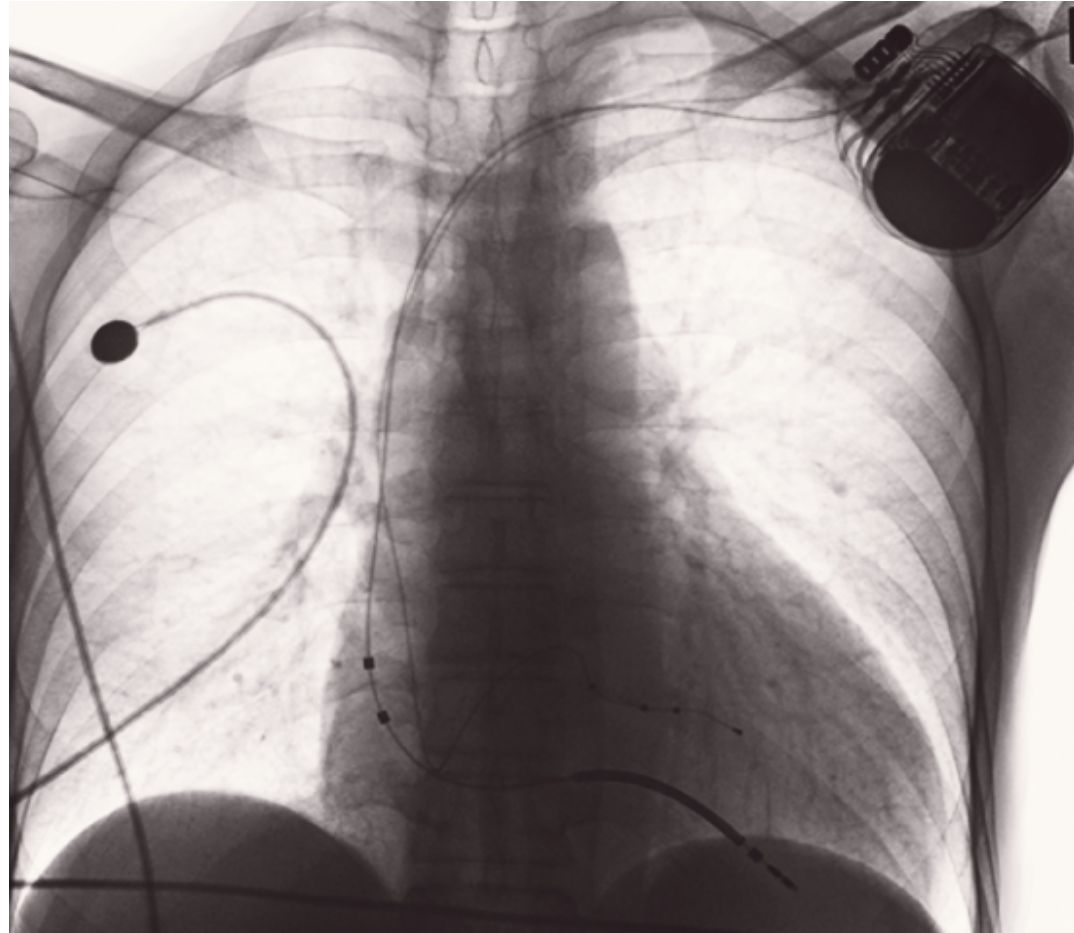
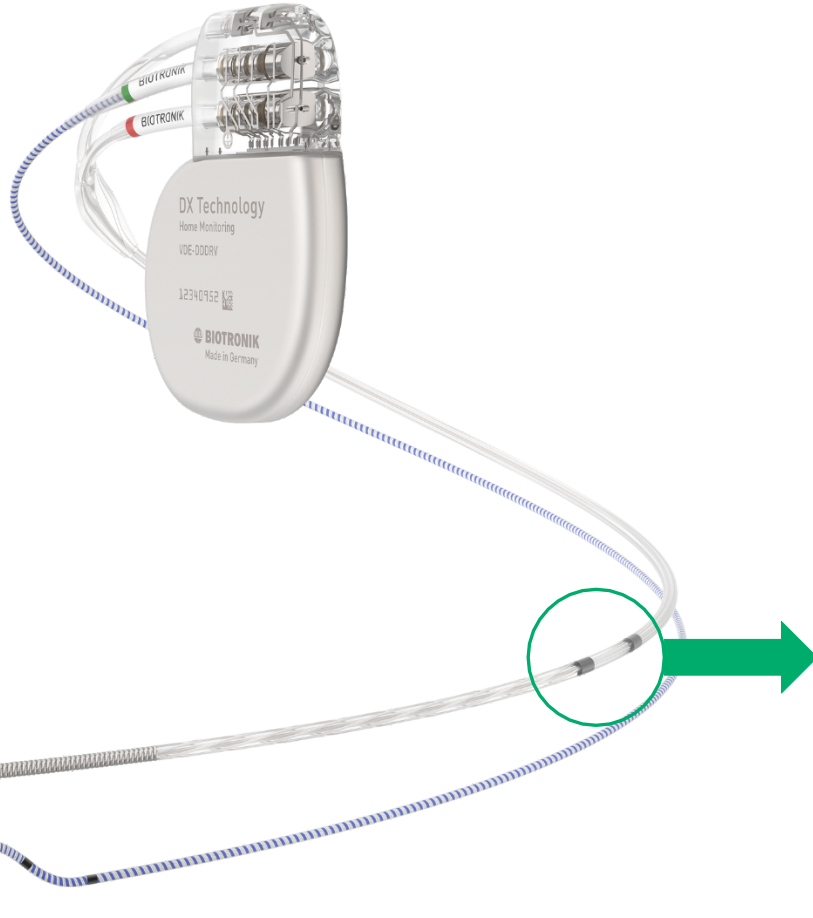


# CRTDX



Dr Olivier le VAVASSEUR,  
HNO Villefranche/CHU Lyon

# CRT-DX



## Pour qui ?

- Indication CRT-D sans stimulation OD
- Indication CRT-D Bi-V (Patient en FA)

## Les avantages :

- **Réduction du temps de procédure**, moins de rayons X
- **Diminue** le risque de **complications majeures**
- **Capital veineux préservé**

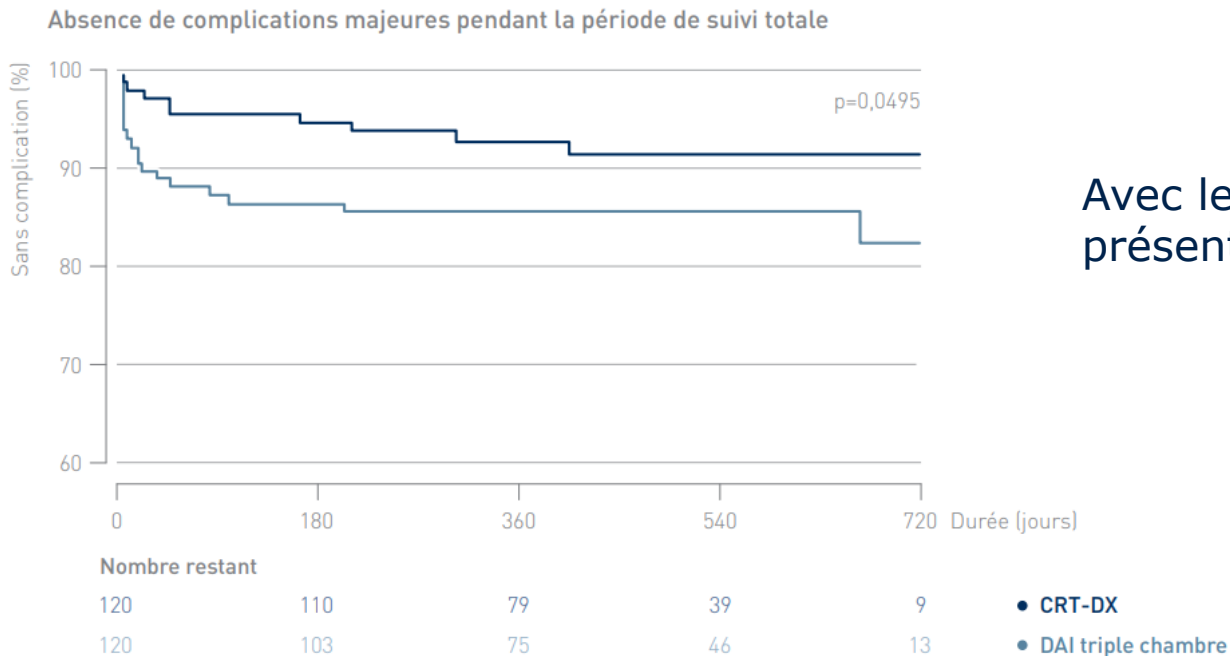
# QP ExCELS Lead Registry

SHAIK N ET AL., JOURNAL OF CARDIOVASCULAR ELECTROPHYSIOLOGY 2020 DOI: 10.1111/JCE.14552

## Conception et caractéristiques de l'étude

- Sous-analyse de QP ExCELS (étude internationale, observationnelle, prospective et multicentrique destinée à évaluer la sécurité et l'efficacité de la sonde VG Sentus QP chez 1 907 patients)
- Participation de 240 patients de novo avec une indication standard de CRT provenant de 50 centres américains (120 paires)

## Taux de complications majeures significativement plus faible avec le CRT-DX



Avec le **CRT-DX**, significativement **moins de patients** présentent des **complications majeures**

**TABLE 2** Percentage of subjects with major/minor complication by system component

Reason for complication	Subjects with major complications		P value	Subjects with minor complications		P value
	CRT-DX (n = 120)	CRT-D (n = 120)		CRT-DX (n = 120)	CRT-D (n = 120)	
RA lead-related						
Dislodgement	N/A	6, 5.0%	...	N/A	0, 0.0%	...
RV lead-related						
Dislodgement	3, 2.5%	2, 1.7%	.8230	0, 0.0%	0, 0.0%	...
Extracardiac stimulation	0, 0.0%	0, 0.0%	...	1, 0.8%	0, 0.0%	.6171
LV lead-related						
Dislodgement	5, 4.2%	8, 6.7%	.4510	0, 0.0%	0, 0.0%	...
Extracardiac stimulation	0, 0.0%	2, 1.7%	.2888	9, 7.5%	11, 9.2%	.7237
High impedance	1, 0.8%	0, 0.0%	.6171	4, 3.3%	0, 0.0%	.0801
Oversensing	1, 0.8%	0, 0.0%	.6171	0, 0.0%	0, 0.0%	...
Pulse generator related						
Inability to defibrillate	0, 0.0%	1, 0.8%	.6171	0, 0.0%	0, 0.0%	...
Electronic failure	1, 0.8%	0, 0.0%	.6171	0, 0.0%	0, 0.0%	...
Discomfort/pain	0, 0.0%	0, 0.0%	...	1, 0.8%	0, 0.0%	.6171
Implant related						
Pneumothorax	0, 0.0%	1, 0.8%	.6171	0, 0.0%	1, 0.8%	.6171
Pericardial effusion	0, 0.0%	1, 0.8%	.6171	0, 0.0%	0, 0.0%	...
Hematoma	0, 0.0%	1, 0.8%	.6171	0, 0.0%	0, 0.0%	...
Infection	0, 0.0%	0, 0.0%	...	0, 0.0%	3, 2.5%	.1489
Pleural effusion	0, 0.0%	0, 0.0%	...	1, 0.8%	0, 0.0%	.6171
Thrombosis	0, 0.0%	0, 0.0%	...	0, 0.0%	1, 0.8%	.6171
Arrhythmia	0, 0.0%	0, 0.0%	...	1, 0.8%	0, 0.0%	.6171

Note: A major complication is defined as events related or possibly related to the implanted system or the implant procedure and requiring invasive intervention to resolve. A minor complication is defined as events related or possibly related to the implanted system or the implant procedure and not requiring invasive intervention to resolve. A major/minor complication in more than one system component is possible; therefore, the total in Table 2 may be more than the number of subjects with one or more major/minor complication.

Abbreviation: CRT, cardiac resynchronization therapy.

**CLINICAL RESEARCH**

*Pacing and cardiac resynchronization therapy*

## Infections and associated costs following cardiovascular implantable electronic device implantations: a nationwide cohort study

Nicolas Clémenty<sup>1\*</sup>, Phuong Lien Carion<sup>2</sup>, Lucie de Léotoing<sup>3</sup>, Ludovic Lamarsalle<sup>3</sup>, Fanny Wilquin-Bequet<sup>2</sup>, Benedict Brown<sup>4</sup>, Koen J. P. Verhees<sup>5</sup>, Jérôme Fernandes<sup>6</sup>, and Jean-Claude Deharo<sup>7</sup>

**Table 1** Infection rates

		CIED <i>de novo</i>		CIED replacement	
		36M infection rate	P-value (at 36M)	36M infection rate	P-value (at 36M)
Defibrillators	SCD + DCD	1.6%		2.9%	
	CRT-D	1.6%	0.93 (vs. SCD + DCD)	3.9%	0.36 (vs. SCD + DCD)
Pacemakers	SCP + DCP	0.5%		1.4%	
	CRT-P	1.0%	0.01 (vs. SCP + DCP)	1.3%	0.93 (vs. SCP + DCP)

CIED, cardiac implantable electronic device; CRT-D, cardiac resynchronization therapy-defibrillator; CRT-P, cardiac resynchronization therapy-pacemaker; DCD, double-chamber defibrillator; DCP, double-chamber pacemaker; SCD, single-chamber defibrillator; SCP, single-chamber pacemaker; 36M, 36 months.

[Zoom arrière](#)

## Similar CRT Responses Shown in LV Pacing and Clinical Outcome Parameters

### Median LV pacing during CRT



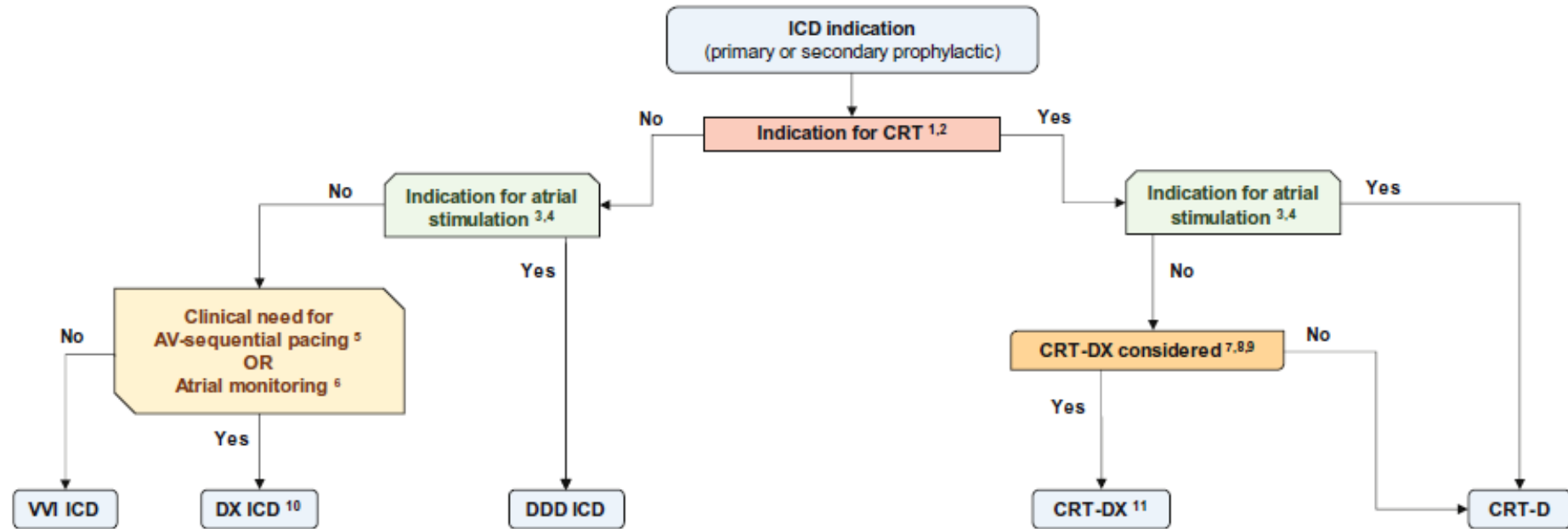
**No significant difference in median LV pacing between groups**

Clinical outcome parameters	CRT-DX	CRT-D
NYHA class improvement <sup>1</sup>	43.3%	45.0%
Heart failure hospitalization	2.5%	2.5%
Daily patient activity	7.9%	8.6%
All-cause mortality	0.8%	1.7%

**Clinical outcomes in the two groups were similar.**

All values represent percentage of patients.

# ICD Selection – A Decision-Making Flowchart



## Indication for CRT

- Symptomatic HF AND LVEF  $\leq 35\%$  WITH LBBB QRS  $\geq 130\text{ms}$  OR non-LBBB QRS  $\geq 150\text{ms}$ <sup>1</sup>
- Narrow QRS BUT LVEF 36-50% AND anticipated requirement for significant ventricular pacing<sup>2</sup>

## Clinical need for AV-sequential pacing

- AV-block indicating AV sequential bradypacing<sup>5</sup>

## OR Atrial monitoring

- Patients without current need for oral anticoagulation, but  $\geq 65$  y of age, or those with elevated risk of stroke<sup>6</sup>

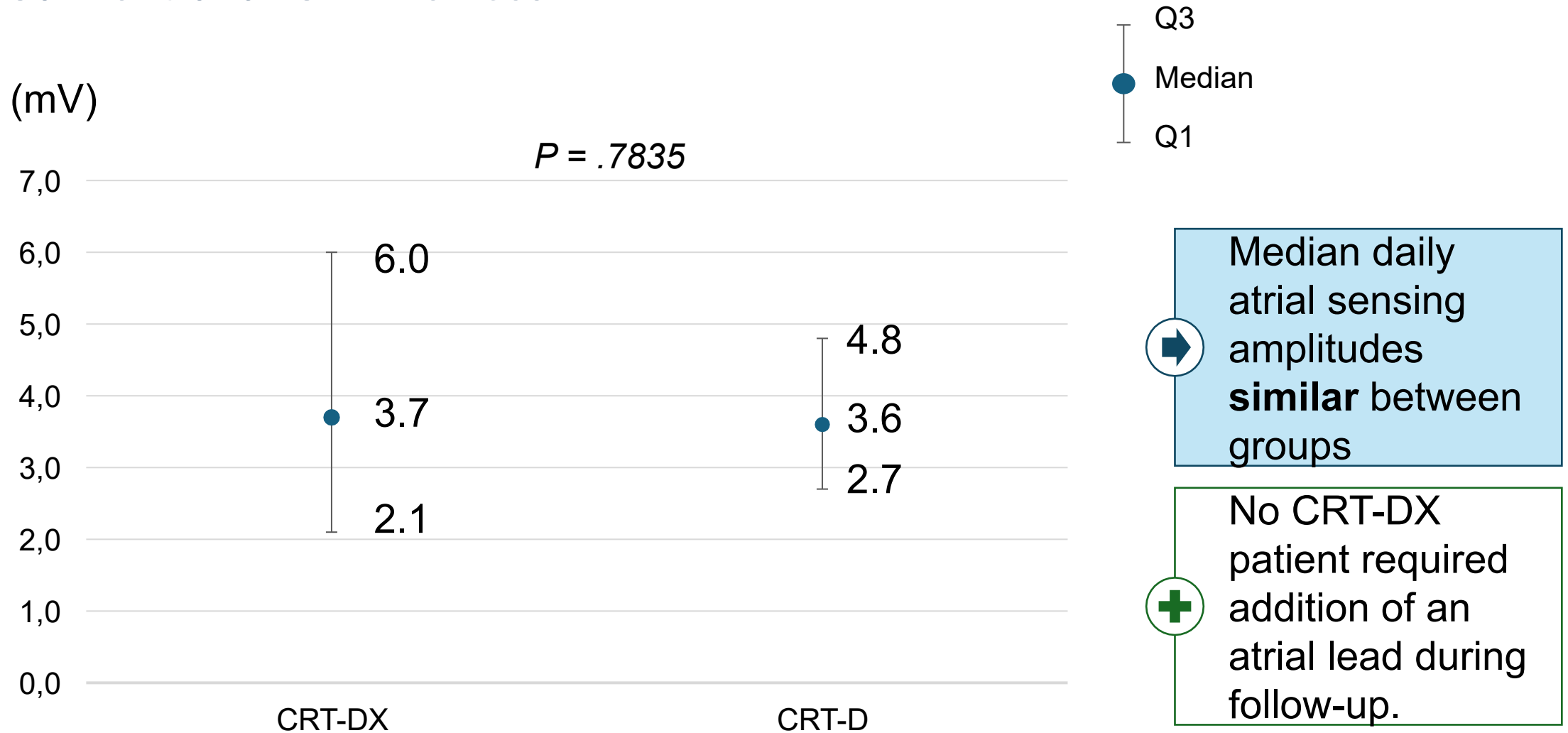
## Indication for atrial stimulation

- Symptomatic SSS<sup>3</sup>
- Clinically relevant sinus bradycardia limiting BB therapy<sup>4</sup>

## CRT-DX considered

- No need for atrial pacing<sup>7</sup>
- Permanent AF but SR may be expected<sup>8</sup> (i.e. planned cardioversion or spontaneous conversion may occur)
- Upgrade from DX ICD<sup>9</sup>

# CRT-DX@QP-ExCELS: Median Daily Atrial Sensing Comparable to Conventional CRT Devices





# Etude MATRIX

MAGLIA G ET AL. - EHRA 2022

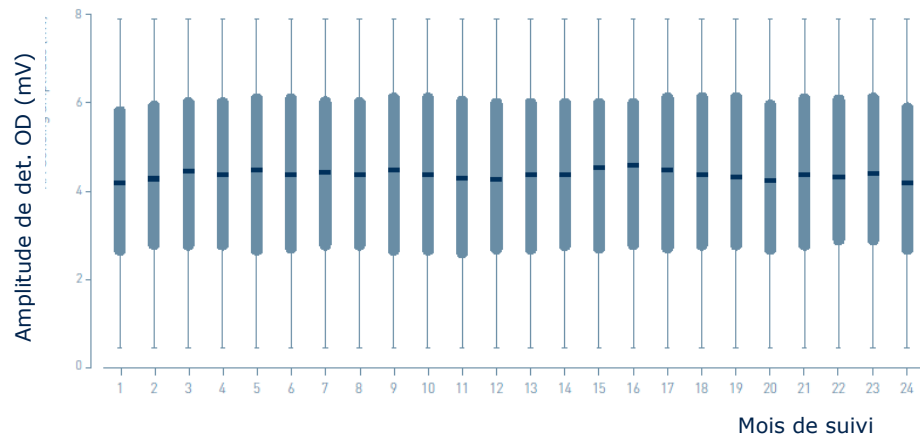
## Méthodologie :

- Prospective, multicentrique (119 centres dans 24 pays)
- Implantation et suivi sur 24 mois de patients porteurs de DAI DX.
- 2041 patients implantés d'un DAI DX avec indication de DAI standard en prévention primaire ou secondaire.

## Principaux résultats :

### ➤ Stabilité du signal atrial

Mesures transmises via la téléc@rdiologie de **1746 patients** (85,5%)



**95.6**  
%

amplitudes de détection OD sont  $\geq 1$  mV

**4.6mV**  
2.8-6.2 mV

amplitude de détection médiane OD

# Relevance of AF Management

## Cardiovascular Morbidity and Mortality Associated with Atrial Fibrillation<sup>1</sup>

- Most frequent tachycardia
- Subclinical AF often underdiagnosed
- “AF begets AF”
- Major cause of clinical events<sup>1</sup>

Event	Association with AF
Death	Increased mortality, especially cardiovascular mortality due to sudden death, heart failure or stroke.
Stroke	20–30% of all strokes are due to AF. A growing number of patients with stroke are diagnosed with 'silent', paroxysmal AF.
Hospitalizations	10–40% of AF patients are hospitalized every year.
Quality of life	Quality of life is impaired in AF patients independent of other cardiovascular conditions.
Left ventricular dysfunction and heart failure	Left ventricular dysfunction is found in 20–30% of all AF patients. AF causes or aggravates LV dysfunction in many AF patients, while others have completely preserved LV function despite long-standing AF.
Cognitive decline and vascular dementia	Cognitive decline and vascular dementia can develop even in anticoagulated AF patients. Brain white matter lesions are more common in AF patients than in patients without AF.

## Incidence of AF in ICD Patients (Calculation by Reinhold et al.<sup>2</sup>)

Model item	Mean annual probability
Incidence of AF in ICD patients	20.94%

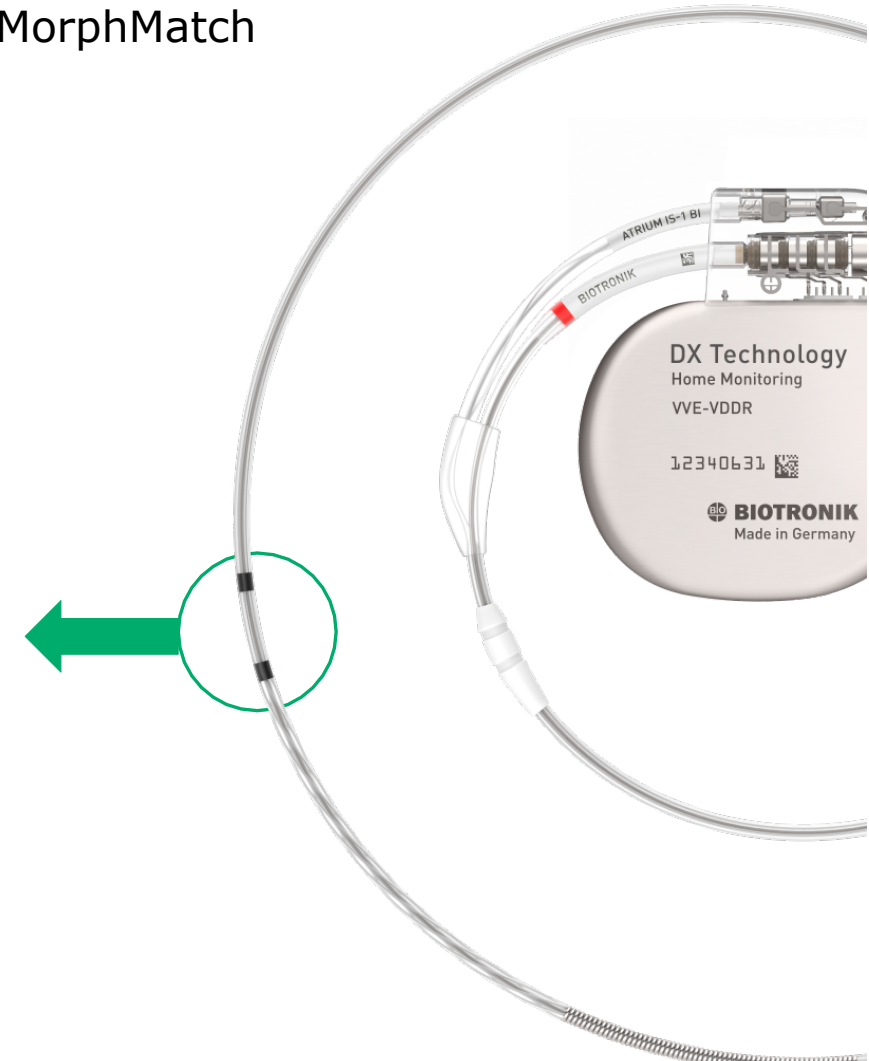
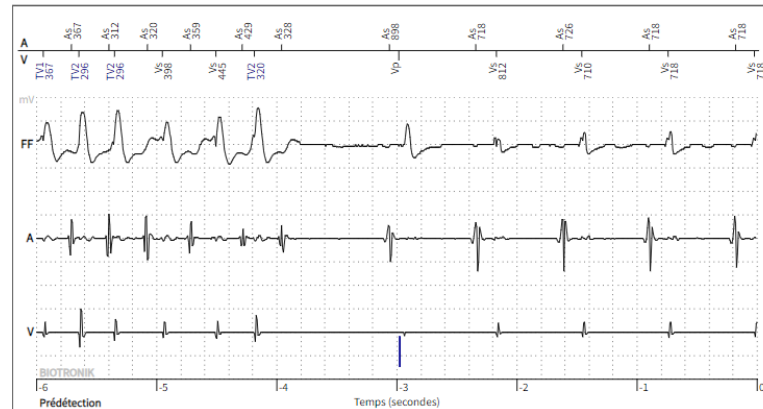
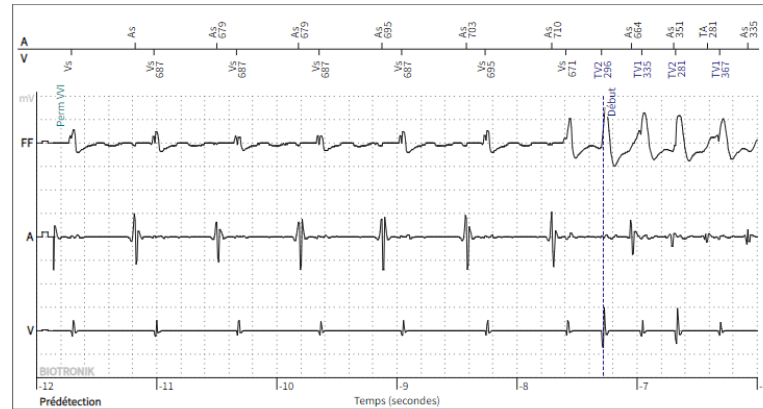
➔ Fully exploiting the value of AF management includes timely intervention to reduce stroke, prevent heart failure (HF) exacerbation, and halt or reverse atrial remodeling

<sup>1</sup> Kirchhof P et al., Europace (2016), doi:10.1093/europace/euw295. Table: same source.

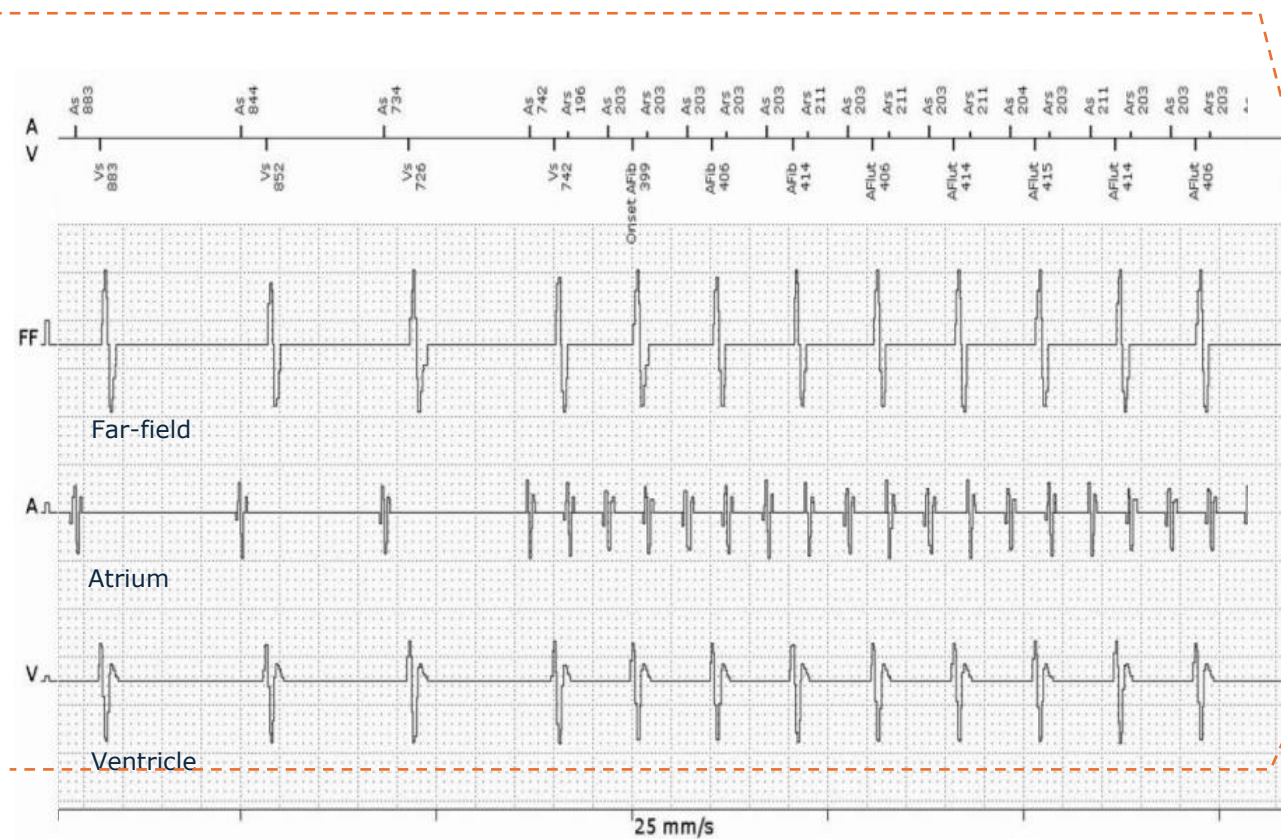
<sup>2</sup> Reinhold T et al., BioMed Research International (2018), Article ID 3417643.

# Technologie DX - Intérêts

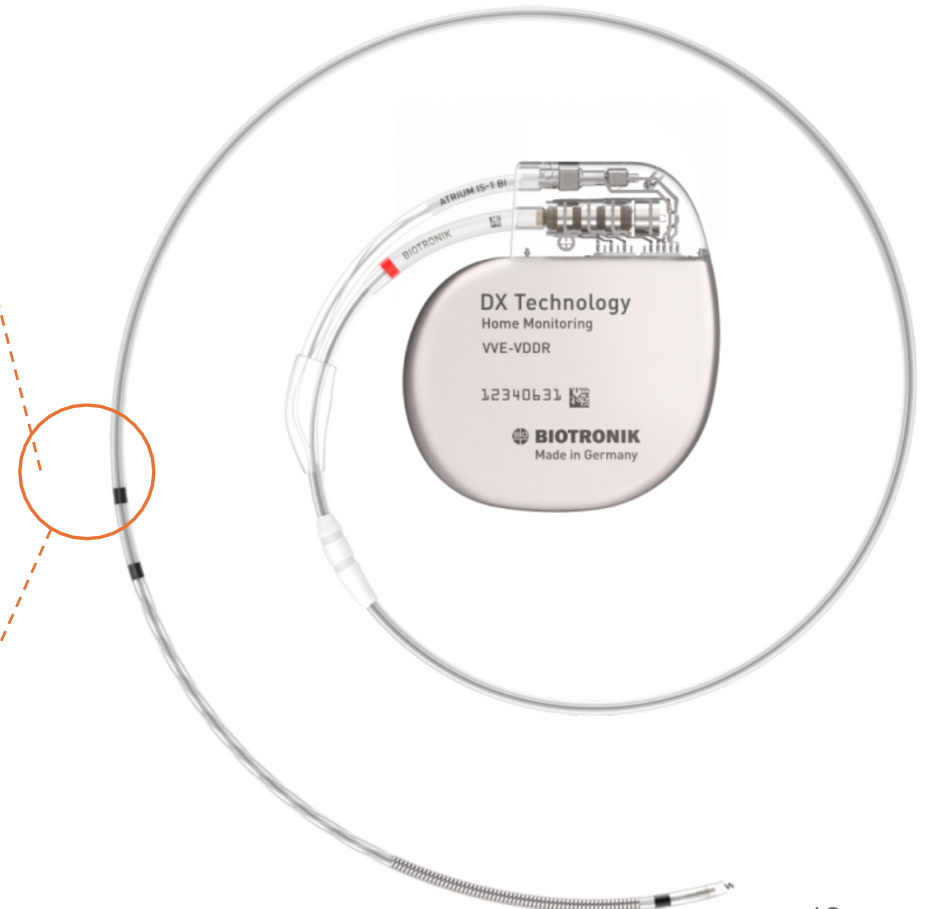
- Diagnostics **auriculaires complets**
- **Détection et gestion de la FA** asymptomatique grâce à la Téléc@rdiologie
- Algorithmes de discrimination des TV/TSV disponibles : SMART et MorphMatch



## The additional information gives clear evidence on the origin of the tachycardia.

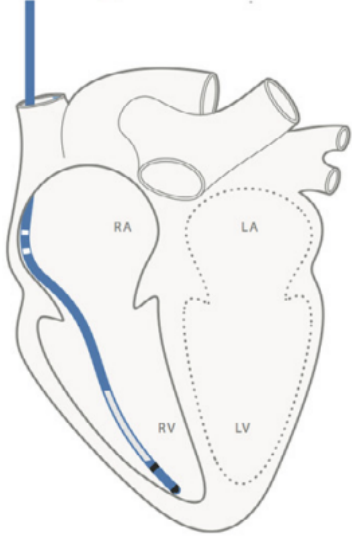


Clinical example of an atrial tachycardia episode



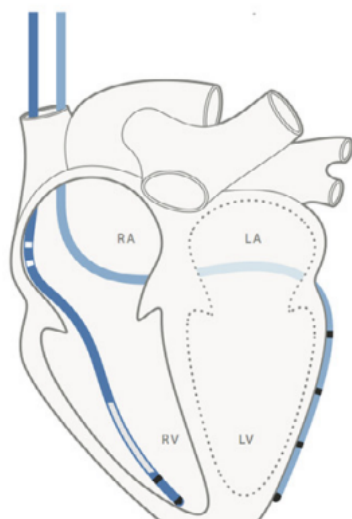
## DX ICD

Single-lead ICD with atrial diagnostics



## CRT-DX

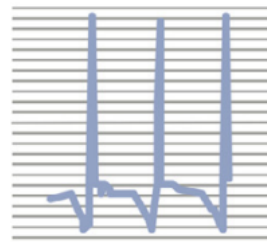
Resynchronization with 2 leads



Specifically designed atrial sensing



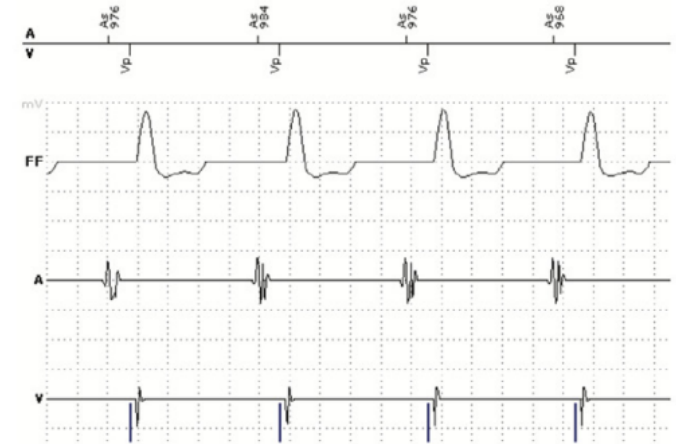
x4



Increased amplification and a wider bandpass



Detection of atrial arrhythmias



AV sequential pacing

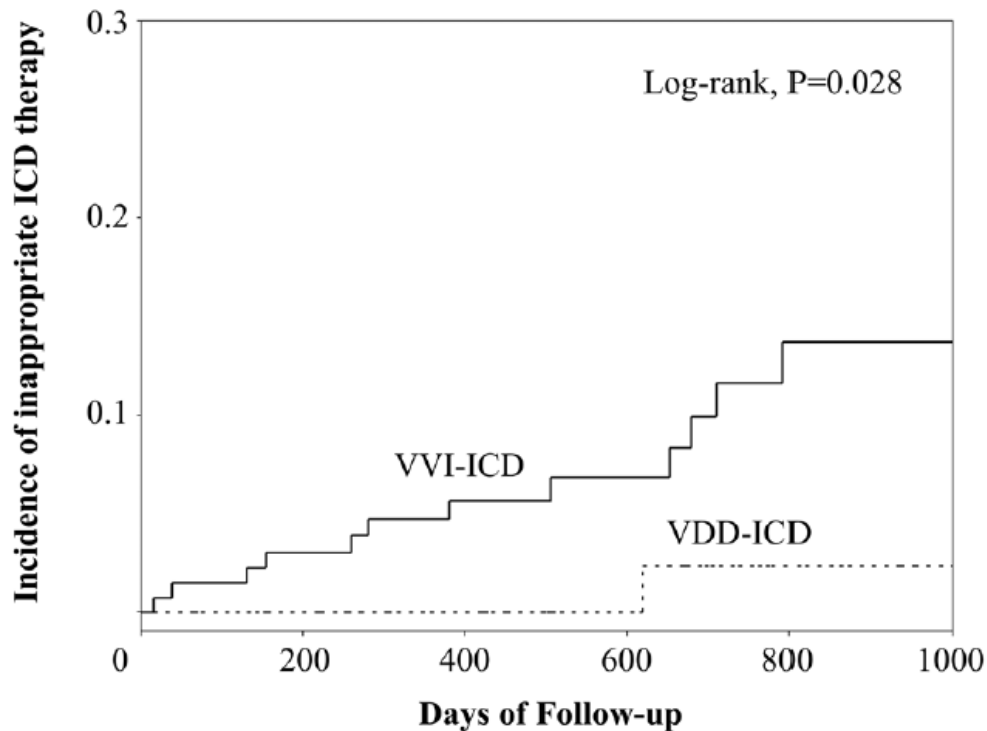


Better tachycardia discrimination



# Significantly Lower Incidence of Inappropriate ICD Therapies with DX Technology

Figure: Incidence of inappropriate ICD therapy including ATP and shock (primary endpoint)



No. at risk	0	200	400	600	800	1000
VVI-ICD	134	120	99	71	43	18
VDD-ICD	77	67	55	43	28	22



**With DX, significantly fewer patients experienced inappropriate ICD therapies.**

## VDD-ICD (DX):

- 1/77 patients (1%)

## VVI-ICD

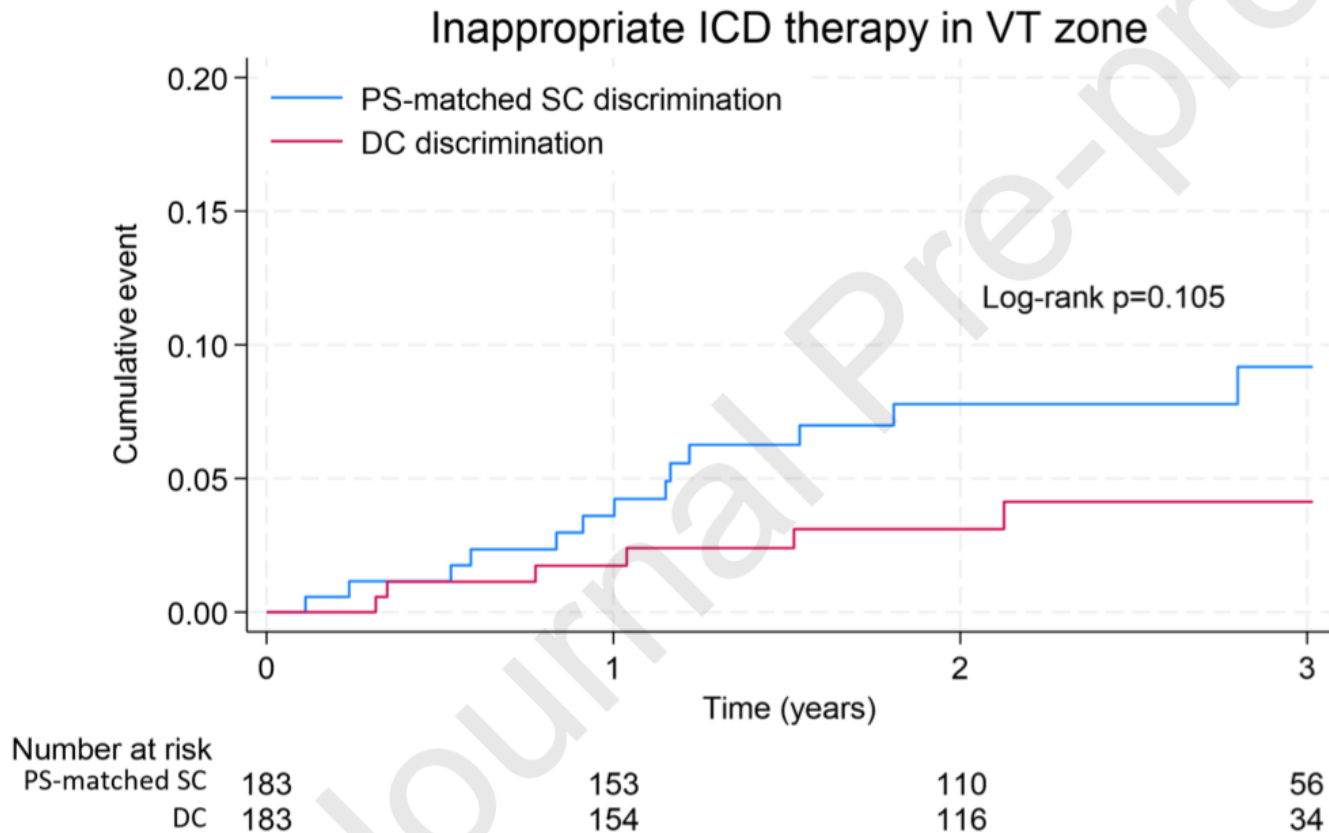
- 12/135 patients (9%)

(*P*=0.028)

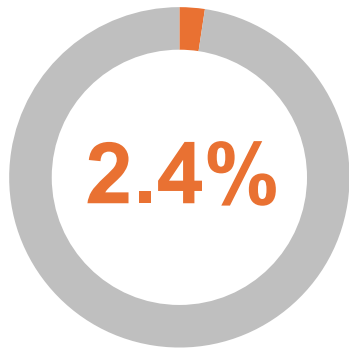
## Inappropriate therapies in modern implantable cardioverter-defibrillators: A propensity score–matched comparison between single- and dual-chamber discriminators in single-chamber devices THE sINGLE lead Study (THINGS Study)

Mauro Biffi, MD <sup>1</sup> ✉ · Giovanni Statuto, MD, PhD <sup>1</sup> · Valeria Calvi, MD <sup>2</sup> · ... · Eduardo Celentano, MD, FHRS <sup>14</sup> · Davide Giorgi, MD, PhD <sup>15</sup> · Matteo Ziacchi, MD, PhD <sup>1</sup>... Show more

**B**



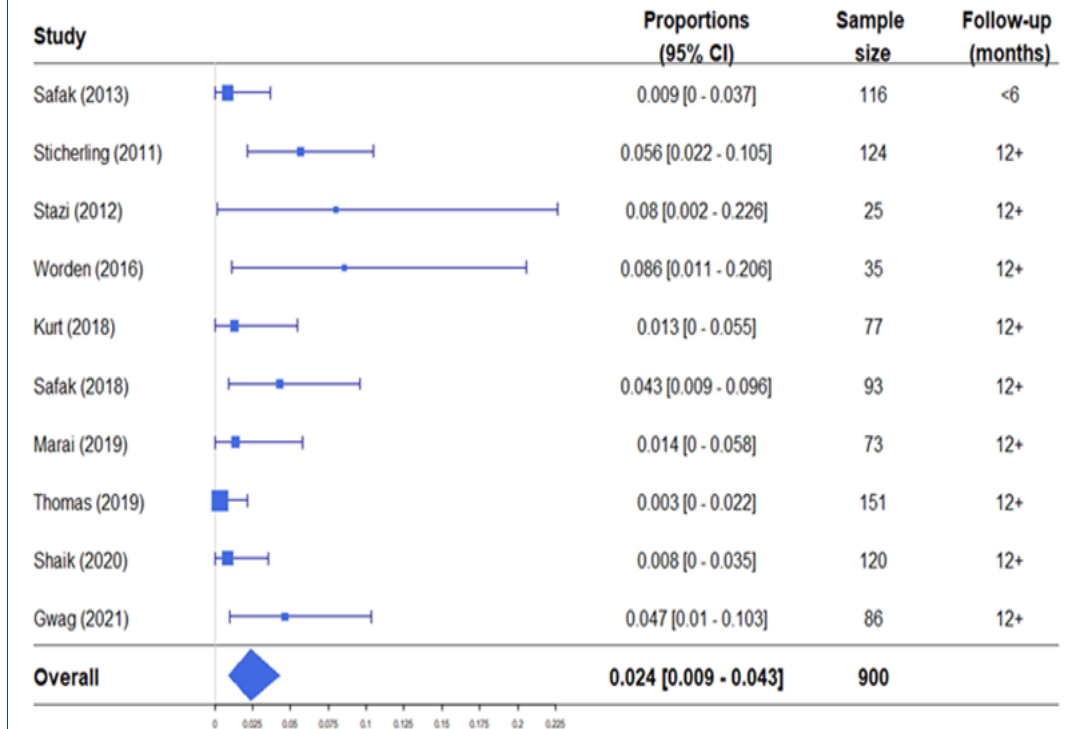
# DX Technology reliably delivers life-saving therapy with low rate of inappropriate shocks



Patients with inappropriate shock

Mean follow-up time: 422.5 days

Figure 9A: Pooled rate of inappropriate shocks<sup>1</sup>





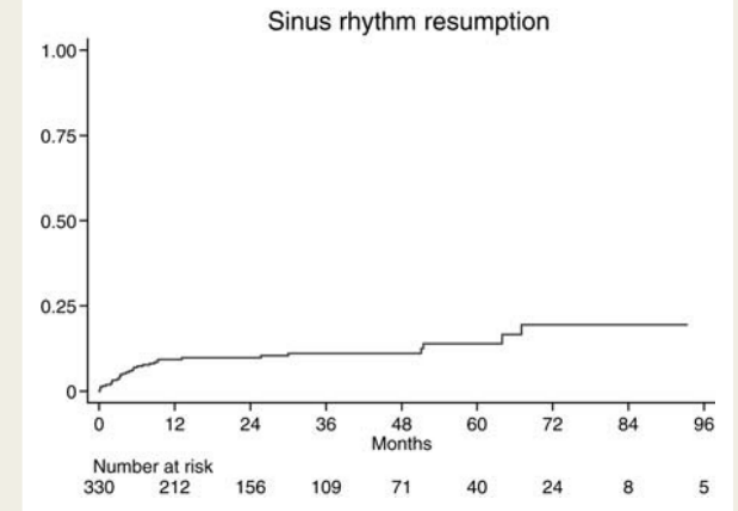
# Resumption of sinus rhythm in patients with heart failure and permanent atrial fibrillation undergoing cardiac resynchronization therapy: a longitudinal observational study

Maurizio Gasparini<sup>1\*</sup>, Jonathan S. Steinberg<sup>2</sup>, Aysha Arshad<sup>2</sup>, François Regoli<sup>1</sup>, Paola Galimberti<sup>1</sup>, Arnaud Rosier<sup>3</sup>, Jean Claude Daubert<sup>3</sup>, Catherine Klersy<sup>4</sup>, Ganesh Kamath<sup>2</sup>, and Christophe Leclercq<sup>3</sup>

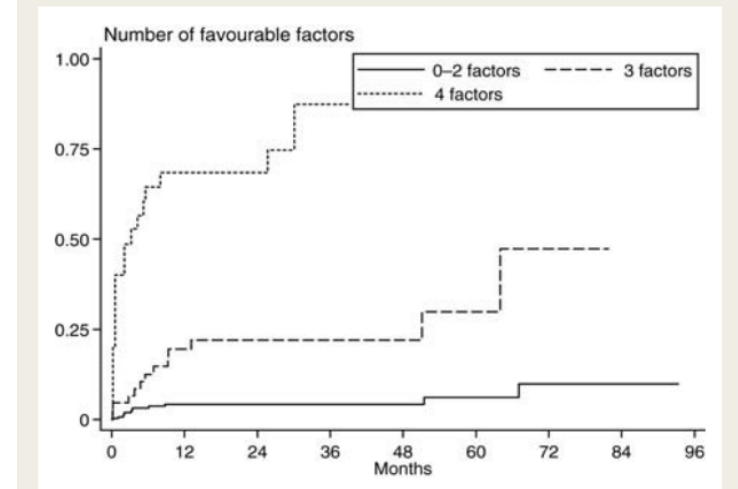
<sup>1</sup>Electrophysiology and Pacing Unit, Cardiology Department, IRCCS Istituto Clinico Humanitas, Via Manzoni 56, Rozzano, Milano, Italy; <sup>2</sup>Division of Cardiology, St Luke's-Roosevelt Hospital Center, 1111 Amsterdam Avenue, NY 10025, USA; <sup>3</sup>Departement of Cardiology, University Hospital Rennes, Rennes, France; and <sup>4</sup>Biometry and Clinical Epidemiology, Research Department, IRCCS Fondazione Policlinico San Matteo, Pavia, Italy

Received 16 July 2009; revised 19 October 2009; accepted 1 December 2009; online publish-ahead-of-print 12 January 2010

Post-CRT QRS						
≤150	21 (20)	8.4 (5.5–12.9)	3.45 (1.39–8.33)	0.004	2.63 (1.02–7.15)	0.046
>150	6 (6)	2.0 (0.9–8.4)	ref.		ref.	
End-systolic diameter						
≤53	25 (27)	9.9 (6.7–14.6)	ref.	0.003		
>53	8 (8)	3.6 (1.8–7.2)	0.33 (0.15–0.73)			
Left atrium						
≤50	22 (18)	8.8 (5.8–13.4)	2.86 (1.20–6.67)	0.011	4.76 (1.72–11.82)	0.002
>50	7 (8)	3.0 (1.4–6.3)	ref.		ref.	
AVJ ablation <sup>a</sup>						
No	7 (9)	3.3 (1.6–7.0)	ref.	0.003	ref.	0.005
Yes	27 (11)	5.0 (3.4–7.2)	3.72 (1.48–9.38)		4.27 (1.54–11.84)	

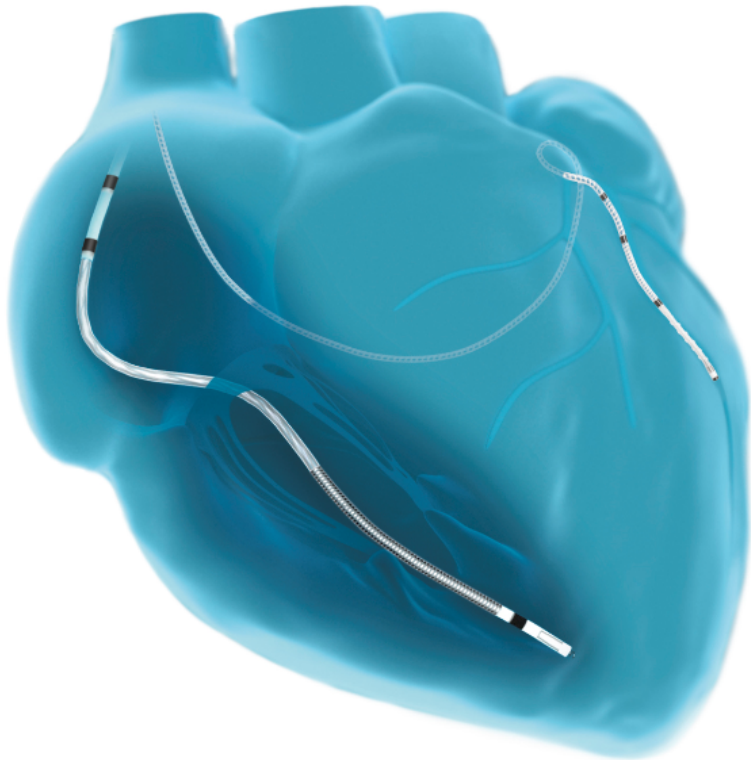


**Figure 1** Kaplan–Meier estimation of cumulative SR resumption. Patients at risk are reported below the curve.



**Figure 2** Kaplan–Meier estimation of cumulative SR resumption according to the number of favourable factors present (derived from the multivariable analysis). Cox model  $P < 0.001$ . Three vs. zero to two predictors HR = 3.5 for SRR, four vs. three predictors HR = 5.7 for SRR.

# Dual-Lead System for CRT Patients



**Sinus rhythm patients** with no atrial pacing indication:

- CRT system with just two leads

**AF patients** not receiving an atrial lead:

- Keep track of atrial fibrillation (AF) status
- AV synchrony for periods in sinus rhythm

**ICD DX patients** who require an **upgrade** to CRT:

- Easy upgrade
- No additional atrial lead implantation needed, unless atrial pacing is required

# Key Points of Review by Vamos et al.



- Due to reliable atrial sensing, the DX ICD system offers an additional atrial IEGM, early detection of atrial arrhythmias, possibly improved SVT discrimination and AV sequential pacing in single-lead devices.
- Moreover, the CRT-DX system provides the possibility of CRT via 2 leads.
- DX technology may lead to lower procedural complexity, a lower radiation dose, and lower implant complications due to the lack of an additional atrial lead.
- Based on the available scientific evidence, the use of the DX ICD and CRT-DX systems may be a reasonable option in carefully selected patients.
- Based on evidence and guidelines, Vamos et al. derive a proposal for ICD selection.

