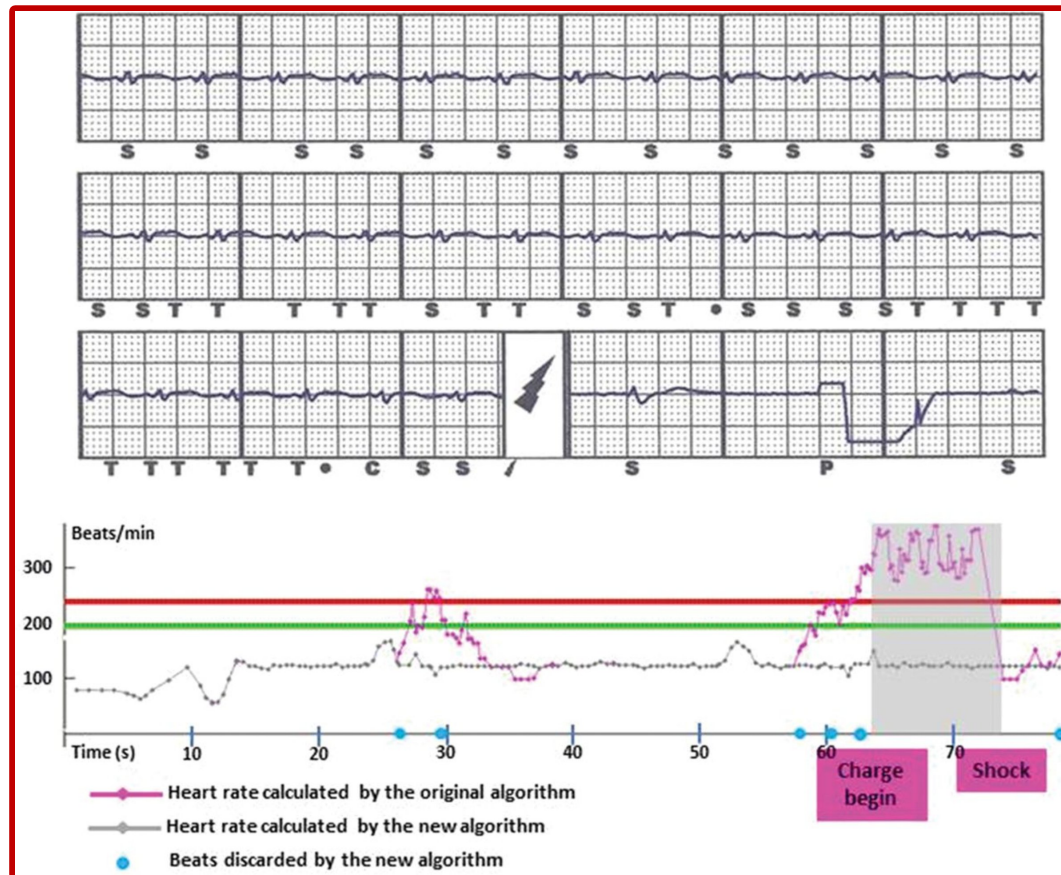
# ECG features in ARVC

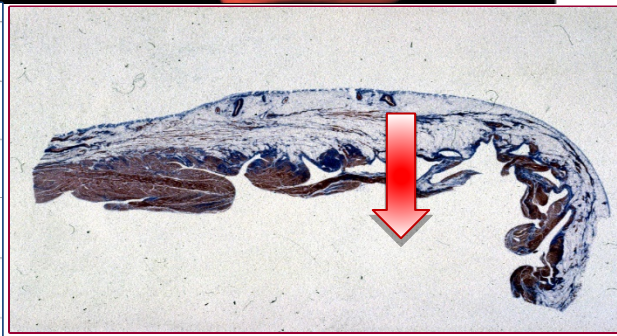
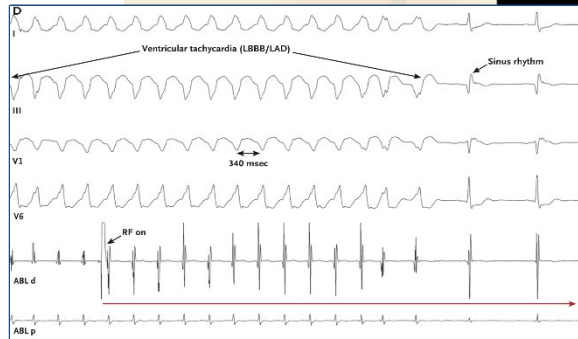
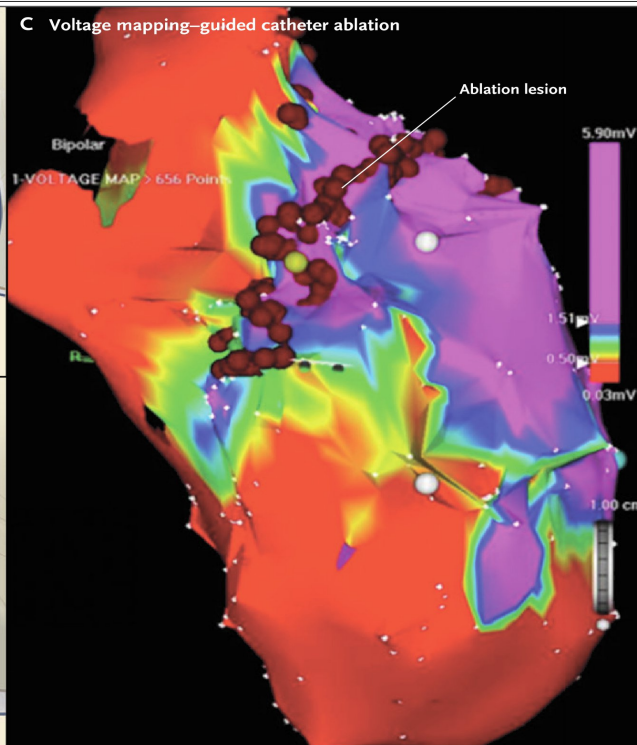
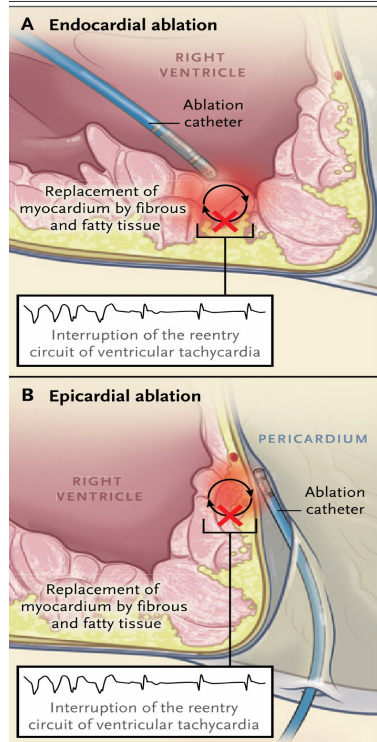




# Pseudonormalization of negative T –waves during effort: Limitation of S-ICD screening eligibility







# Subcutaneous implantable cardioverter defibrillator in patients with arrhythmogenic right ventricular cardiomyopathy: Results from an Italian multicenter registry☆

Federico Migliore <sup>a</sup>, Stefano Viani <sup>b</sup>, Maria Grazia Bongiorno <sup>b</sup>, Alessandro Zorzi <sup>a</sup>, Massimo Stefano Silvetti <sup>c</sup>, Pietro Francia <sup>d</sup>, Antonio D'Onofrio <sup>e</sup>, Pietro De Franceschi <sup>a</sup>, Simone Sala <sup>f</sup>, Stefano Donzelli <sup>g</sup>, Giuseppe Ricciardi <sup>h</sup>, Endry Menardi <sup>i</sup>, Massimo Giammaria <sup>j</sup>, Carmelo La Greca <sup>k</sup>, Barbara Baucé <sup>a</sup>, Ilaria Rigato <sup>a</sup>, Sabino Iliceto <sup>a</sup>, Emanuele Bertaglia <sup>a</sup>, Igor Diemberger <sup>l,1</sup>, Domenico Corrado <sup>a,\*,1</sup>

	n = 44
Male gender	25 (57)
Age, years	37 ± 17
Height, cm	174 ± 10
Weight, kg	73 ± 14
BMI	24 ± 4
LV ejection fraction	53 ± 11
LV ejection fraction ≤50%	13 (30)
New York Heart Association	
Class I	39 (89)
Class II	5 (11)
Previous transvenous ICD	7 (16)
Primary prevention	26 (59)
History of sustained VT	17 (39)
History of SCD	1 (2)
NSVT	14 (32)
Syncope	10 (23)
Inducibility at EPS	3/13 (23)
ECG characteristics	
Sinus rhythm	44 (100)
QRS duration, ms	94 ± 16
PQ interval	175 ± 4
QTc interval	429 ± 9
Negative T-wave in V1–V3 leads	26 (59)
Negative T-wave in lateral/inferior leads	14 (32)
Epsilon wave	4 (9)
Medications at implant	
Beta-blockers	26 (59)
Amiodarone	2 (4)
Sotalol	11 (25)

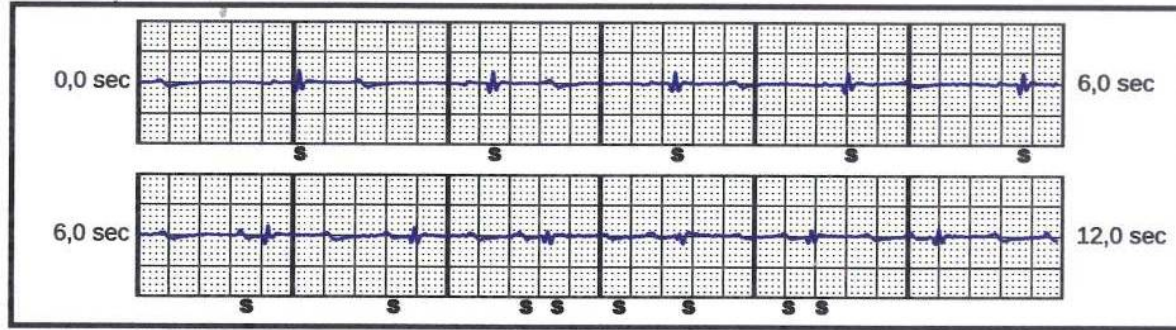


- ✓ Appropriate and successful shocks on VA: **14%**
- ✓ Inappropriate shocks : **14%**
- ✓ **No** patients had the device explanted due to the **need for ATP**

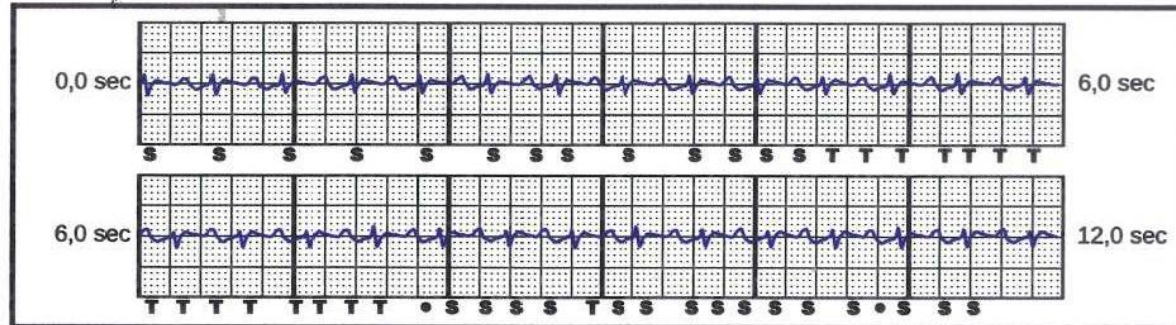


# Oversensing due to P/T-wave oversensing during rest

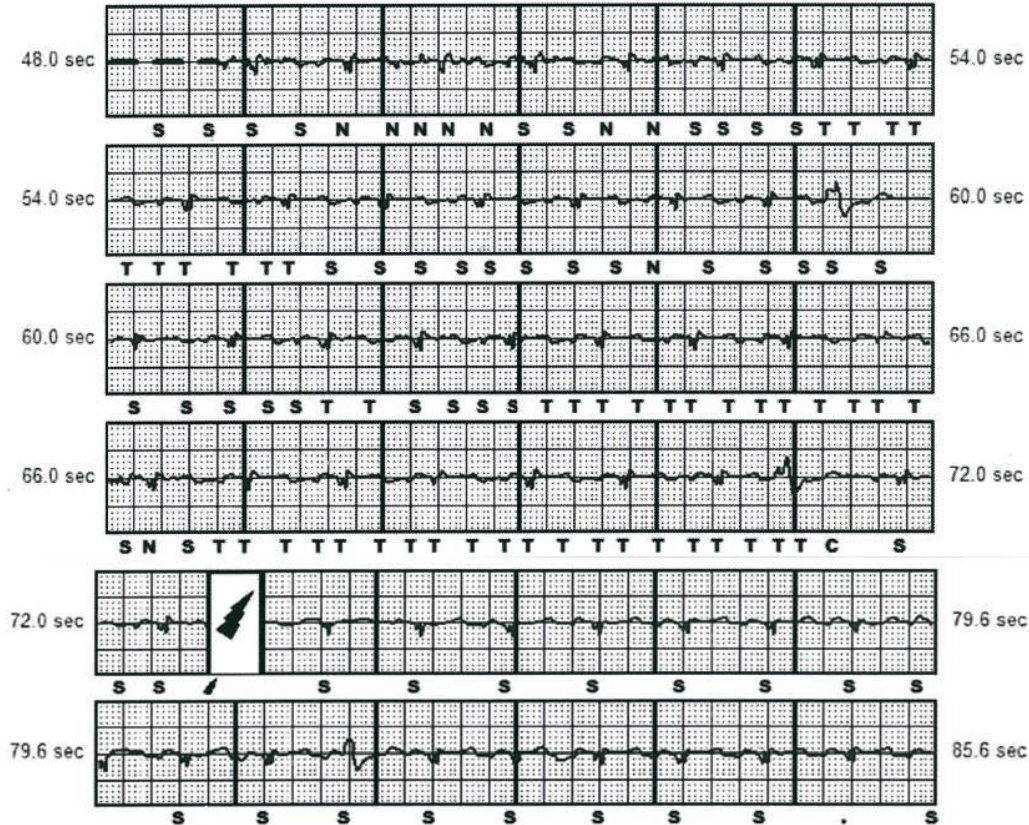
A

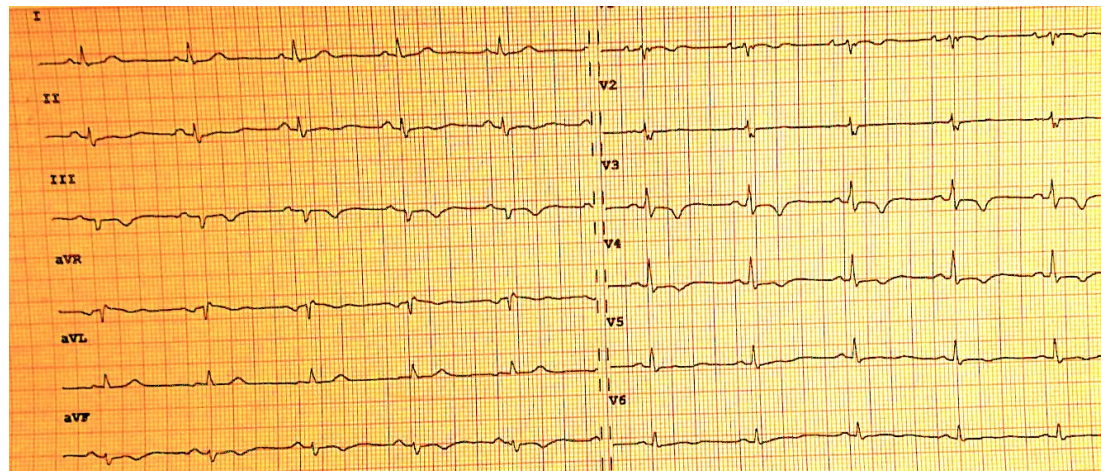


B



# Inappropriate Shock due to P/T-wave oversensing during effort





Ora 12:42:50  
 Pos. elettr. Margine sternale sx.  
 Postura Supino DX

Velocità 25 mm/s

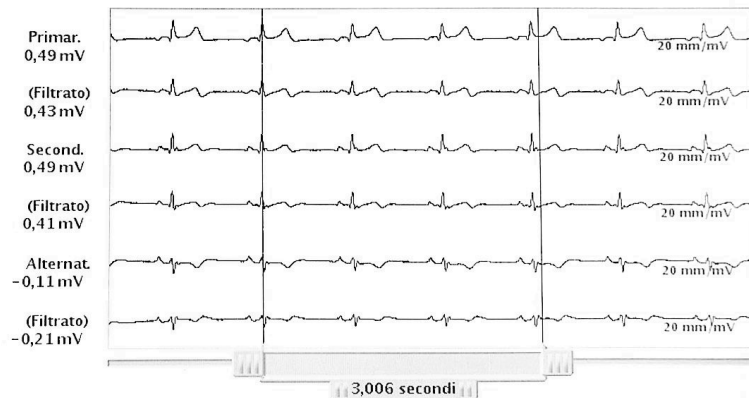
Primar.

☒ Visualizzazione Avanzata

Risultati:  
 Primar. FALLITO  
 Second. FALLITO  
 Alternat. FALLITO

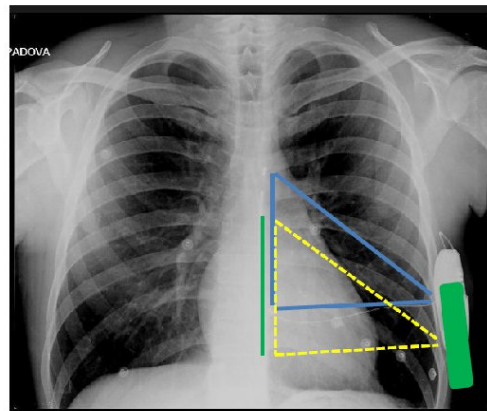
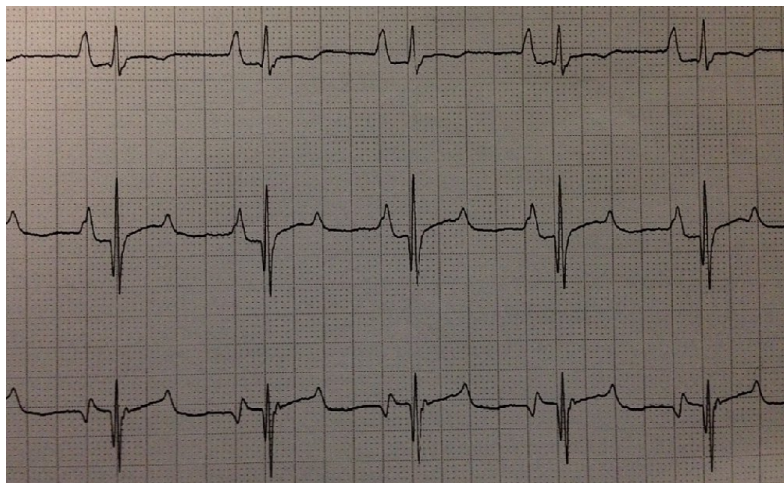
Note

Stampa



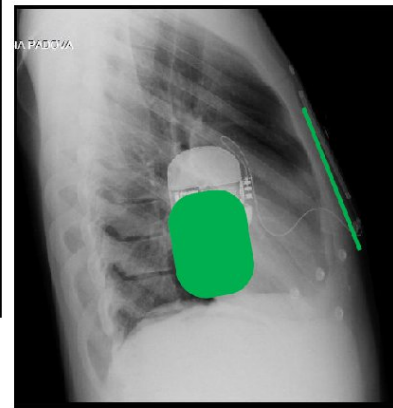


# The P-wave in ARVC

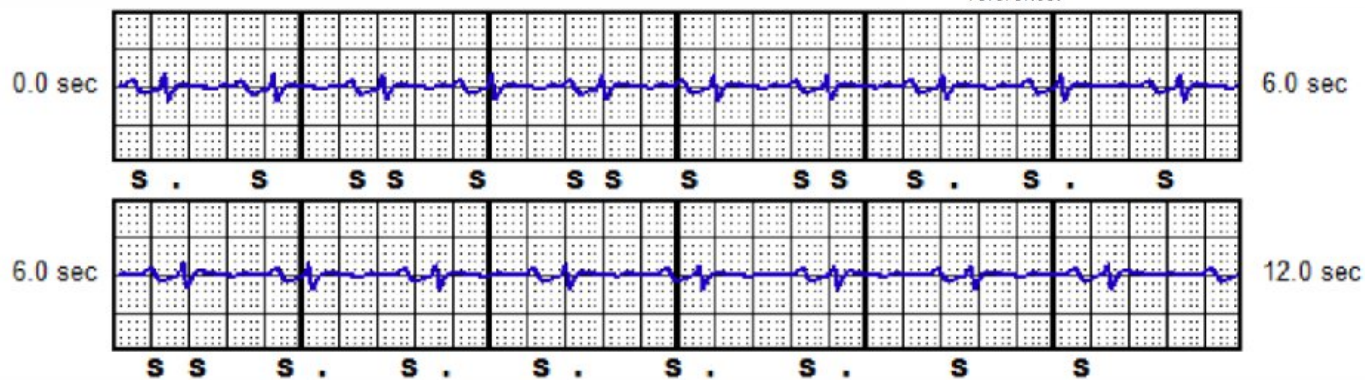


Blue lines represent current vectors

Yellow lines represent potential vectors if system is repositioned to match green reference.



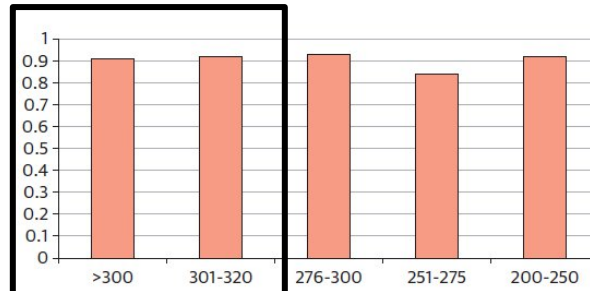
CAPTURED S-ECG: 07/20/2015 12:20:46 PM 25 mm/s





# Need for ATP?

- ❑ **A potential limitation of the S-ICD** is the inability to deliver ATP which may be an effective “pain-free” therapy in ARVC patients
- ❑ However, to judge whether this should be regarded as an absolute contraindication to S-ICD in ARVC, other factors should be taken into account
- ❑ First of all, it has to be noted that **≈2/3 of VTs** that were interrupted by ATP in the North American study (3) were **slower than 200 beats** per minute, i.e. probably **non-life-threatening and potentially self-limited**, considering that the majority of ARVC patients have a normal or near-normal LV ejection fraction



**FIGURE 2** Success of Anti-Tachycardia Pacing in the Termination of Ventricular Tachycardia Stratified by Cycle Length of Arrhythmia in Milliseconds

Even rapid ventricular tachycardias had a high likelihood of termination with anti-tachycardia pacing.

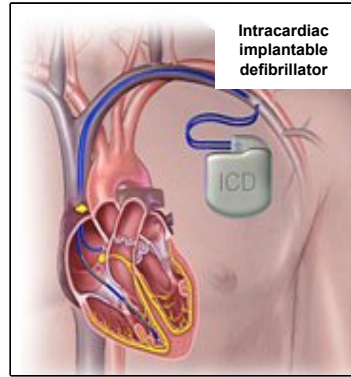
*Link et al. J Am Coll Cardiol 2014*

# *Tip and tricks for S-ICD implantation in ARVC patients*

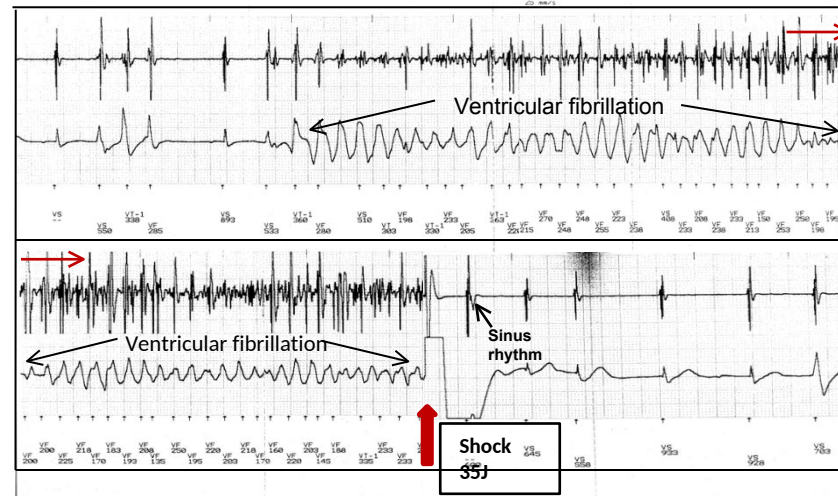
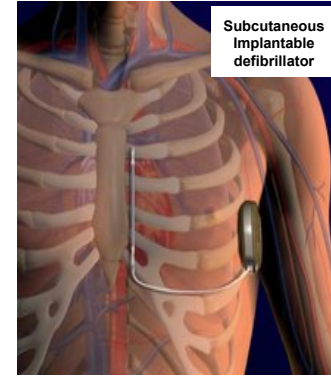
## Need for effective strategies to prevent inappropriate shocks

- ✓ Appropriate pre-implantation ECG screening
  - *Rest/stress*
  - *at least 2 or 3 leads suitable in the S-ICD screening template*
  - *left/right parasternal screening*
  - *ECG R-wave amplitude > 1 mV at implant*
- ✓ Accurate implantation technique
- ✓ Better device programming (*Conditional zone, shock zone*)
- ✓ Software upgrade (*SMART Pass*)
- ✓ Post-operative follow-up
- ✓ Drug therapy and catheter ablation of VT in ARVC should be considered a potentially effective strategy for eliminating frequent both fast or slow VT

# *TV-ICD vs S-ICD in ARVC Patients*



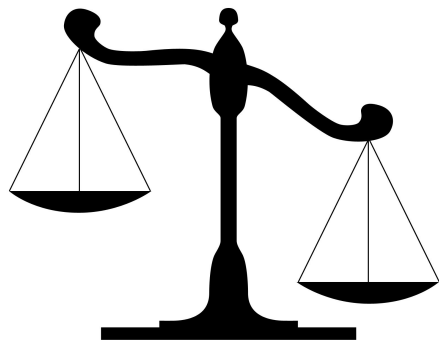
**vs**



## Treatment of arrhythmogenic right ventricular cardiomyopathy/dysplasia: an international task force consensus statement

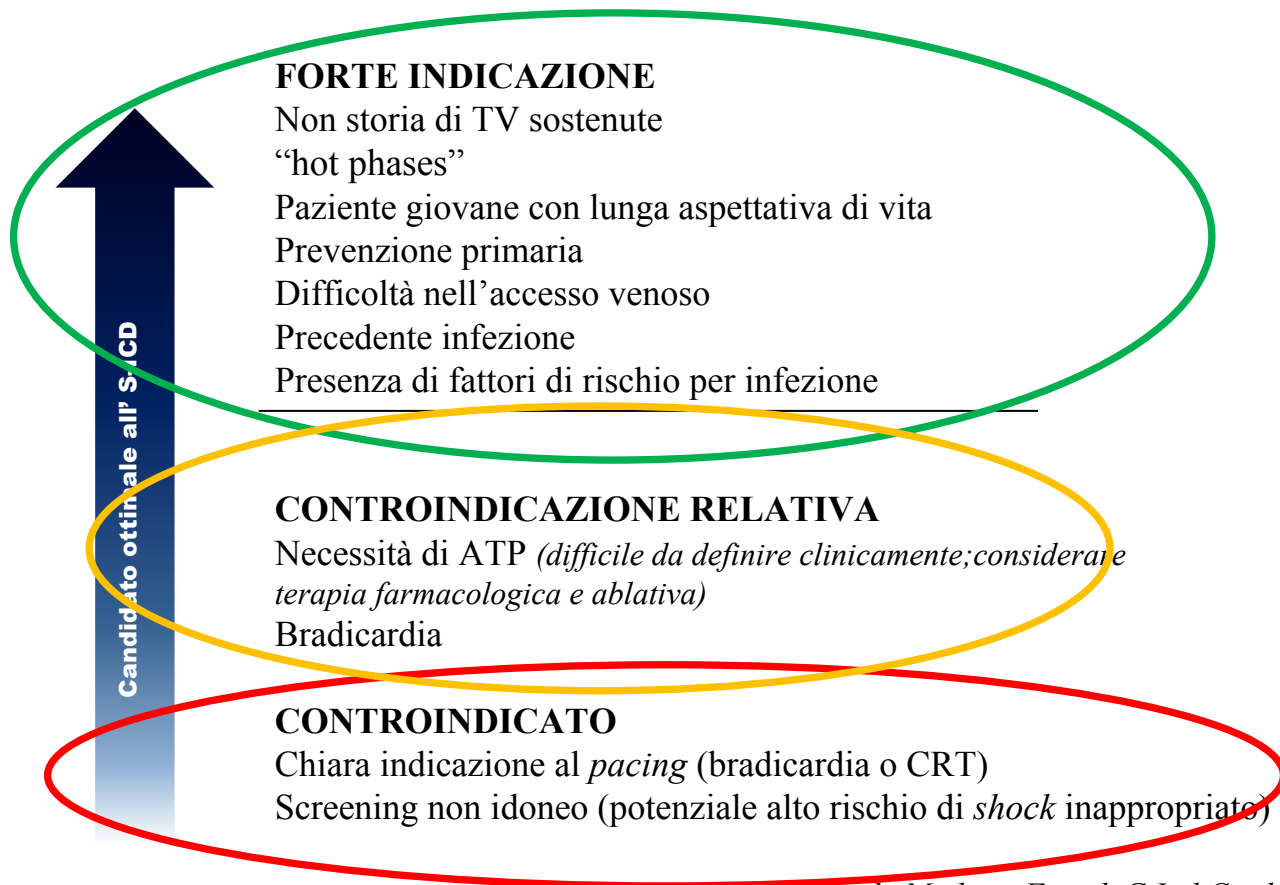
Domenico Corrado<sup>1\*</sup>, Thomas Wichter<sup>2</sup>, Mark S. Link<sup>3</sup>, Richard Hauer<sup>4</sup>, Frank Marchlinski<sup>5</sup>, Aris Anastasakis<sup>6</sup>, Barbara Bauce<sup>1</sup>, Cristina Basso<sup>1</sup>, Corinna Bruckhorst<sup>7</sup>, Adalena Tsatsopoulou<sup>8</sup>, Harikrishna Tandri<sup>9</sup>, Matthias Paul<sup>10</sup>, Christian Schmied<sup>7</sup>, Antonio Pelliccia<sup>11</sup>, Firat Duru<sup>7</sup>, Nikos Protonotarios<sup>8</sup>, NA Mark Estes III<sup>3</sup>, William J. McKenna<sup>12</sup>, Gaetano Thiene<sup>1</sup>, Frank I. Marcus<sup>13</sup>, and Hugh Calkins<sup>9</sup>

### *Device selection*



A decision whether to implant an S-ICD device needs to be patient specific, **balancing the likelihood of recurrent and life-threatening VT with the prevalence of serious lead-related complications.**

# ***PRO e CONTRO di S-ICD nei pazienti con ARVC***



# Implantable defibrillators in primary prevention of genetic arrhythmias. A shocking choice?

Domenico Corrado <sup>1</sup>, Mark S. Link <sup>2</sup>, and Peter J. Schwartz <sup>3\*</sup>

