IX Congresso – Novas fronteiras em medicina Cardiovascular

CDI Subcutâneo: Vantagens e Resultados

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HOSPITAL DOS LUSÍADAS

LISBOA

JACC Journals

From: 16-Year Trends in the Infection Burden for Pacemakers and Implantable Cardioverter-Defibrillators in the United States: 1993 to 2008

J Am Coll Cardiol. 2011;58(10):1001-1006. doi:10.1016/j.jacc.2011.04.033

1993 – 2008

96% aumento de implantações de dispositivos cardíacos

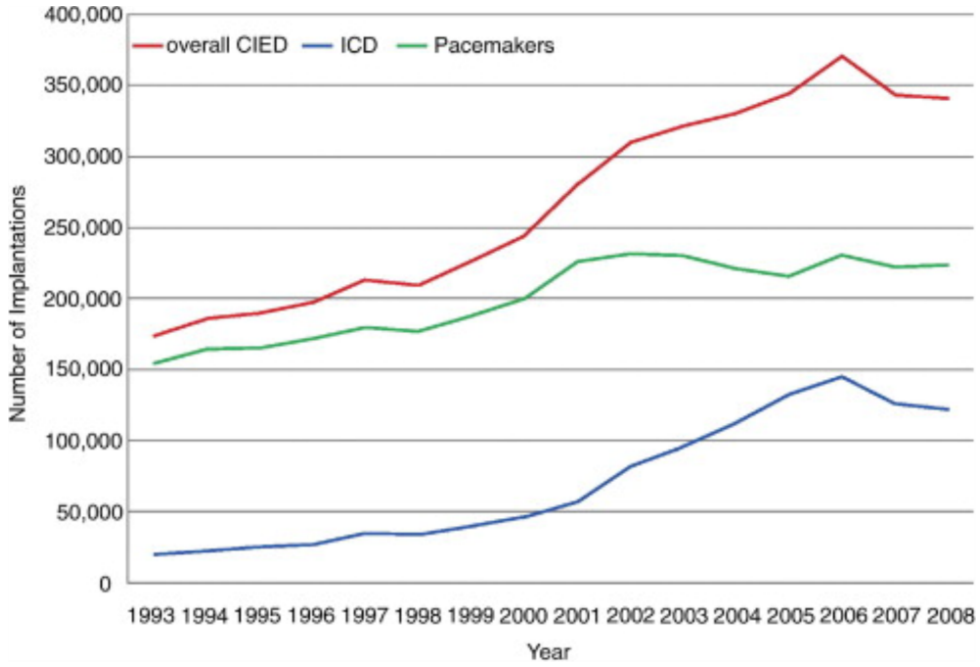

Figure Legend:

Annual Number of PM and ICD Implantations: 1993 to 2008

Between 1993 and 2008, overall cardiac implantable electrophysiological device (CIED) implantation increased by 96% (an average of 4.7%/year). Pacemaker (PM) implantation increased by 45%, whereas implantable cardioverter-defibrillator (ICD) implantation increased by 504%.

JACC Journals

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…De 2004 a 2008

Risco de Infecção aumentou

de 1,53% para 2,41%

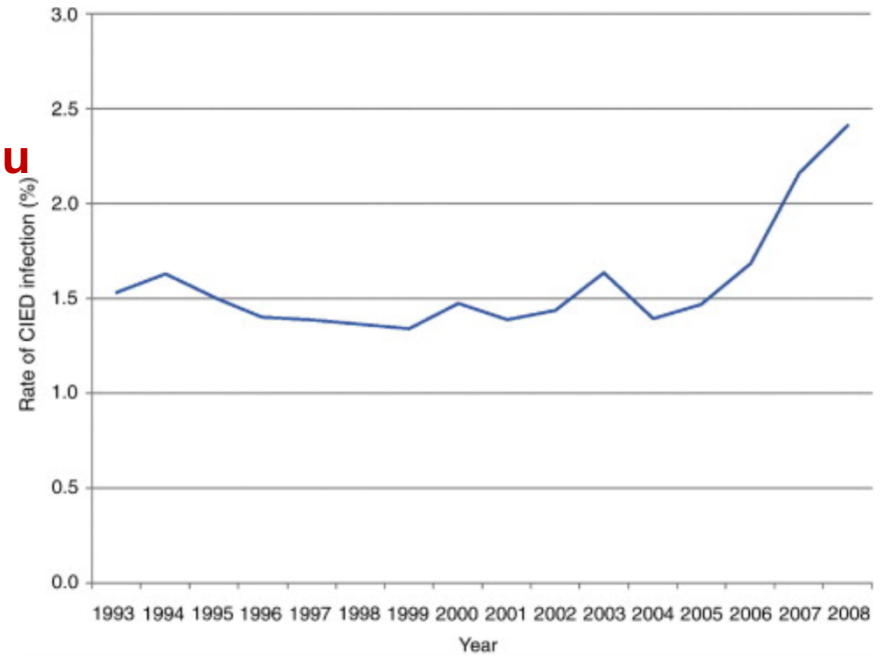


Figure Legend:

Rate of CIED Infection

The annual rate of cardiac implantable electrophysiological device (CIED) infection remained fairly constant until 2004 when there was a marked increase. The infection rate increased from 1.53% in 2004 to 2.41% in 2008 ($p < 0.001$).

JACC Journals

From: 16-Year Trends in the Infection Burden for Pacemakers and Implantable Cardioverter-Defibrillators in the United States: 1993 to 2008

J Am Coll Cardiol. 2011;58(10):1001-1006. doi:10.1016/j.jacc.2011.04.033

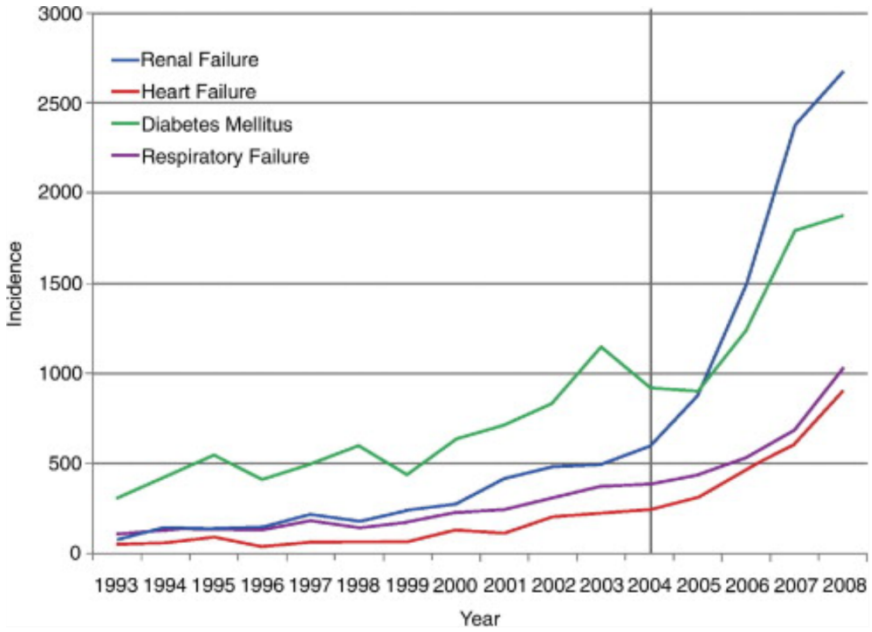


Figure Legend:

Incidence of Comorbidities in Patients With CIED Infection

The incidence of 4 major comorbidities (renal failure, respiratory failure, heart failure, and diabetes) remained fairly constant until 2004 when a marked increase was observed. This paralleled both the observed increase in implantable cardioverter-defibrillator implantation and the increased infection rate. CIED = cardiac implantable electrophysiological device.

Cardiac Device Infection (CDI): Epidemiology

- Reported infection rate 1.2-2.4 %
- ICD more frequent
- No benefit from sophistication in device manifacturing and implantation techniques
- 3.1 fold increase in hospitalization rate for CDI (PM 2.8; ICD 6)
- 41% mortality with endocarditis and cardiac devices treated medically vs 18% in those combined medical and surgical therapy
- Worse prognosis in endocarditis compared with pocket infection
- 2-4 years mean time from first implantation to infection

Growing Need for Managing Leads
5% Estimated Annual Incidence

1%	Infection • 2-7% infection rate for replacements/upgrades • ≤0.5% infection rate for new implants
2.5%	Malfunction • 1.65%-20% annual ICD lead failure based on age
0.5%	Occlusion • 9-35% of device replacement or upgrade
1%	Redundant
+	Advisory Leads (Riata and Fidelis)
+	MR Conditional Devices & Quadripolar IS-4/DF-4 Leads

Limitações CDI Transvenoso

COMPLICAÇÕES

- Na implantação: pneumotórax, hemotórax, infecção sistema, hematoma, disfunção de eléctrodos, deslocação…
- No seguimento: disfunção de eléctrodos, problemas relacionados com gerador, infecções (endocardite), choques inapropriados, choques apropriados mas evitáveis…

Table 2. Most Common Adverse Events (per 100 Patients), Overall and by ICD Type

Type of Complication	Overall	Single Chamber	Dual Chamber	Biventricular
All complications (N=10 994)	3.08	1.88	2.89	4.13
Lead dislodgement (N=3634)	1.02	0.47	0.90	1.53
Hematoma (N=3056)	0.86	0.58	0.77	1.15
Pneumothorax (N=1579)	0.44	0.34	0.46	0.49
Cardiac arrest (N=1042)	0.29	0.23	0.29	0.34
Coronary venous dissection (N=432)	0.12	0.01	0.10	0.22
No. of Patients*	356 515	83 191	148 723	124 108

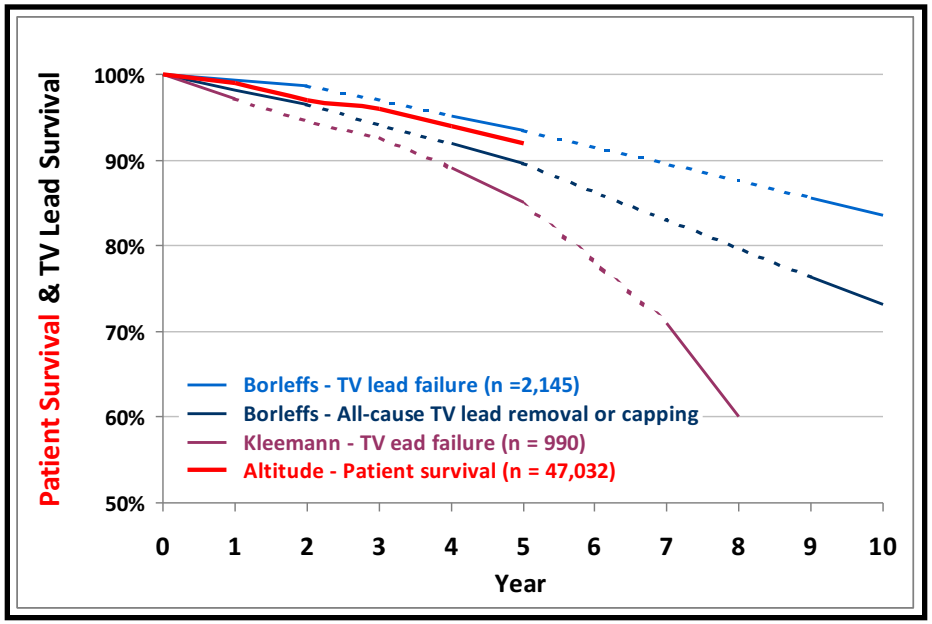
ICD indicates implantable cardioverter-defibrillator.
*Data on ICD type missing in 493 patients.

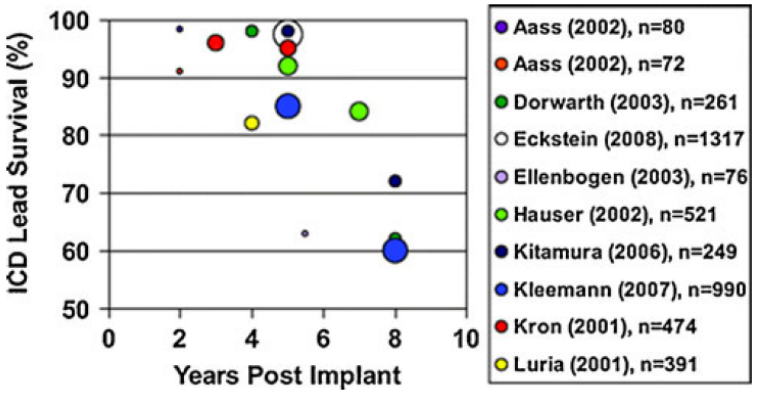
Circulation. 2012;125:57-64.

Limitações CDI Transvenoso

- **Electrodo no seguimento ou o "elo mais fraco"**

- Disfunção/deslocação electrodo com necessidade de reintervenção: 10 anos: 16.4%



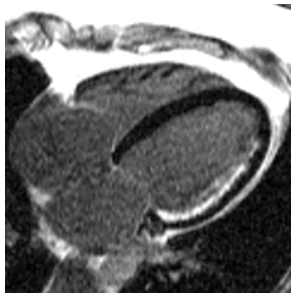


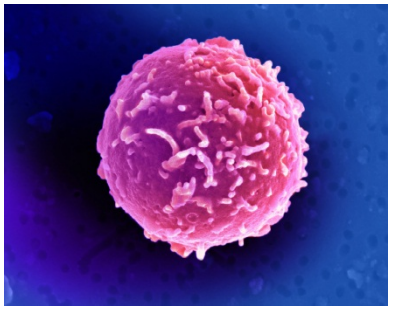
Maisal, W., & Kramer, D. (2008). Implantable cardioverter defibrillator lead performance. Circulation, 117(21), 2721–2723.

Limitações CDI / Pacing Transvenosos

CDI e PM convencional é um compromisso para a

- Extração procedimento de risco considerável
- Impossível descontinuar mesmo que se modifiquem as indicações

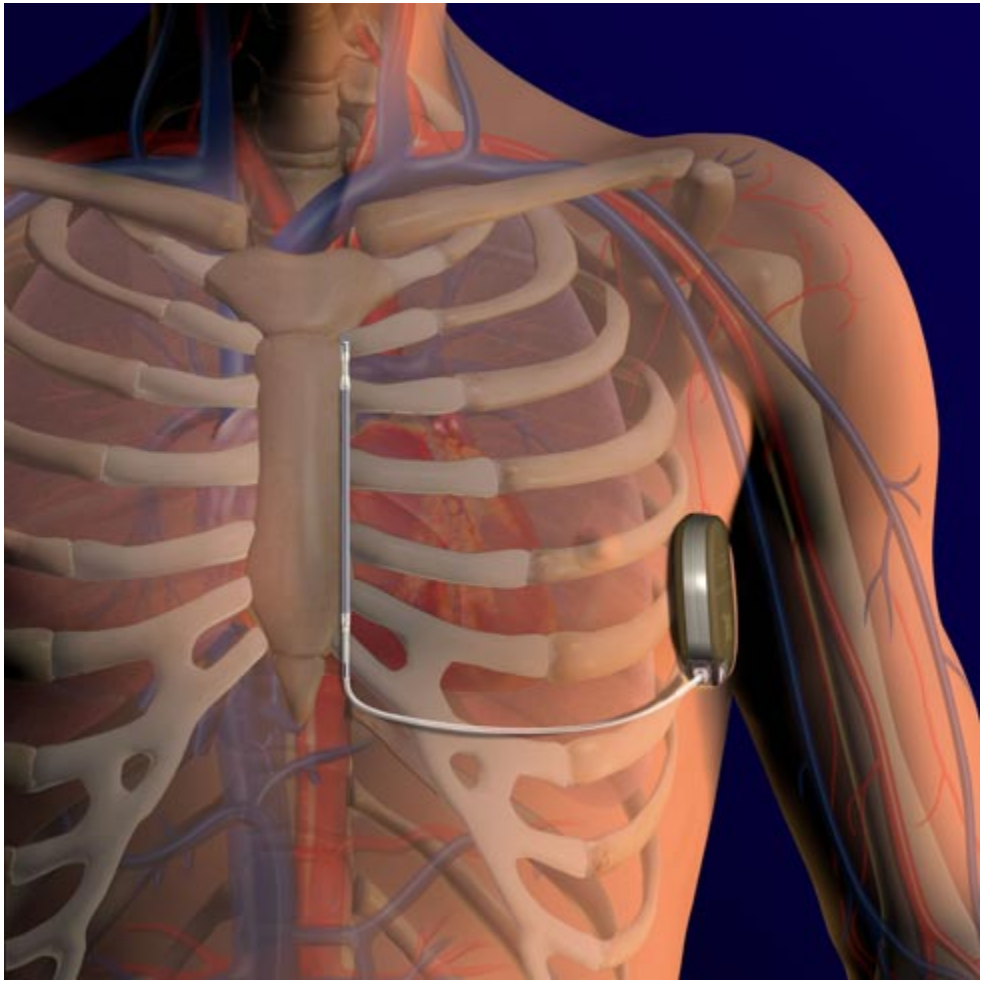




- Desenvolvimento de tratamentos alternativos

- Importância CDI “menos definitivo”

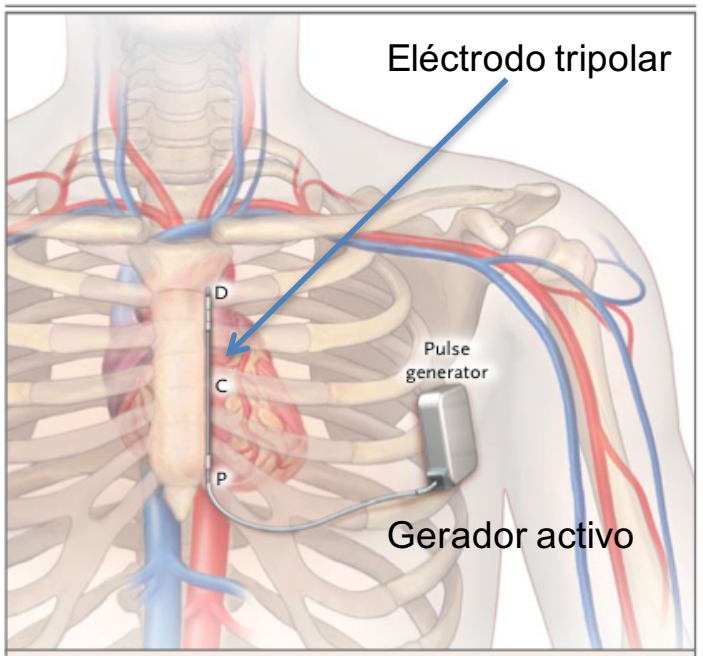
CDI subcutâneo



Ultrapassar problemas

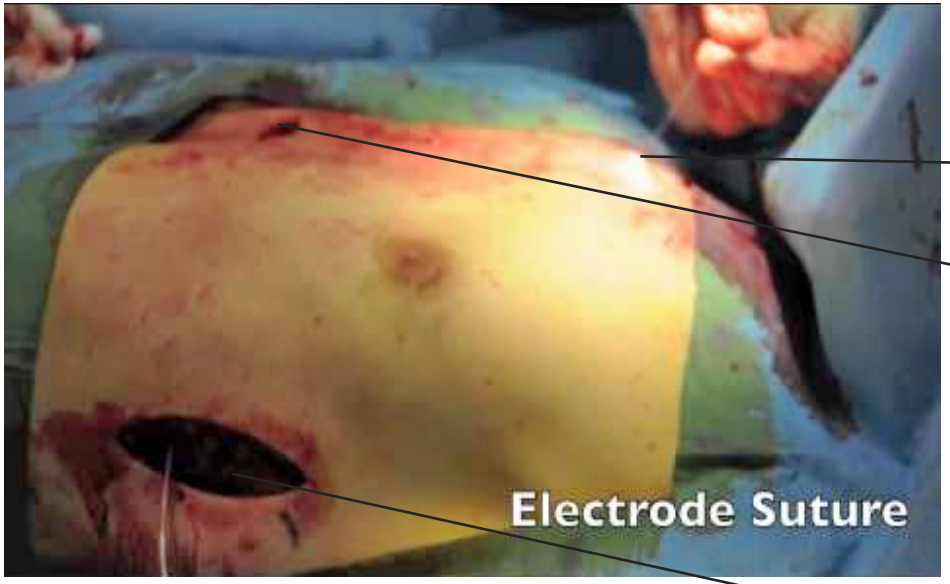
- Acesso vascular ou acesso ao VD difícil ou ausente
- Complicações da implantação
- Infecção com envolvimento endocardico
- Insuficiência tricúspide
- Extracção com menor risco

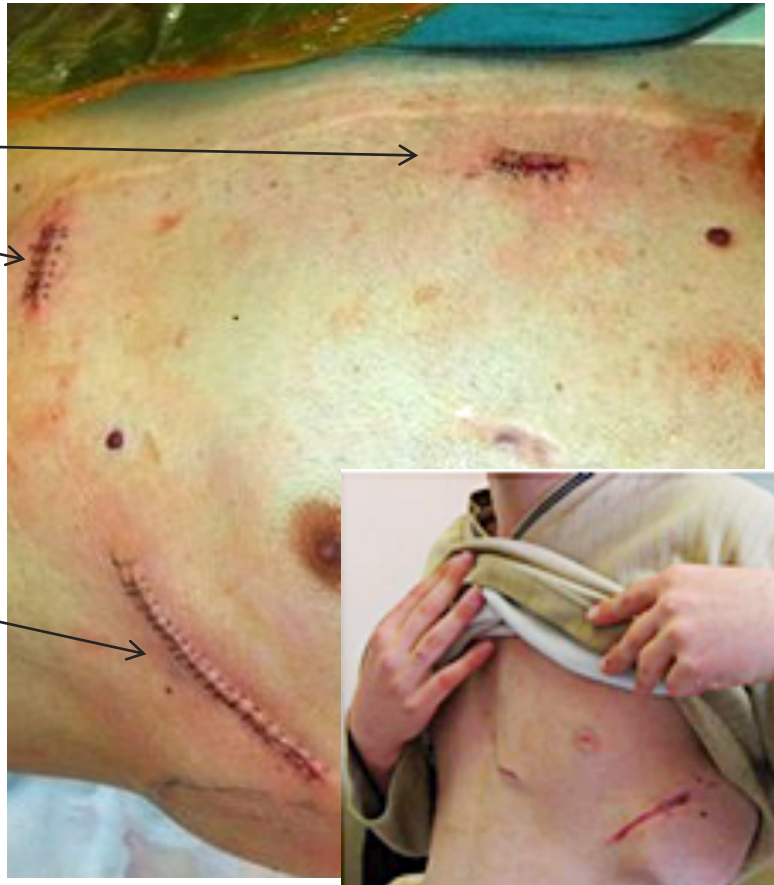
CDI subcutâneo

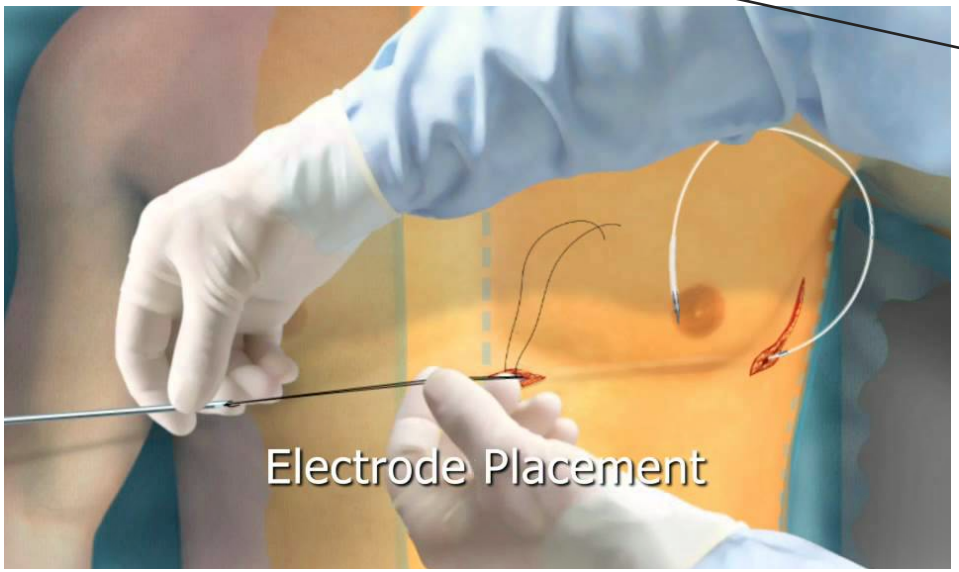


Longevidade esperada 7,3 anos
Monitorização à distância
Compatível com RMN
80 J energia máxima

Sem pacing bradicardia
Sem pacing anti-taquicardia
Poucos “diagnósticos”



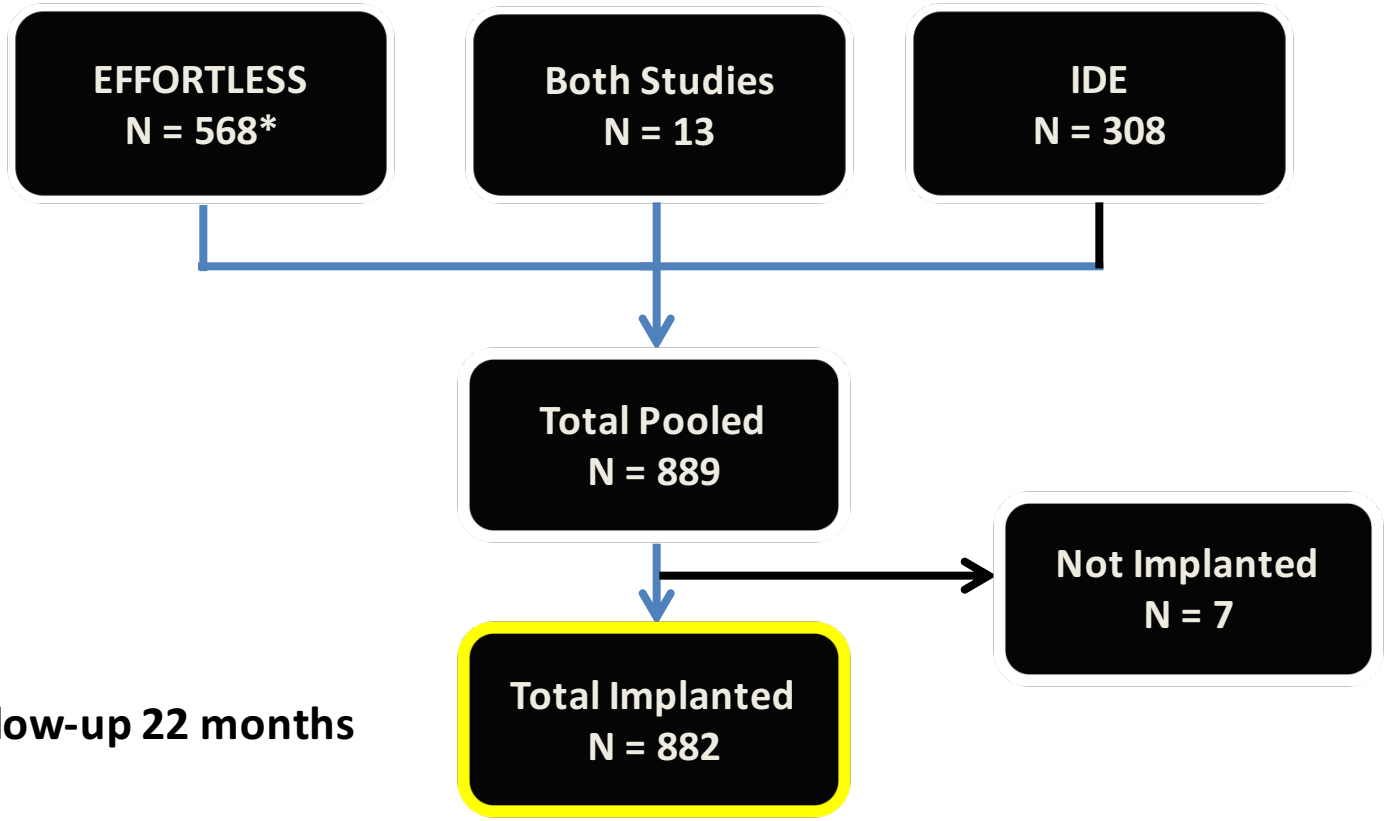




Implantação totalmente extra-vascular

RX=0

S-ICD Pooled Analysis Cohort



Mean follow-up 22 months

2-year Results from a Pooled Analysis of the IDE Study and EFFORTLESS Registry

Martin C. Burke, DO, FACC*;Michael R. Gold, MD, PhD, FACC†, Bradley P. Knight, MD,FACC‡;Craig S. Barr, MD§;Dominic A.M.J.Theuns, PhD, FACC‖;Lucas V.A. Boersma MD,PhD FESC¶;Reinoud E. Knops, MD#;Raul Weiss, MD, FACC††;Angel R. Leon, MD, FACC‡‡;John M. Herre, MD, FACC§§;Michael Husby, MS, MPH‖‖;Kenneth M. Stein, MD, FACC‖‖,Pier D. Lambiase, PhD FRCP FHRS¶¶

S-ICD Pooled Results

S-ICD and TV-ICD Spontaneous Conversion Efficacy

When evaluating TV-ICD studies[1-4], S-ICD was as effective as TV-ICD in treating spontaneous arrhythmias

	Spontaneous Shock Efficacy	
	First Shock	Final Shock in episode
S-ICD Pooled Data*	90.1%	98.2%
ALTITUDE First Shock Study[1]	90.3%	99.8%
SCD-HeFT[2]	83%	
PainFree Rx II[2]	87%	
MADIT-CRT[3]	89.8%	
LESS Study[4]		97.3%

* Excluded VT/VF Storm events

S-ICD Pooled Data
100% Clinical conversion to normal sinus rhythm

Of two "unconverted" episodes
- **One spontaneously terminated after the 5th shock**
- **In the other episode, the device prematurely declared the episode ended. A new episode was immediately reinitiated and the VF was successfully terminated with one shock**

1 Cha YM et al. *Heart Rhythm* 2013;10:702–708. 2 Swerdlow CD et al. *PACE* 2007; 30:675–700. 3 Kutyifa V, et al. *J Cardiovasc Electrophysiol* 2013;24:1246-52.
4 Gold MR et al. *Circulation* 2002;105:2043-2048.

S-ICD Pooled Results
Mortality Compared to TV-ICD Studies

S-ICD had a 2 year mortality rate that compared favorably with mortality rates in studies with TV-ICDs

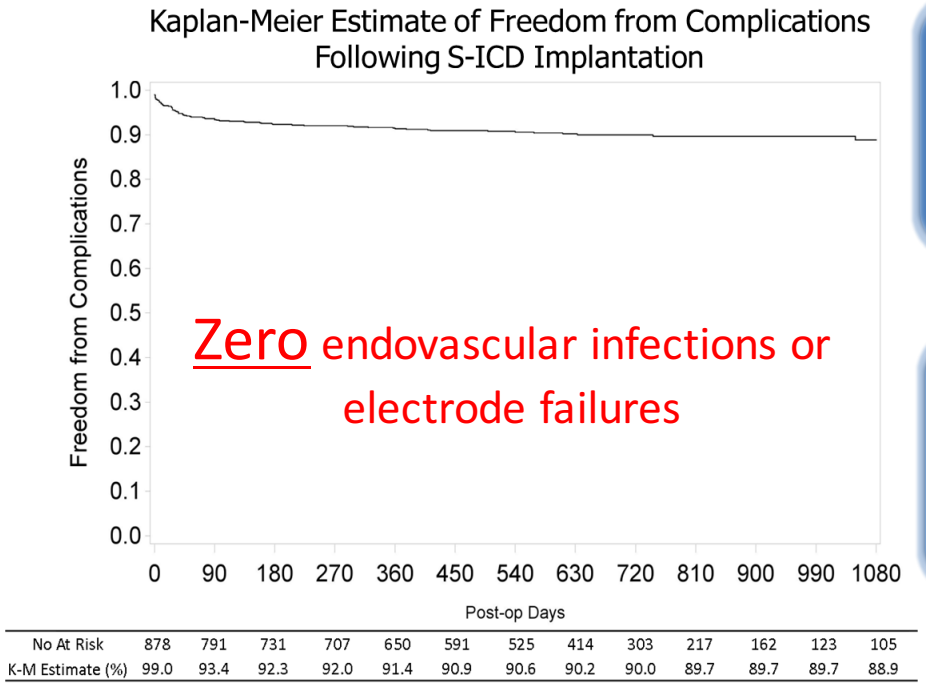
Study	Mortality (At 2 years)	Average Age	1^0 Prevention	Ischemic	NYHA	LVEF
S-ICD Pooled*	3.2%	50	70%	38%	37.5% class II-IV	39%
MADIT RIT[1]	5-7% High rate and Delayed Therapy Arms	63	100%	53%	98% class II or III	26%
SIMPLE[2]	11%	64	70%		63% class II or III	32%

*The **1.6% annual mortality rate** with the S-ICD was deemed **"provocative"** by the authors as it is lower than observed in TV-ICD studies.*

*This analysis was not designed or powered to assess mortality and care should be taken as the population in this analysis may differ from the patient population in TV-ICD studies.

1 Burke MC et al. Pooled Analysis of the EFFORTLESS and IDE Registry. *JACC* April 20th 2015 2 Moss AJ et al. MADIT RIT Study *NEJM* 2012;367;2275-2283. 3 Healy JS et al. SIMPLE Study *Heart Rhythm* 2014;LBCT01;LB01-01.

S-ICD Pooled Results
Complications



There were **zero** endovascular infections or electrode failures which could be a factor in the observed low mortality rate[3]

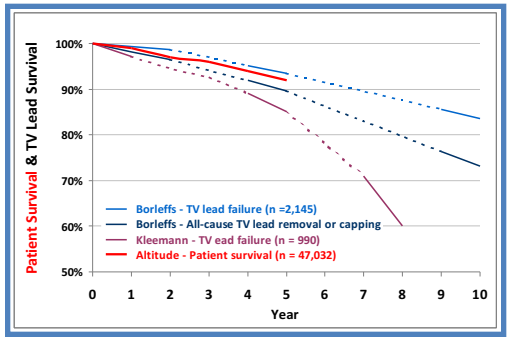
The acute major complication rate was lower when compared to studies with TV-ICD, likely because S-ICD doesn't require vascular access[1,2]

Acute Major Complications (% of patients)	S-ICD Pooled Data	TV-ICD NCDR Analysis (Peterson et al, JAMA 2013[1] Meta-analysis (van Rees et. al. JACC 2011)[2]
	2 %	3 - 5 %
	(Hematoma, Lead or Device Mal-position or Displacement, Pneumothorax)	

1. Peterson PN et al. *JAMA. 2013;309(19):2025-2034.*
2. Van Rees JB et al. *JACC* 2011;58:995-1000
3. Tarakji KG, Wazni OM, Wilkoff BL et al. Europace 2014; 16:490-495

CDI subcutâneo

Choques inapropriados / *Oversensing* da onda T



- Dependentes das características basais do doente
- Incidência máxima no início do seguimento

Choques do CDI convencional

- Relação com disfunção do electrodo e arritmias auriculares
- Aumento da incidência de disfunção do electrodo e arritmias auriculares ao longo de seguimento
- Mais choques inapropriados a longo prazo

Gold MR, Theuns DA, Knight BP et al. Head-to-head comparison of arrhythmia discrimination performance of subcutaneous and transvenous ICD arrhythmia detection algorithms: the START study. J Cardiovasc Electrophysiol. 2012 Apr;23(4):359-66

Kooiman et al. Inappropriate subcutaneous implantable cardioverter-desfibrillator shocks due to T-wave oversensing can be prevented: implication for management. Heart Rhythm 2014.

Poole JE, Gold MR. Who should receive the subcutaneous implanted defibrillator?: The subcutaneous implantable cardioverter defibrillator (ICD) should be considered in all ICD patients who do not require pacing. Circ Arrhythm Electrophysiol. 2013 Dec;6(6):1236-44

A propensity matched case–control study comparing efficacy, safety and costs of the subcutaneous vs. transvenous implantable cardioverter defibrillator

S. Honarbakhsh, R. Providencia, N. Srinivasan, S. Ahsan, M. Lowe, E. Rowland, RJ Hunter, M. Finlay, O. Segal, MJ Earley, A. Chow, RJ Schilling, PD Lambiase *

Department of Cardiac Electrophysiology, Barts Heart Centre, St Bartholomew's Hospital, West Smithfield, London EC1A 7BE, UK

Propensity matched case (S-ICD)-control (TV-ICD) Study:

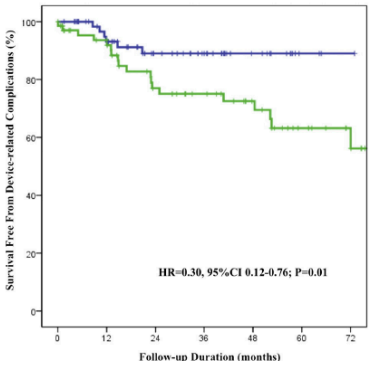
i) safety/efficacy – long-term follow-up

ii) cost-efficacy analysis (are the initial implant costs balanced by the long-term economic impact of device-related complications?)

Baseline characteristics used in propensity match	S-ICD n = 69	TV-ICD n = 69	p-Value
Age mean ± SD	35 ± 13	40 ± 10	0.17
Male n (%)	52 (75)	52 (75)	1.00
DM n (%)	0	0	
Hypertension n (%)	6 (9)	4 (6)	0.74
CKD n (%)	1 (1)	1 (1)	1.00
Etiology n (%)			
Ischaemic cardiomyopathy	6 (9)	5 (7)	1.00
Dilated cardiomyopathy	4 (6)	5 (7)	1.00
Hypertrophic cardiomyopathy	41 (59)	42 (61)	1.00
Arrhythmogenic right ventricular cardiomyopathy	7 (10)	6 (9)	0.79
Idiopathic ventricular fibrillation	6 (9)	6 (9)	1.00
Brugada syndrome	4 (6)	4 (6)	1.00
Congenital heart disease	1 (1)	1 (1)	1.00
Indication n (%)			
Primary prevention	56 (81)	56 (81)	1.00
Secondary prevention	13 (19)	13 (19)	1.00
Left ventricular ejection fraction mean ± SD	57 (±15)	58 (±13)	0.80
EF ≤ 35 n (%)	12 (17)	7 (10)	0.32
EF 36–44 n (%)	1 (1)	5 (7)	0.21
EF 45–54 n (%)	4 (6)	3 (4)	1.00
EF ≥ 55 n (%)	52 (75)	54 (78)	0.69

Table 3
Shows the device-related complications in each group during follow-up.

Device related complications during follow-up	TV-ICD n = 69	S-ICD n = 69	p-Value
Mean follow up ± SD	32 ± 21	31 ± 19	0.88
Total number of complications including inappropriate shocks n (%)	20 (29.0)	6 (8.7)	0.004
Total number of complication excluding inappropriate shocks n (%)	14 (20.3)	3 (4.3)	0.008
Total number of complication excluding inappropriate shocks in those with two therapy zones programmed n (%)	17 (23.2)	6 (8.7)	0.021
Implant-related complications (<30 days) n (%)	2 (2.9)	0	0.24
Right ventricular lead perforation resulting in tamponade	1 (1.4)	0	1.00
Right ventricular lead displacement	1 (1.4)	0	1.00
Device infection n (%)	4 (5.8)	1 (1.4)	0.37
Generator and leads explanted	4 (5.8)	1 (1.4)	0.37
ICD generator-related complications n (%)	1 (1.4)	1 (1.4)	1.00
Generator displacement requiring repositioning	0	1 (1.4)	1.00
Wound revision	1 (1.4)	0	1.00
ICD lead-related complications resulting in lead intervention n (%)	6 (8.7)	0	0.028
Drop in RV sensing ± resulting in T wave oversensing	2 (2.9)	0	0.50
Raised RV threshold with suspected micro-displacement	1 (1.4)	0	1.00
Lead fracture or lead insulation defect	3 (4.3)	0	0.12
Device failed to cardiovert ventricular arrhythmia n (%)	1 (1.4)	1 (1.4)	1.00
Generator replaced to a high energy box	1 (1.4)	0	1.00
Inappropriate shocks n (%)	6 (8.7)	3 (4.3)	0.49
Sinus tachycardia	2 (2.9)	0	0.50
Atrial tachycardia	1 (1.4)	0	1.00
Atrial fibrillation	3 (4.3)	0	0.24
T wave-oversensing in context of sinus tachycardia	0	3 (4.3)	0.24



*Device-related complication rates with TV-ICDs are higher
*no significant difference in inappropriate shock rates
*Significant difference in unit cost of the S-ICD, overall S-ICD costs may be mitigated versus TV-ICD over a longer period of follow-up.

Int J Cardiol 228 (2017) 280–285

European Heart Journal
doi:10.1093/eurheartj/ehv316

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

Subcutaneous implantable cardioverter defibrillator

Recommendations	Class[a]	Level[b]	Ref.[c]
Subcutaneous defibrillators should be considered as an alternative to transvenous defibrillators in patients with an indication for an ICD when pacing therapy for bradycardia support, cardiac resynchronization or antitachycardia pacing is not needed.	IIa	C	157, 158
The subcutaneous ICD may be considered as a useful alternative to the transvenous ICD system when venous access is difficult, after the removal of a transvenous ICD for infections or in young patients with a long-term need for ICD therapy.	IIb	C	This panel of experts

ICD = implantable cardioverter defibrillator.
[a]Class of recommendation.
[b]Level of evidence.
[c]Reference(s) supporting recommendations.

SICD has a class I recommendation for patients at higher risk of infection

10.1. Subcutaneous Implantable Cardioverter-Defibrillator

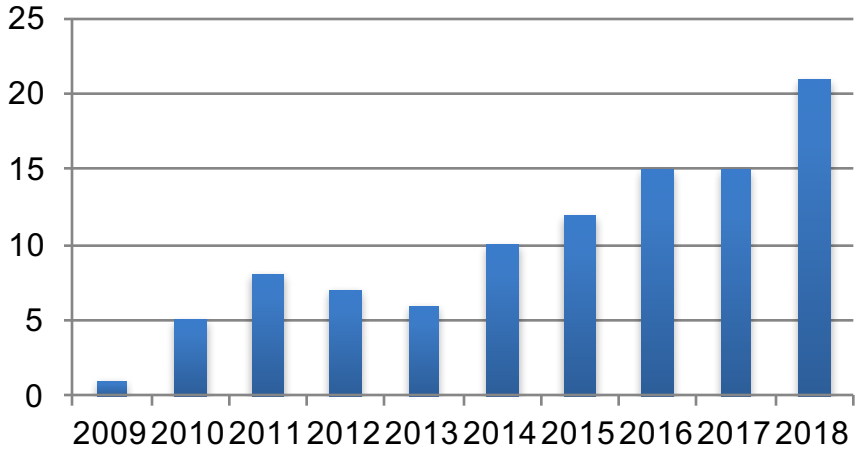
Recommendations for Subcutaneous Implantable Cardioverter-Defibrillator References that support the recommendations are summarized in Online Data Supplement 55.		
COR	**LOE**	**Recommendations**
I	B-NR	1. n patients who meet criteria for an ICD who have inadequate vascular access or are at high risk for infection, and in whom pacing for bradycardia or VT termination or as part of CRT is neither needed nor anticipated, a subcutaneous implantable cardioverter-defibrillator is recommended (1-5).
IIa	B-NR	2. In patients who meet indication for an ICD, implantation of a subcutaneous implantable cardioverter-defibrillator is reasonable if pacing for bradycardia or VT termination or as part of CRT is neither needed nor anticipated (1-4).
III: Harm	B-NR	3. In patients with an indication for bradycardia pacing or CRT, or for whom antitachycardia pacing for VT termination is required, a subcutaneous implantable cardioverter-defibrillator should not be implanted (1-4, 6-8).

2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death (online advance published October 2017)

S-ICD (até 31 Agosto 2018)

Hospital Santa Cruz

- n= 100
- Idade: 40,2±16,8 anos
- Prevenção primária: 71%
- Seguimento: 665 dias



Terapêutica apropriada: 19 in 7 patients (19%)
Tempo até choque: 22 ± 4,6s
Terapêutica inapropriada – 16% - (2 zonas 6%)

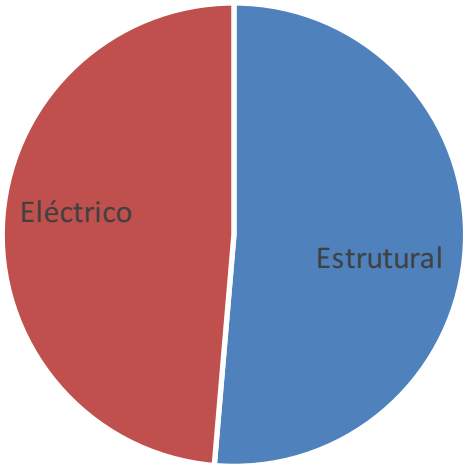
Indicação	n
Miocardiopatia hipertrófica	21
Miocardiopatia isquémica (Fej.<35%)	19
Miocardiopatia dilatada (Fej.<35%)	16
FV ventricular idiopática	12
Síndrome de Brugada	8
Displasia arritmogénica do VD	6
Ventrículo esquerdo não compactado	6
Outras causas	12

Porquê a preferência?	
Idade	41
Acesso vascular	10
Infecção CDI prévia	7
Disfunção prévia CDI	4

2018 – Estimado 31 dispositivos (aumento 50%)

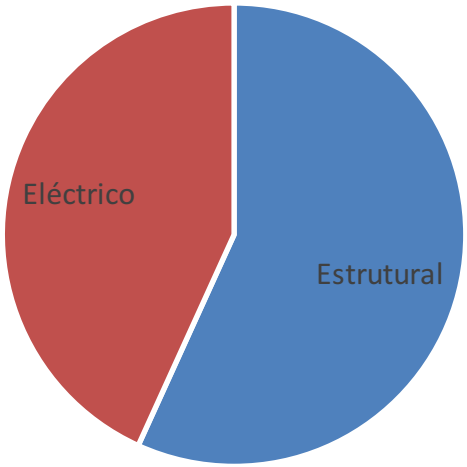
S-ICD (até 31 Agosto 2018)

Até 2014
n=37



9,7% total CDI uni
(n=163)

Até 2018
n=100



17% total CDI uni
(n=157)

CENTRO HOSPITALAR DE LISBOA OCIDENTAL, E.P.E.

Int J Cardiol. 2017 Apr 1;232:176-180. doi: 10.1016/j.ijcard.2017.01.034. Epub 2017 Jan 5.

Effectiveness of subcutaneous implantable cardioverter-defibrillators and determinants of inappropriate shock delivery.

Mesquita J[1], Cavaco D[2], Ferreira A[2], Lopes N[2], Santos PG[2], Carvalho MS[2], Haas A[3], Costa F[2], Carmo P[2], Morgado F[2], Adragão P[2], Mendes M[2].

Author information

Abstract

AIMS: Assess subcutaneous implantable cardioverter-defibrillator (S-ICD) effectiveness in the prevention of sudden cardiac death and the impact of demographics and the initial detection algorithm in the delivery of inappropriate shocks (safety).

METHODS: Real world prospective registry in which we assessed 54 patients (40±17years old, 85% males) who underwent S-ICD implantation for primary or secondary prevention of SCD. Safety and efficacy outcomes were defined as the delivery of inappropriate shocks and the prevention of sudden cardiac death, respectively. Tiered-therapy S-ICD had at least two programmed zones, determined by the longest RR interval.

RESULTS: During a mean follow-up of 2.6±1.9years, 6 patients (11%) died, none due to sudden cardiac death. Six patients (11%) received appropriate therapies, irrespectively of the established detection algorithm (p=0.59). All ventricular tachycardia and fibrillation episodes were adequately treated. Nine patients (17%) had inappropriate shocks: 6 without tiered-therapy vs 3 with previously programmed tiered-therapy (p=0.001). The yearly rate of inappropriate shocks was 17%/year with single zone detection vs 4%/year with tiered-therapy programming (p=0.007). Single-zone detection programming was an independent predictor of inappropriate shock delivery (HR 1.49, IC 95%: 1.05-18.80, p=0.04).

CONCLUSION: In this selected population of patients, the S-ICDs proved effective in preventing sudden cardiac death. Tiered-therapy was independently associated with a lower rate of inappropriate shock delivery.

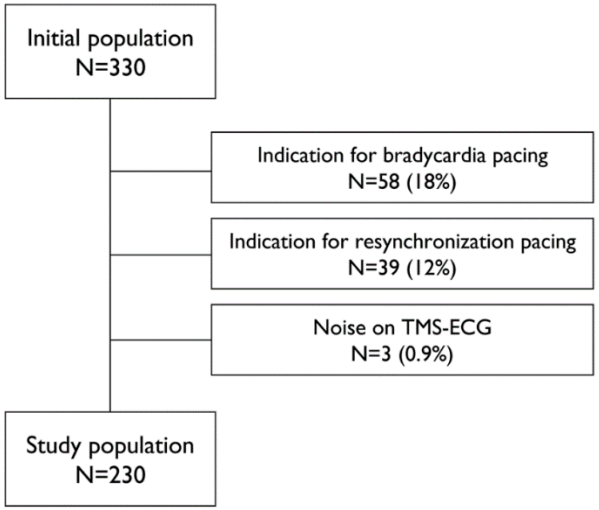
KEYWORDS: Defibrillator; Subcutaneous implantable cardioverter-defibrillator; Sudden cardiac death; Ventricular arrhythmia

PMID: 28082086 DOI: 10.1016/j.ijcard.2017.01.034

Experiencia do H Sta Cruz

- follow-up 2.6±1.9years
- 6 patients (11%) died
- None due to sudden cardiac death
- Six patients (11%) received appropriate therapies
- All ventricular tachycardia and fibrillation episodes were adequately treated
- Nine patients (17%) had inappropriate shocks:
  - 6 without tiered-therapy vs 3 with previously programmed tiered-therapy (p=0.001).
  - The yearly rate of inappropriate shocks was 17%/year with single zone detection vs 4%/year with tiered-therapy programming (p=0.007). Single-zone detection programming was an independent predictor of inappropriate shock delivery (HR 1.49, IC 95%: 1.05-18.80, p=0.04).

Quantos são potenciais candidatos?



Doentes consecutivos seguidos em consulta de CDI
"screening" para CDI-SC (ECG com derivações xifóide-V6; manúbrio-V6 e xifóide-manúbrio)
"screening tool"

Pelo menos 1 vector apropriado (em pé e deitado) em todos os complexos de ECG 10-20 seg

213 (93%) doentes passaram o screening
17 (7%) doentes falharam o screening
Vector primário/secundário – onda T grande
Vector alternativo – onda R pequena
13% de todos vectores medidos com discrepância pé/deitado

J Cardiovasc Electrophysiol, Vol. 25, pp. 494-499, May 2014

Quem são os candidatos?

- Doentes jovens (> 30 kg)
  - Elevado tempo de seguimento previsto (risco de complicações maior)
  - Síndrome Brugada, miocardiopatia hipertrófica
  - Cardiopatias congénitas operadas sem acesso às cavidades direitas (Fontan)
- Insuficientes renais em HD (elevado risco de infecção dos sistemas convencionais)
- Sobreviventes de FV, sem cardiopatia estrutural
- Prevenção primária em geral, desde que não candidatos a CRT (duração QRS) e sem necessidade de pacing
- Doentes não dependentes de pacing que já tiveram infecções de sistemas convencionais

- (possível implantar em doentes com sistemas de pacing bipolar)

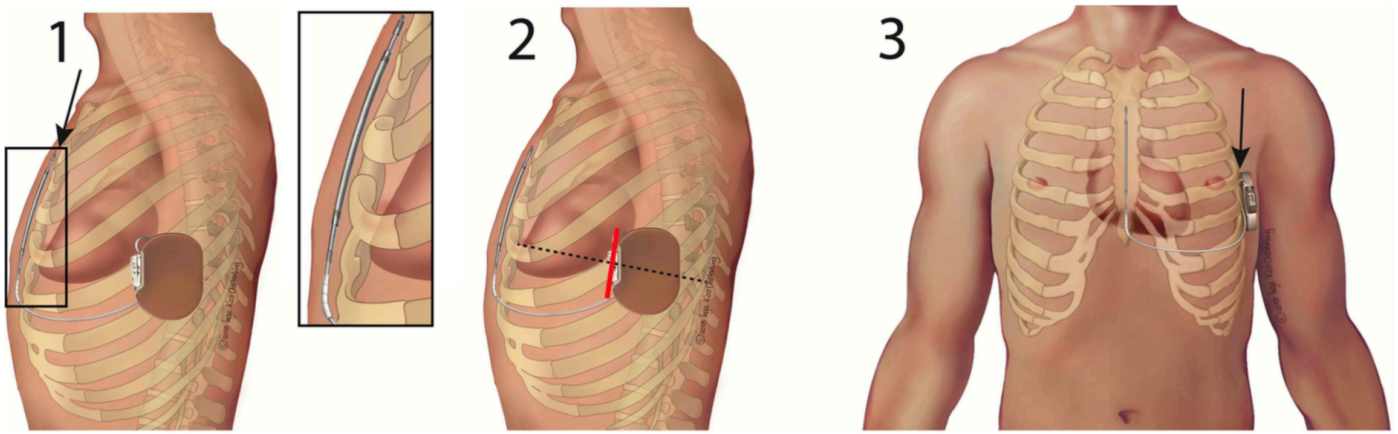
Limitações

- Pacing (taquicardia/bradicardia)
- Screening
- Gerador ainda grande (difícil de ser utilizado em crianças < 30 kg)
- Duração menor que CDI convencional (vamos saber com o tempo)

Motivos para não implantar

- Hábito/resistência mudança
- Medo da técnica (muito cirúrgica)
- Receio de que o doente venha a necessitar de pacing, CRT
- Receio choques inapropriados
- Necessidade de teste de desfibrilhação
- Preço

Score PRAETORIAN



Step 1)
Determine the number of coil widths of fat tissue between the **nearest** half of the S-ICD coil and the sternum or ribs.

≤ 1	coil-width	**30**
> 1 ≤ 2	coil-widths	**60**
> 2 ≤ 3	coil-widths	**90**
> 3	coil-widths	**150**

Step 2)
Determine the position of the S-ICD generator in relation to the mid-line (red line).

Generator is on or posterior of the mid-line	**x 1**
Entire generator is anterior of the mid-line	**x 2**
Entire generator is > 1/2 length anterior	**x 4**

Step 3)
Determine the amount of fat tissue between the **nearest** point of the generator and the thoracic wall.

< 1 generator-width	**x 1**
≥ 1 generator-width	**x 1.5**

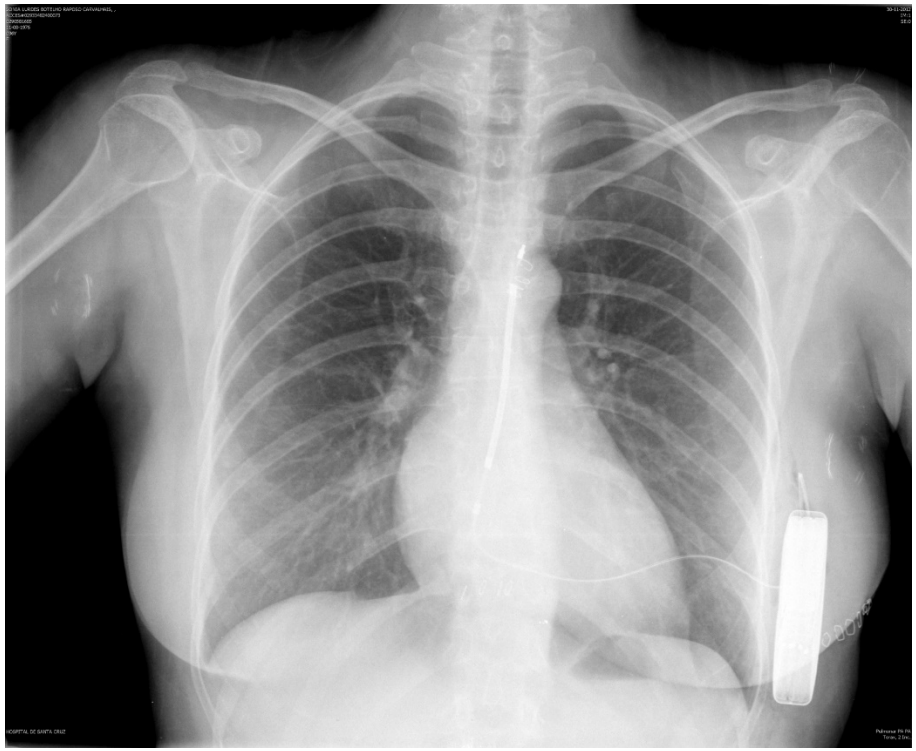
Step 4)

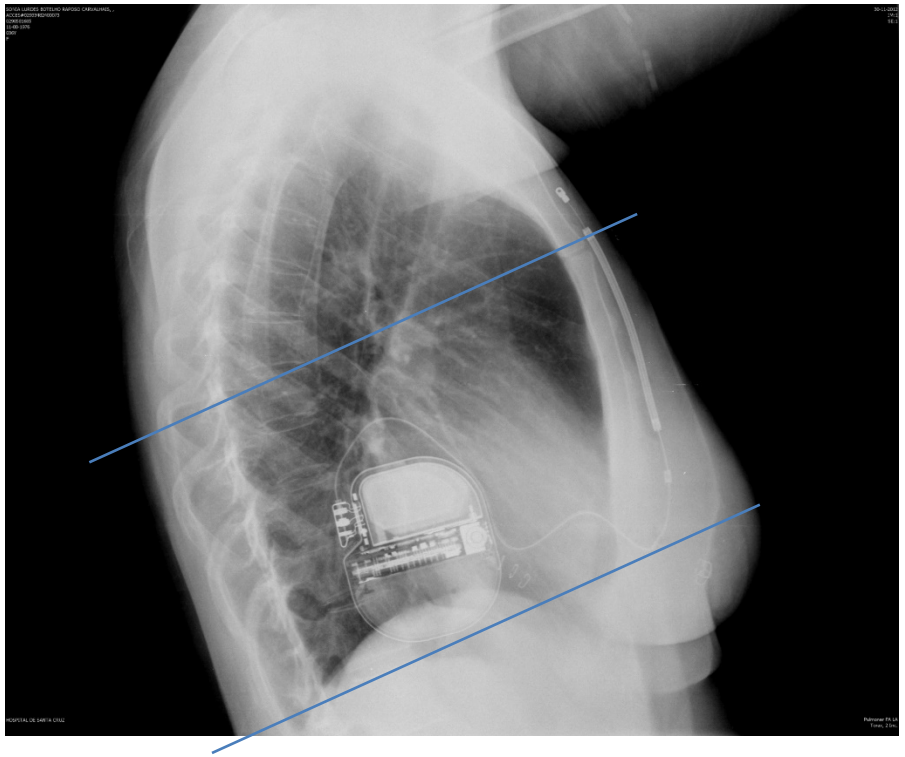
PRAETORIAN score ≥ 90:
BMI ≤ 25 kg/m² **- 40**
BMI ≥ 25 kg/m² **= Final score**

Final PRAETORIAN score

< 90	**Low risk of conversion failure**
90 < 150	**Intermediate risk of conversion failure**
≥ 150	**High risk of conversion failure**

Knops RE, Heart Rhythm (2018)

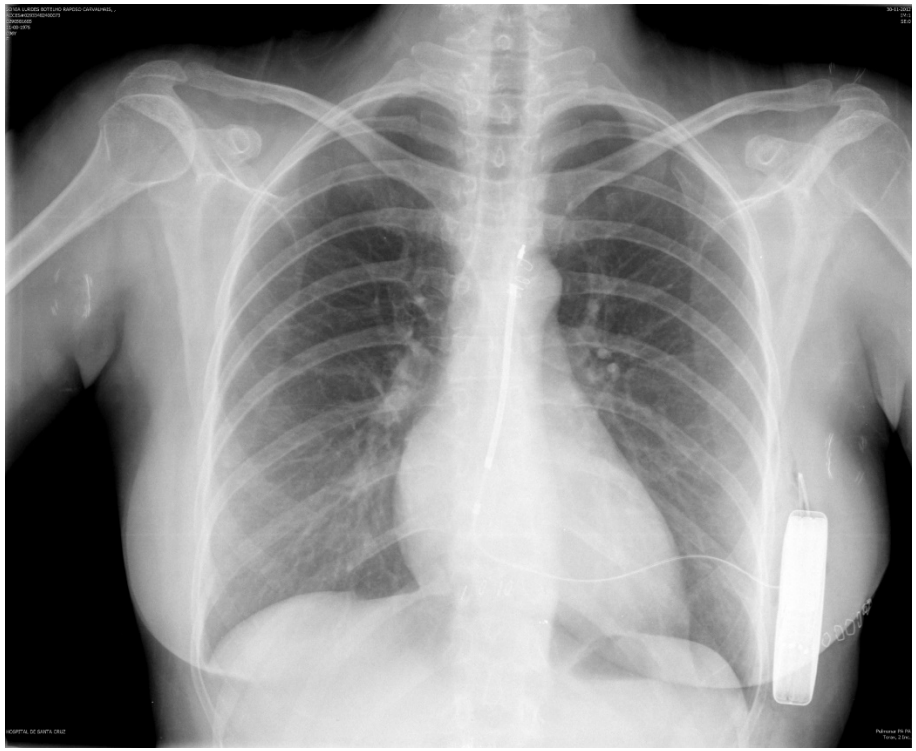


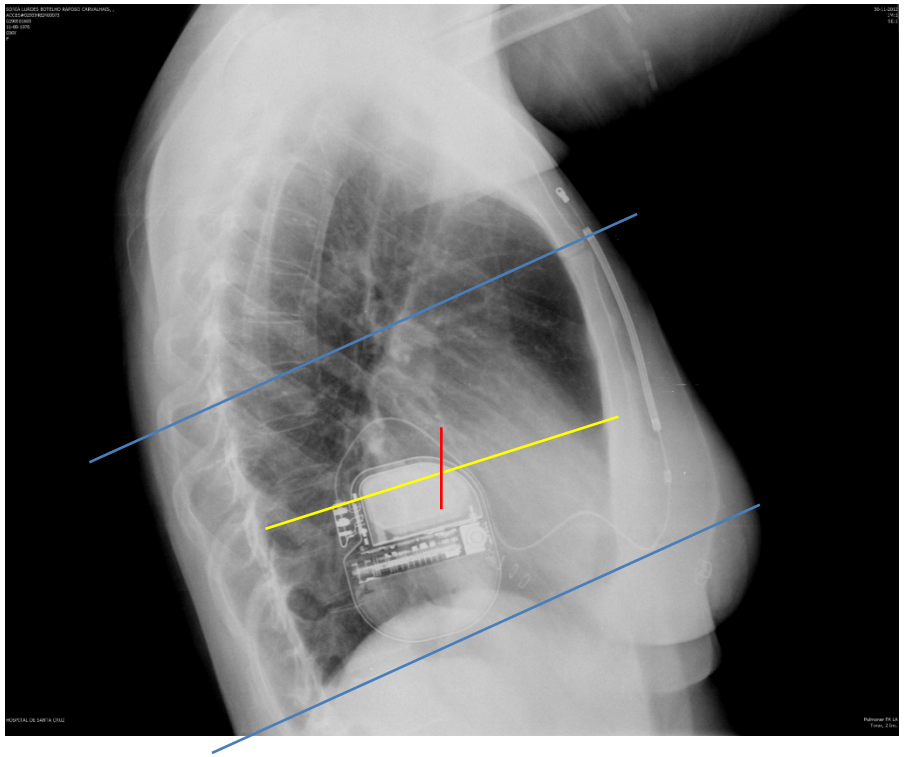


Podemo saplicar o score?
Coil acima do apêndice xifóide e abaixo do manúbrio
Topo do gerador na sombra cardíaca (2 projeções)

Hospital de Santa Cruz

Step 1 – 30 (espessura gordura abaixo esterno baixa)
Step 2 – x1 (gerador posterior)
Step 3 – x1 (espessura gordura abaixo gerador baixa)





SCORE=30 – risco baixo

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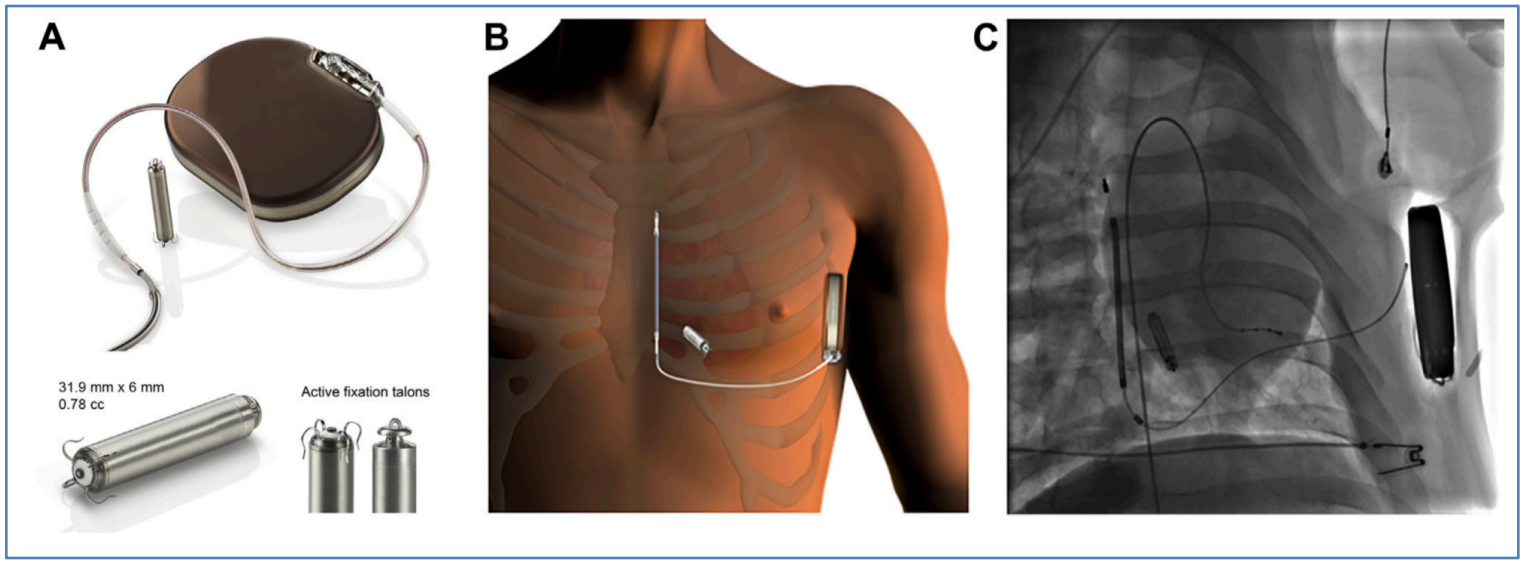
- Está a decorrer o ensaio PRAETORIAN DFT
- No futuro será possível implantar sem DFT?
- Não é uma solução perfeita... O RX é feito depois do implante...

Acute and 3-Month Performance of a Communicating Leadless Antitachycardia Pacemaker and Subcutaneous Implantable Defibrillator

Fleur V.Y. Tjong, MD,[a] Tom F. Brouwer, MD,[a] Brendan Koop, PHD,[b] Brian Soltis, MSC,[b] Allan Shuros, MSC,[b] Brian Schmidt, MSC,[b] Bryan Swackhamer, BSC,[b] Anne-Floor E.B. Quast, MD,[a] Arthur A.M. Wilde, MD, PHD,[a] Martin C. Burke, DO,[c] Reinoud E. Knops, MD, PHD[a]

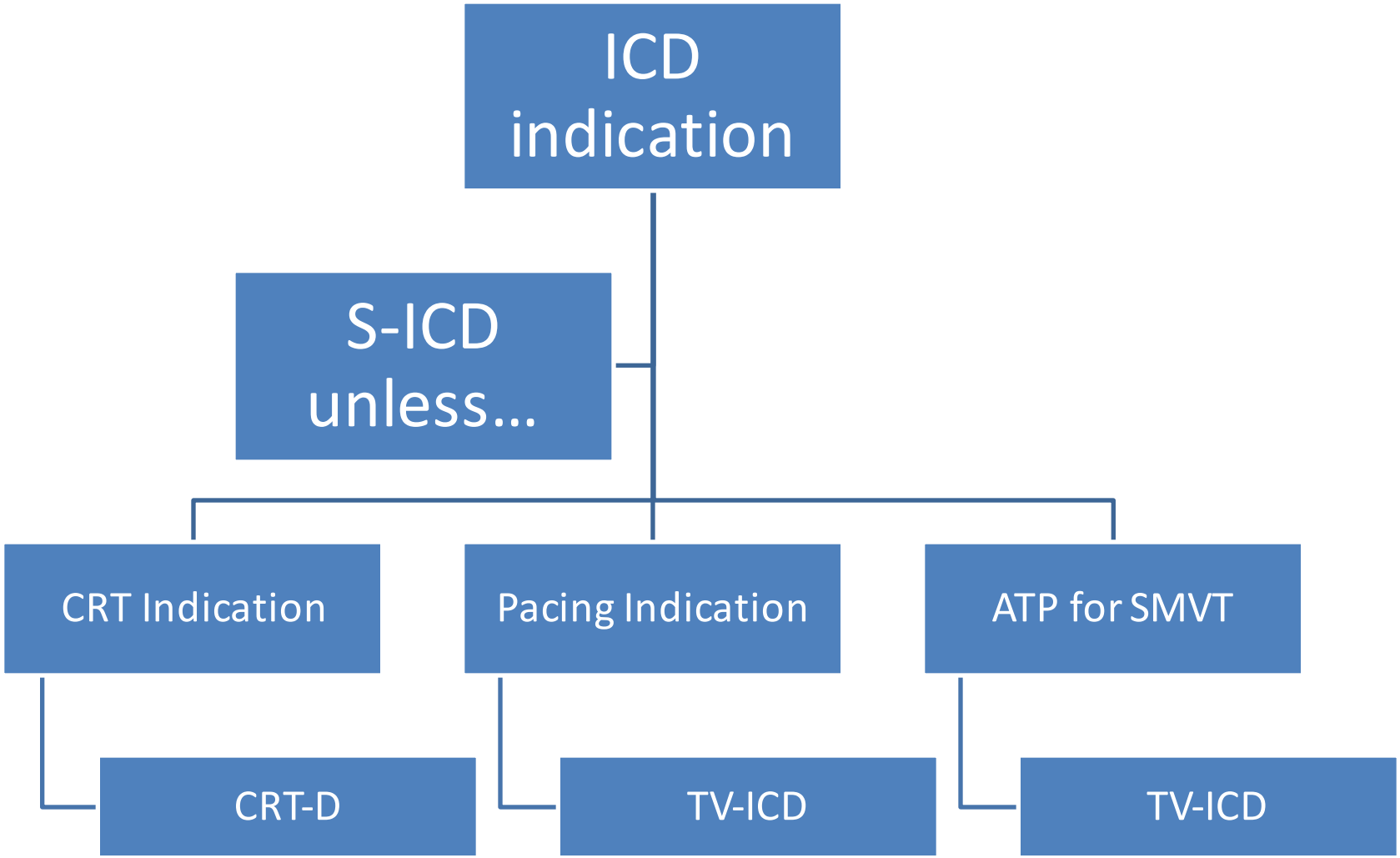


Knops R, J Am Coll Cardiol EP 2017;3:1487–98

Here's how 'The Simpsons' keeps predicting the future

By **Alexis Kleinman** | Jan. 19, 2018

Indicações futuras??



- 1. L Boersma. ICD from real life to the future: ICD innovations. ESC 2014

Conclusões

- Dispositivos sem eléctrodos intracavitários fazem seguramente parte do futuro do tratamento de bradi e taquiarritmias
- Já possuem hoje vantagens indiscutíveis sobre sistemas de que dispomos
- A lenta adopção da tecnologia é multifactorial
- É necessário identificar em cada centro quais os factores principapais que estão a tornar lenta a adopção do SICD