ESC
European Society of Cardiology
European Heart Journal (2021) **00**, 1–94
doi:10.1093/eurheartj/ehab364

ESC GUIDELINES

2021 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

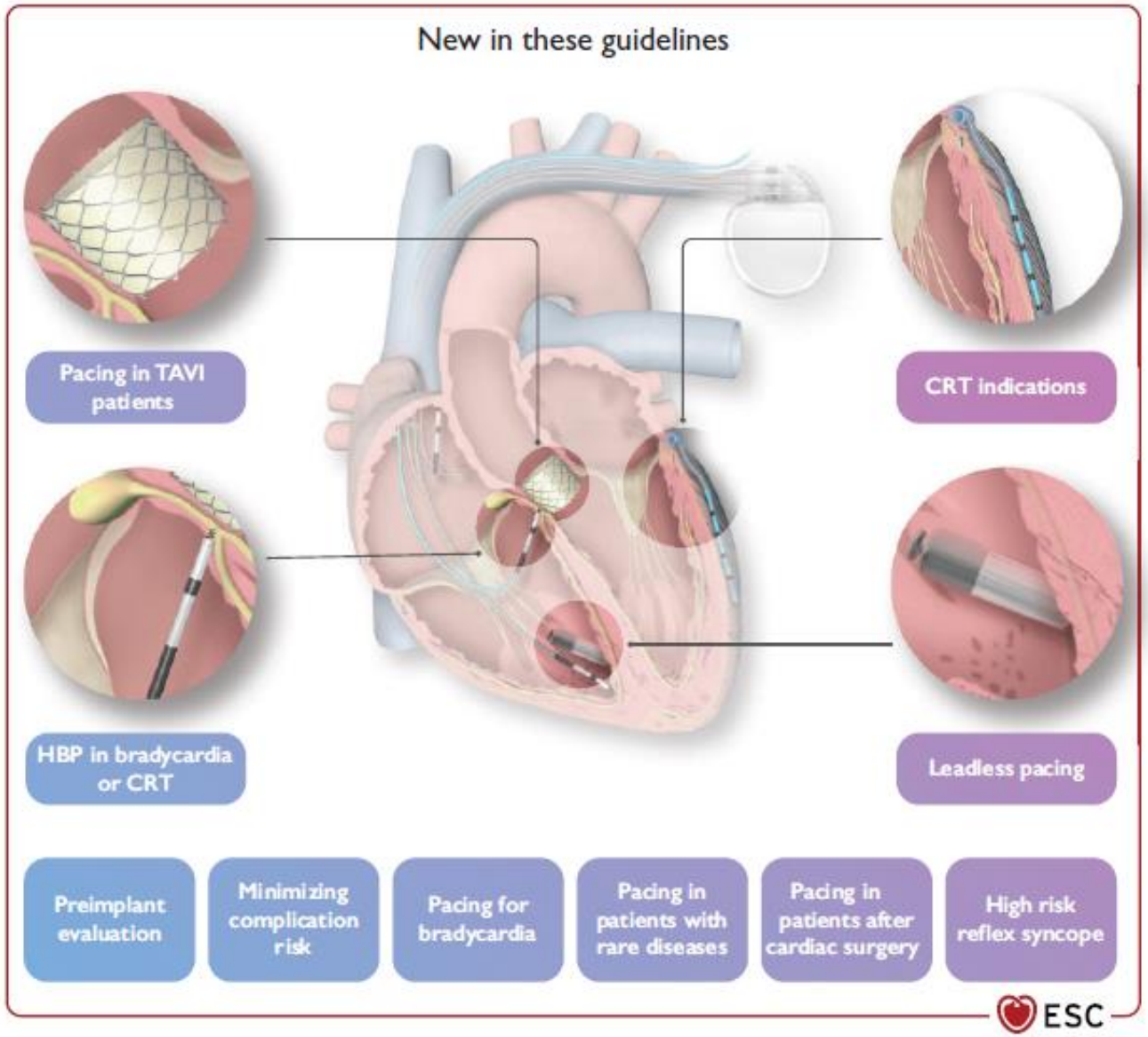
Developed by the Task Force on cardiac pacing and cardiac resynchronization therapy of the European Society of Cardiology (ESC)

With the special contribution of the European Heart Rhythm Association (EHRA)

Authors/Task Force Members: Michael Glikson * (Chairperson) (Israel), Jens Cosedis Nielsen* (Chairperson) (Denmark), Mads Brix Kronborg (Task Force Coordinator) (Denmark), Yoav Michowitz (Task Force Coordinator) (Israel), Angelo Auricchio (Switzerland), Israel Moshe Barbash (Israel), José A. Barrabés (Spain), Giuseppe Boriani (Italy), Frieder Braunschweig (Sweden), Michele Brignole (Italy), Haran Burri (Switzerland), Andrew J. S. Coats (United Kingdom), Jean-Claude Deharo (France), Victoria Delgado (Netherlands), Gerhard-Paul Diller (Germany), Carsten W. Israel (Germany), Andre Keren (Israel), Reinoud E. Knops (Netherlands), Dipak Kotecha (United Kingdom), Christophe Leclercq (France),

Nicolas Lellouche
Fédération de Cardiologie
Hopital Henri Mondor
Créteil

- Dernières guidelines ESC en 2013



Indications du pacing: pas de changement majeur

Recommendations for pacing in sinus node dysfunction

Recommendations	Class[a]	Level[b]
In patients with SND and a DDD pacemaker, minimization of unnecessary ventricular pacing through programming is recommended.[144,151,159,164,166–169]	I	A
Pacing is indicated in SND when symptoms can clearly be attributed to bradyarrhythmias.[14,128–131]	I	B
Pacing is indicated in symptomatic patients with the bradycardia–tachycardia form of SND in order to correct bradyarrhythmias and enable pharmacological treatment, unless ablation of the tachyarrhythmia is preferred.[17,20,21,136–138,170,171]	I	B
In patients who present chronotropic incompetence and have clear symptoms during exercise, DDD with rate-responsive pacing should be considered.[172,173]	IIa	B
AF ablation should be considered as a strategy to avoid pacemaker implantation in patients with AF-related bradycardia or symptomatic pre-automaticity pauses, after AF conversion, taking into account the clinical situation.[136–139,174]	IIa	C
In patients with the bradycardia–tachycardia variant of SND, programming of atrial ATP may be considered.[161,163]	IIb	B
In patients with syncope, cardiac pacing may be considered to reduce recurrent syncope when asymptomatic pause(s) >6 s due to sinus arrest is documented.[133,134]	IIb	C
Pacing may be considered in SND when symptoms are likely to be due to bradyarrhythmias, when the evidence is not conclusive.	IIb	C
Pacing is not recommended in patients with bradyarrhythmias related to SND that are asymptomatic or due to transient causes that can be corrected and prevented.[33]	III	C

© ESC 2021

Recommendations for pacing for atrioventricular block

Recommendations	Class[a]	Level[b]
Pacing is indicated in patients in SR with permanent or paroxysmal third- or second-degree type 2, infranodal 2:1, or high-degree AVB, irrespective of symptoms.[c 9–12]	I	C
Pacing is indicated in patients with atrial arrhythmia (mainly AF) and permanent or paroxysmal third- or high-degree AVB irrespective of symptoms.	I	C
In patients with permanent AF in need of a pacemaker, ventricular pacing with rate response function is recommended.[201–204]	I	C
Pacing should be considered in patients with second-degree type 1 AVB that causes symptoms or is found to be located at intra- or infra-His levels at EPS.[177–180]	IIa	C
In patients with AVB, DDD should be preferred over single-chamber ventricular pacing to avoid pacemaker syndrome and to improve quality of life.[20,140,181,182]	IIa	A
Permanent pacemaker implantation should be considered for patients with persistent symptoms similar to those of pacemaker syndrome and clearly attributable to first-degree AVB (PR >0.3 s).[205–207]	IIa	C
Pacing is not recommended in patients with AVB due to transient causes that can be corrected and prevented.	III	C

© ESC 2021

INDICATION DE PM AVEC BLOC DE BRANCHE

Recommendations	Class[a]	Level[b]
In patients with unexplained syncope and bifascicular block, a pacemaker is indicated in the presence of either a baseline HV of ≥70 ms, second- or third-degree intra- or infra-Hisian block during incremental atrial pacing, or an abnormal response to pharmacological challenge.[119,120]	I	B
Pacing is indicated in patients with alternating BBB with or without symptoms.	I	C
Pacing may be considered in selected patients with unexplained syncope and bifascicular block without EPS (elderly, frail patients, high-risk and/or recurrent syncope).[213]	IIb	B
Pacing is not recommended for asymptomatic BBB or bifascicular block.[115,121,215]	III	B

Indication à la resynchronisation cardiaque

- BBG et QRS ≥130 ms (ou lieu de 120 ms)
- Indication à upgrade si > 20% de stimulation VD
- Indication si FA rapide avec FEVG< 50% avant ablation NAV quelque soit la largeur des QRS

Recommendation for upgrade from right ventricular pacing to cardiac resynchronization therapy

Recommendation	Class[a]	Level[b]
Patients who have received a conventional pacemaker or an ICD and who subsequently develop symptomatic HF with LVEF ≤35% despite OMT, and who have a significant[c] proportion of RV pacing, should be considered for upgrade to CRT.[37,148,185,190,324–352]	IIa	B

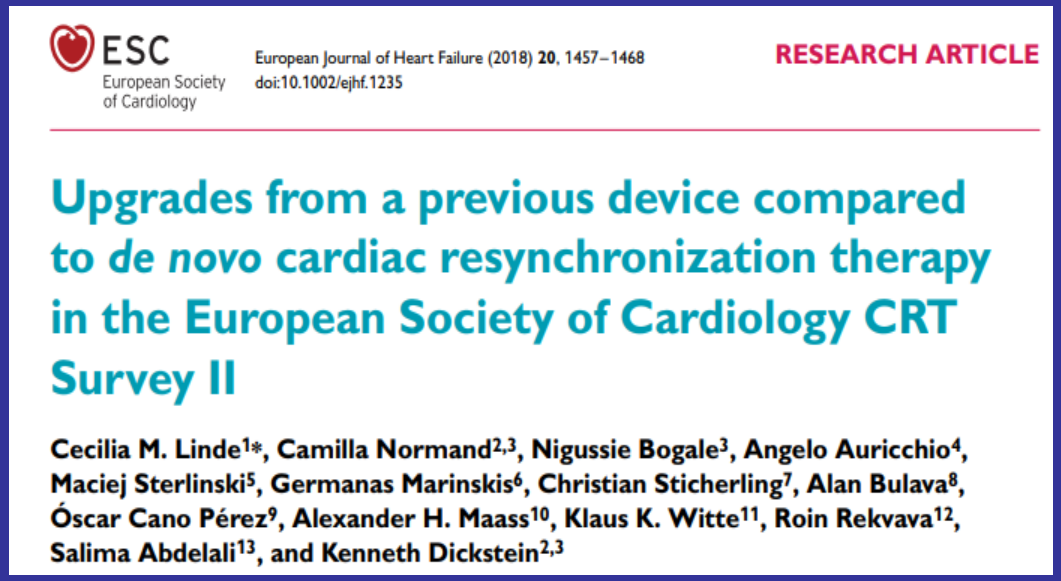
CRT = cardiac resynchronization therapy; HF = heart failure; ICD = implantable cardioverter-defibrillator; LVEF = left ventricular ejection fraction; OMT = optimal medical therapy; RV = right ventricular.

[a]Class of recommendation.

[b]Level of evidence.

[c]A limit of 20% RV pacing for considering interventions for pacing-induced HF is supported by observational data. However, there are no data to support that any percentage of RV pacing can be considered as defining a true limit below which RV pacing is safe and beyond which RV pacing is harmful.

Quels patients sont à risque de développer une IC après un pace-maker standard?



ESC European Society of Cardiology

European Journal of Heart Failure (2018) **20**, 1457–1468
doi:10.1002/ejhf.1235

RESEARCH ARTICLE

Upgrades from a previous device compared to *de novo* cardiac resynchronization therapy in the European Society of Cardiology CRT Survey II

Cecilia M. Linde[1]*, Camilla Normand[2,3], Nigussie Bogale[3], Angelo Auricchio[4], Maciej Sterlinski[5], Germanas Marinskis[6], Christian Sticherling[7], Alan Bulava[8], Óscar Cano Pérez[9], Alexander H. Maass[10], Klaus K. Witte[11], Roin Rekvava[12], Salima Abdelali[13], and Kenneth Dickstein[2,3]

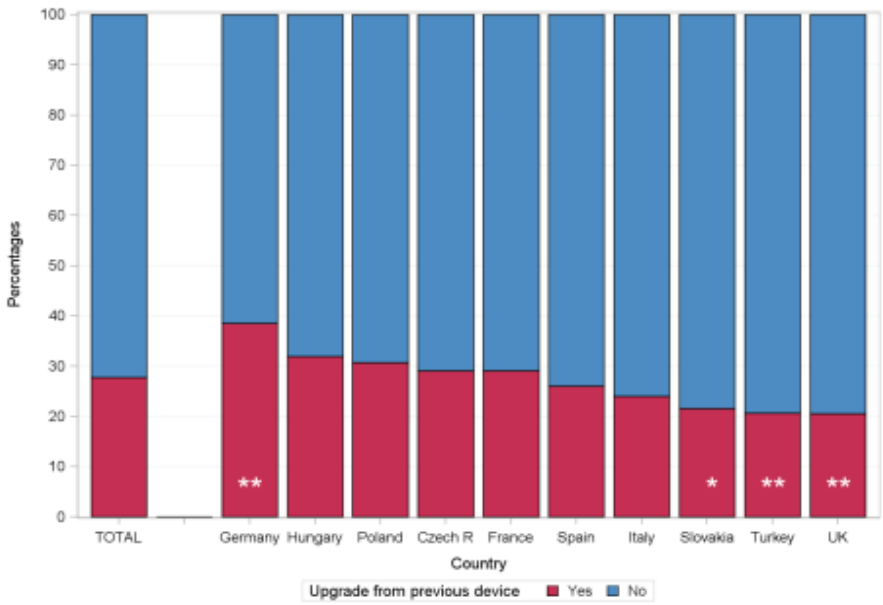


Figure 2 Upgrades in top 10 recruiting countries: cardiac resynchronization therapy-pacemaker (CRT-P) compared to cardiac resynchronization therapy-defibrillator (CRT-D).

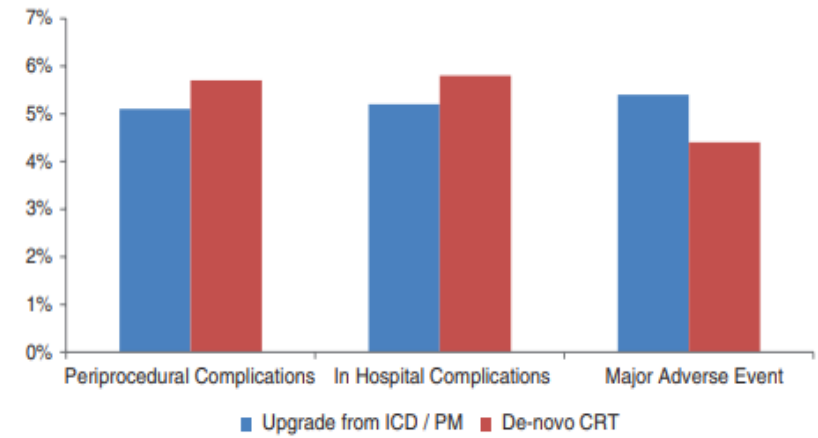


Figure 1 Success rate of procedure in relation to upgrading from a previous device or *de novo* implantation. CRT, cardiac resynchronization therapy; ICD, implantable cardioverter-defibrillator; PM, pacemaker.

Table 1 Clinical characteristics

	Upgrades PM/ICD ($n = 2398$)	*De novo* ($n = 7933$)	*P*-value
Demographics			
Age, years (IQR)	72 (64–78)	69 (62–76)	<0.0001
Age > 75 years	37.9% (909/2398)	30.2% (2398/7930)	<0.0001
Female sex	18.8% (451/2398)	26.1% (2065/7927)	<0.0001
Currently enrolled in a trial	7.1% (169/2395)	8.6% (680/7915)	0.01665
Primary aetiology			
Ischaemic	48.2% (1147/2380)	43.7% (3448/7892)	0.046
Non-ischaemic	43.5% (1035/2380)	51.3% (4052/7892)	
Other	8.3% (198/2380)	5.0% (392/7892)	
Previous history			
Myocardial infarction	40.3% (957/2375)	35.2% (2777/7886)	<0.0001
PCI/CABG	43.1% (1023/2372)	37.8% (2979/7884)	<0.0001
Valvular disease	32.2% (764/2371)	25.3% (1998/7883)	<0.0001
Valvular surgery	36.5% (337/923)	28.7% (739/2571)	0.0001
Hypertension	65.5% (1550/2366)	63.6% (5003/7870)	0.08456
Diabetes	32.2% (763/2373)	31.2% (2463/7885)	0.39902
COPD	11.6% (275/2372)	12.0% (949/7885)	0.56049
Anaemia	16.8% (398/2371)	14.1% (1115/7881)	0.00150
GFR <60 mL/kg/min	40.9% (971/2375)	28.3% (2226/7869)	<0.00001
HF hospitalization <1 year	47.2% (1119/2371)	47.3% (3730/7881)	0.90895
Atrial fibrillation	54.5% (1292/2369)	36.6% (2887/7884)	<0.00001
Paroxysmal	31.7% (409/1292)	36.3% (1049/2887)	
Persistent	21.7% (281/1292)	22.8% (658/2887)	
Permanent	45.8% (592/1292)	40.4% (1165/2887)	
Missing	0.8% (10/1292)	0.5% (15/28879)	
Previous device*			
PM	60.9% (1460/2398)	N/A	
ICD	39.8% (955/2398)	N/A	

CABG, coronary artery bypass grafting; COPD, chronic obstructive pulmonary disease; GFR, glomerular filtration rate; HF, heart failure; ICD, implantable cardioverter-defibrillator; IQR, interquartile range; N/A, not applicable; PCI, percutaneous coronary intervention; PM, pacemaker.
*More than one option could be chosen.

Upgrade: Plus Âgé, C ischémique, homme, FA, I Rénale, IC plus grave.

Table 2 Pre-implantation clinical evaluation and ECG

	Upgrades PM/ICD ($n = 2398$)	*De novo* ($n = 7933$)	*P*-value
NYHA class			<0.00001
I	2.5% (60/2357)	3.5% (275/7829)	
II	33.0% (778/2357)	38.4% (3009/7829)	
III	59.1% (1392/2357)	53.9% (4223/7829)	
IV	5.4% (127/2357)	4.1% (322/7829)	
BMI, kg/m^2, median (IQR)	27 (25–31) ($n = 2291$)	27 (24–30) ($n = 7551$)	0.26781
Systolic BP, mmHg, median (IQR)	120 (110–134) ($n = 2326$)	123 (110–138) ($n = 7722$)	<0.00001
Diastolic BP, mmHg, median (IQR)	70 (65–80) ($n = 2324$)	72 (66–80) ($n = 7721$)	0.00053
Echocardiography			
LVEF,%	30 (22–34) ($n = 2342$)	29 (23–33) ($n = 7806$)	0.3882
LVEF ≥35%	14.1% (331/2342)	11.5% (901/7806)	
LVEDD, mm, median (IQR)	63 (57–69) ($n = 1862$)	63 (58–69) ($n = 6293$)	0.09855
Mitral regurgitation			0.00756
Mild	42.9% (940/2189)	47.7% (3443/7219)	
Moderate	29.1% (637/2189)	26.0% (1875/7219)	
Severe	7.9% (174/2189)	6.6% (1423/7219)	
None	20.0% (1935/2189)	19.7% (1423/7219)	
Laboratory, median (IQR)			
NT-proBNP, pg/mL	2811 (1264–6818) ($n = 848$)	2228 (984–5131) ($n = 2492$)	<0.00001
BNP, ng/L	479 (164–1159) ($n = 283$)	430 (153–1127) ($n = 1016$)	0.44957
Hb, g/dL	13 (12–15) ($n = 2249$)	138 (12–15) ($n = 7408$)	0.50769
SCr, μmol/L	108 (88–139) ($n = 1356$)	98 (82–126) ($n = 4273$)	<0.00001
Pre-implantation ECG			
Heart rate, b.p.m., median (IQR)	70 (65–76)	71 (61–82)	<0.00001
Atrial rhythm			
Sinus rhythm	49.7% (1170/2354)	75.8% (5937/7829)	
Atrial fibrillation	34.4% (810/2354)	22.9% (1791/7829)	
Atrial paced	10.3% (243/2354)	0.1% (9/7829)	
Other	5.6% (131/2354)	1.2% (92/7829)	
PR interval, ms, median (IQR)	180 (157/215)	180 (160/210)	0.47623
AV block II/III,%	44.2% (1028/2327)	10.0% (770/7728)	<0.00001
Paced QRS duration, ms, median (IQR)	180 (160–200)	178 (135–191)	0.05004
Intrinsic QRS duration, ms, median (IQR)	160 (140–180)	160 (140–171)	0.00002
< 120	9.2% (123/1344)	7.3% (563/7738)	
120–130	6.0% (80/1344)	5.2% (401/7738)	
130–150	16.3% (219/1344)	19.1% (1479/7738)	
150–180	39.1% (526/1344)	48.7% (3772/7738)	
> 180	29.5% (396/1344)	19.7% (1523/7738)	
Intrinsic QRS morphology			
LBBB	58.9% (1368/2323)	77.7% (6976/7822)	<0.00001
RBBB	4.9% (137/2323)	7.3% (6569/7822)	0.00005
Indeterminable	17.1% (397/2323)	8.0% (626/7822)	<0.00001
Normal	7.3% (170/2323)	7.3% (568/7822)	0.92658
Missing	11.9% (277/2323)	0.1% (4/7822)	
PM-dependent	51.9% (1213/2338)	0.4% (30/7767)	<0.00001
AV nodal ablation*			<0.00001
Performed	47.6% (78/164)	12.9% (81/627)	
Planned	52.4% (86/164)	87.1% (546/627)	
Indication for CRT†			
HF wide QRS	52.1% (1240/2381)	63.1% (4964/7870)	<0.00001
HF or LV dysfunction and an ICD indication	42.0% (1000/2381)	49.9% (3926/7870)	<0.00001
PM indication and expected to be dependent of RV pacing	39.0% (929/2381)	17.4% (1368/7870)	<0.00001
Mechanical dyssynchrony	12.8% (305/2381)	11.1% (872/7870)	0.02036
Other	6.7% (159/2381)	3.0% (240/7870)	0.02036

2) In patients with symptomatic AF and an uncontrolled heart rate who are candidates for AVJ ablation (irrespective of QRS duration):		
2A) CRT is recommended in patients with HFrEF.[196,197,306,308]	I	B
2B) CRT rather than standard RV pacing should be considered in patients with HFmrEF.	IIa	C
2C) RV pacing should be considered in patients with HFpEF.[188,196,323]	IIa	B
2D) CRT may be considered in patients with HFpEF.	IIb	C

ESC European Society of Cardiology

European Heart Journal (2021) **42**, 4731–4739
doi:10.1093/eurheartj/ehab569

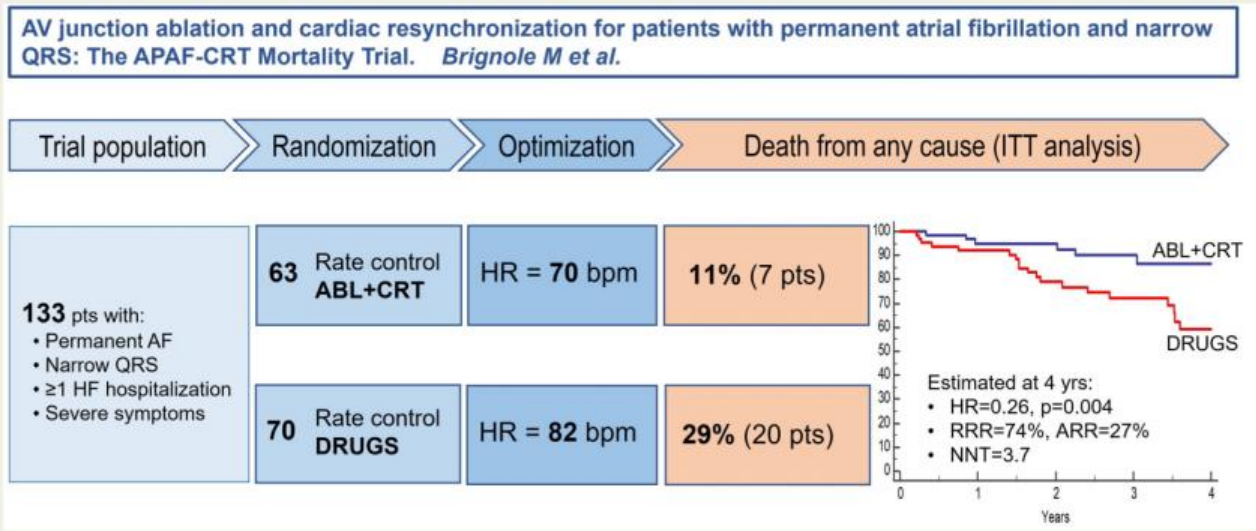
FASTTRACK CLINICAL RESEARCH
Arrhythmias

AV junction ablation and cardiac resynchronization for patients with permanent atrial fibrillation and narrow QRS: the APAF-CRT mortality trial

Michele Brignole [1,2]*, Francesco Pentimalli [3], Pietro Palmisano [4], Maurizio Landolina[5], Fabio Quartieri[6], Eraldo Occhetta[7], Leonardo Calò [8], Giuseppe Mascia [9], Lluis Mont[10], Kevin Vernooy [11], Vincent van Dijk[12], Cor Allaart[13], Laurent Fauchier [14], Maurizio Gasparini [15], Gianfranco Parati [2,16], Davide Soranna[17], Michiel Rienstra [18], and Isabelle C. Van Gelder[18]; for the APAF-CRT Trial Investigators†

Study registration ClinicalTrials.gov Identifier: NCT02137187.

Graphical Abstract



Keywords Atrial fibrillation • Heart failure • Cardiac resynchronization therapy • Catheter ablation • AV node ablation • QRS width

Recommendation for patients with heart failure and atrioventricular block

Recommendation	Class[a]	Level[b]
CRT rather than RV pacing is recommended for patients with HFrEF (<40%) regardless of NYHA class who have an indication for ventricular pacing and high-degree AVB in order to reduce morbidity. This includes patients with AF.[183,190,196,268,313,323,357–359,361,362]	I	A

The NEW ENGLAND JOURNAL of MEDICINE

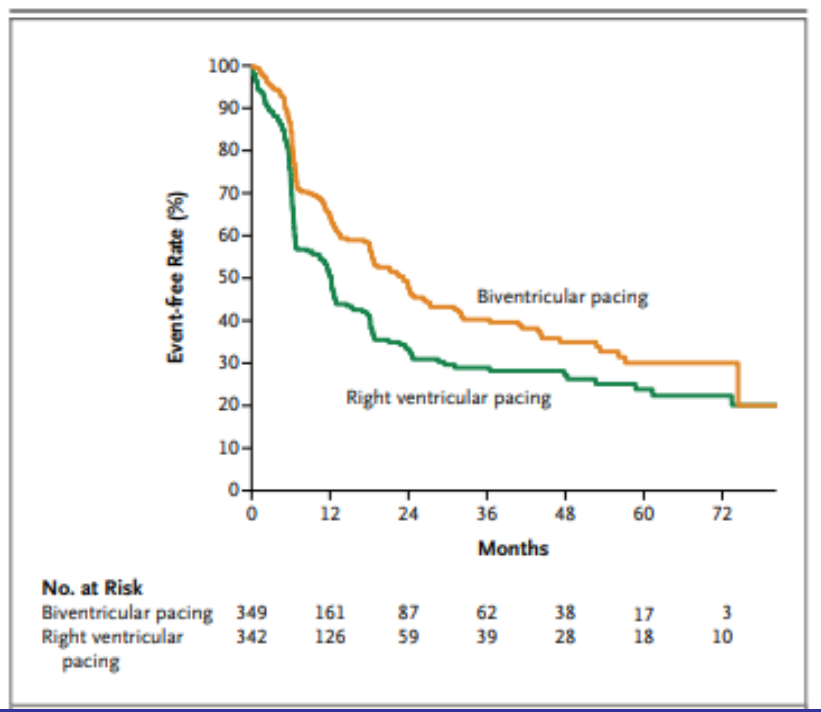
ORIGINAL ARTICLE

Biventricular Pacing for Atrioventricular Block and Systolic Dysfunction

Anne B. Curtis, M.D., Seth J. Worley, M.D., Philip B. Adamson, M.D., Eugene S. Chung, M.D., Imran Niazi, M.D., Lou Sherfesee, Ph.D., Timothy Shinn, M.D., and Martin St. John Sutton, M.D., for the Biventricular versus Right Ventricular Pacing in Heart Failure Patients with Atrioventricular Block (BLOCK HF) Trial Investigators

METHODS

We enrolled patients who had indications for pacing with atrioventricular block; New York Heart Association (NYHA) class I, II, or III heart failure; and a left ventricular ejection fraction of 50% or less. Patients received a cardiac-resynchronization pacemaker or implantable cardioverter–defibrillator (ICD) (the latter if the patient had an indication for defibrillation therapy) and were randomly assigned to standard right ventricular pacing or biventricular pacing. The primary outcome was the time to death from any cause, an urgent care visit for heart failure that required intravenous therapy, or a 15% or more increase in the left ventricular end-systolic volume index.



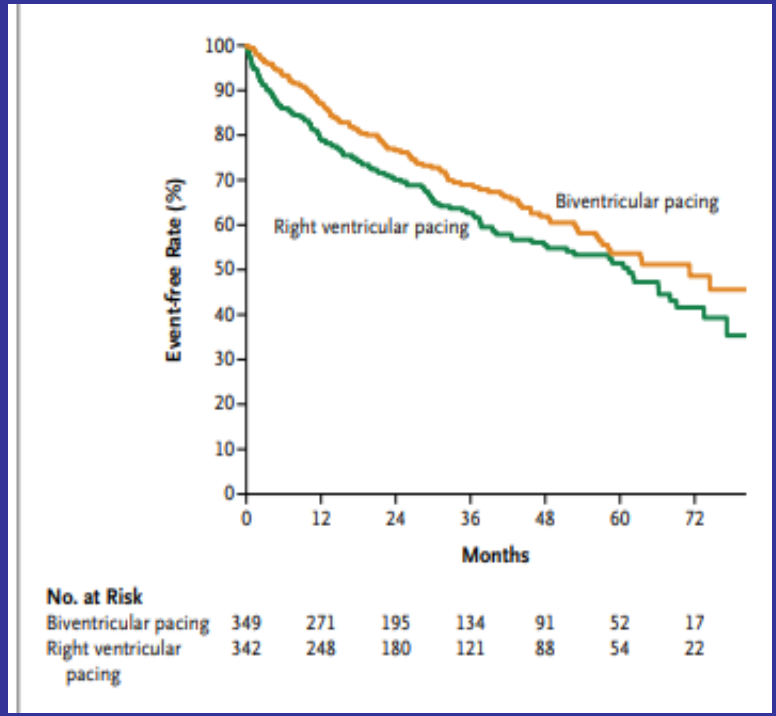
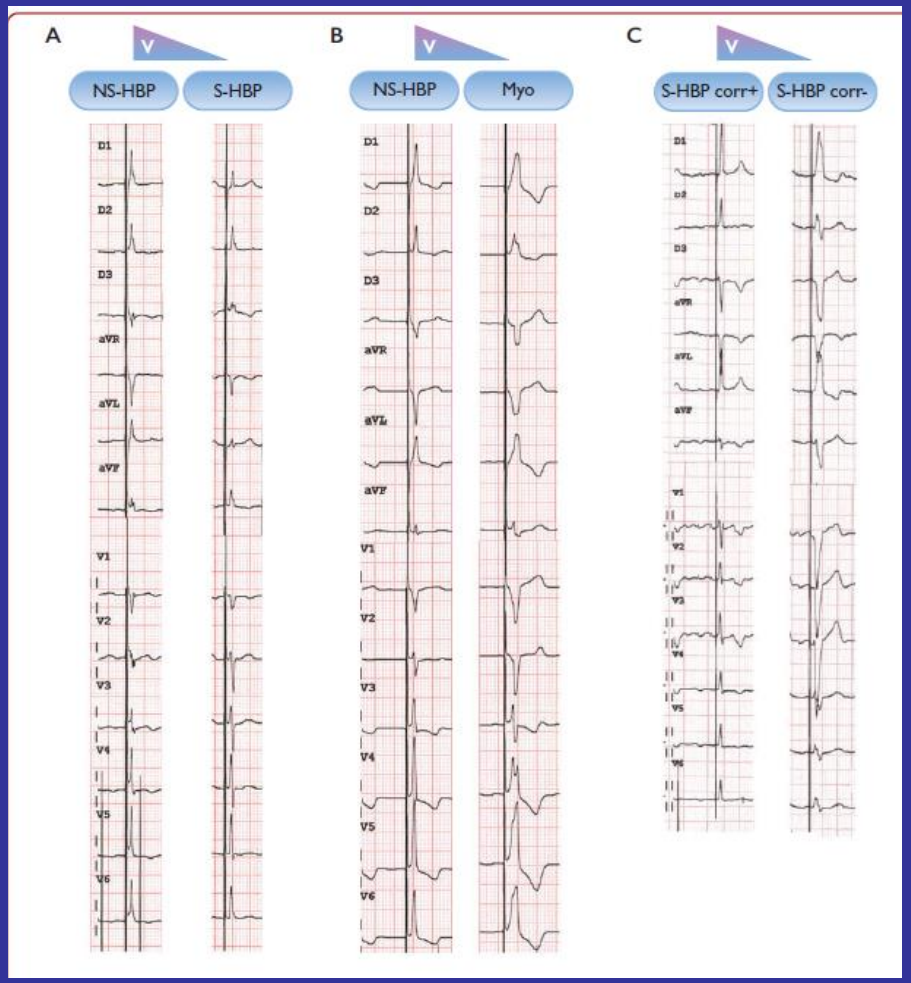


Figure 3. Freedom from the Clinical Components of the Primary Outcome.
The clinical components of the primary outcome included death from any cause or an urgent care visit for heart failure. There was a significant difference in favor of biventricular pacing over right ventricular pacing (hazard ratio, 0.73; 95% credible interval, 0.57 to 0.92).

- Rajout de la stimulation physiologique : stimulation hissienne et/ou de branche gauche en alternative à la CRT si échec



- Avantages de la stimulation physiologique:

-QRS fins

-Probable amélioration de l'hémodynamique

- Inconvénients:

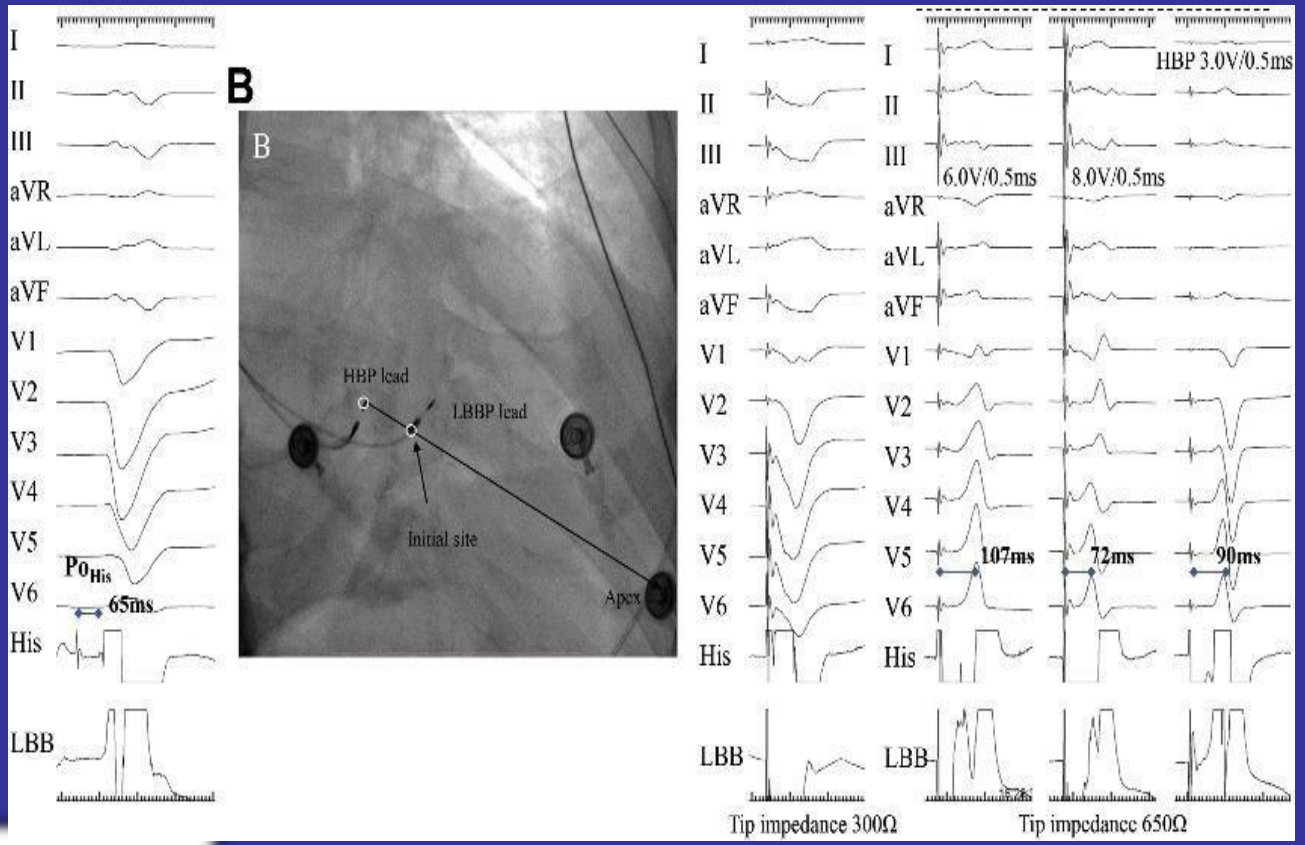
-Longueur et difficulté de la procédure

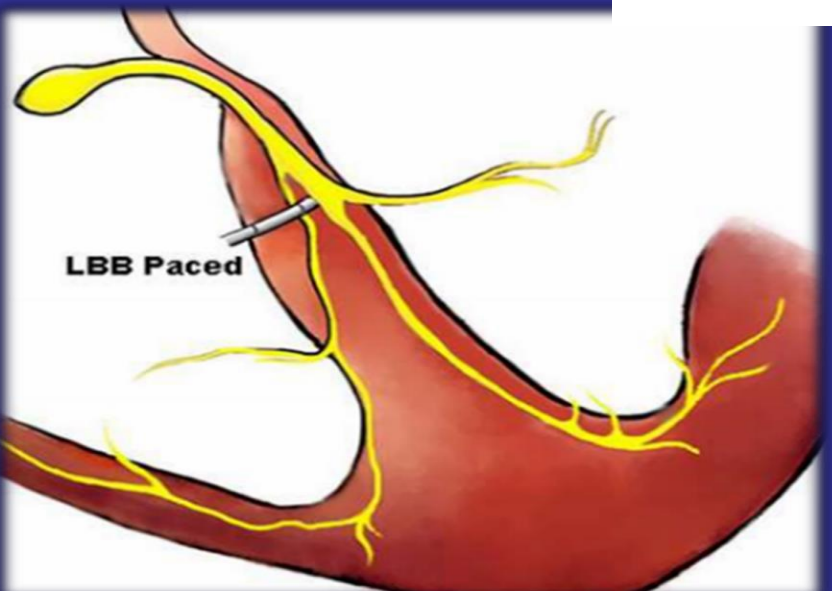
-Elévation des seuils

-Surdétection atriale

Nécessité d'une sonde VD en back-up?

Nombreuses études en cours pour évaluer son efficacité par rapport à la CRT

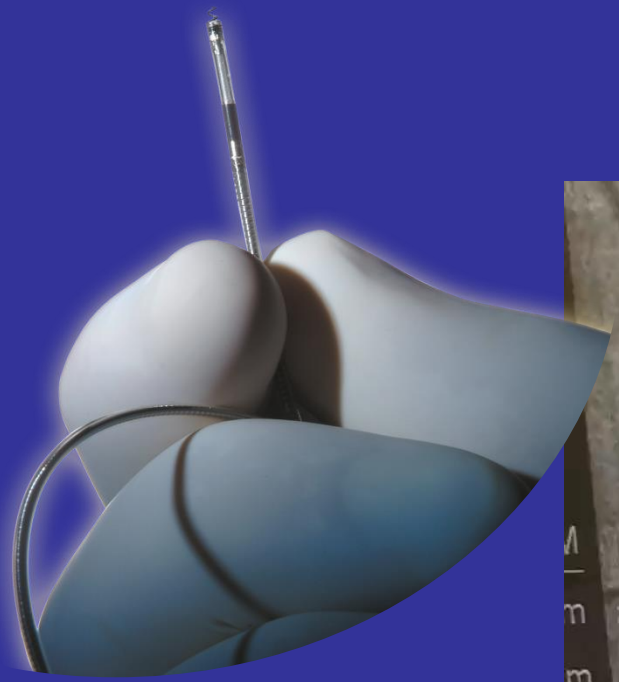


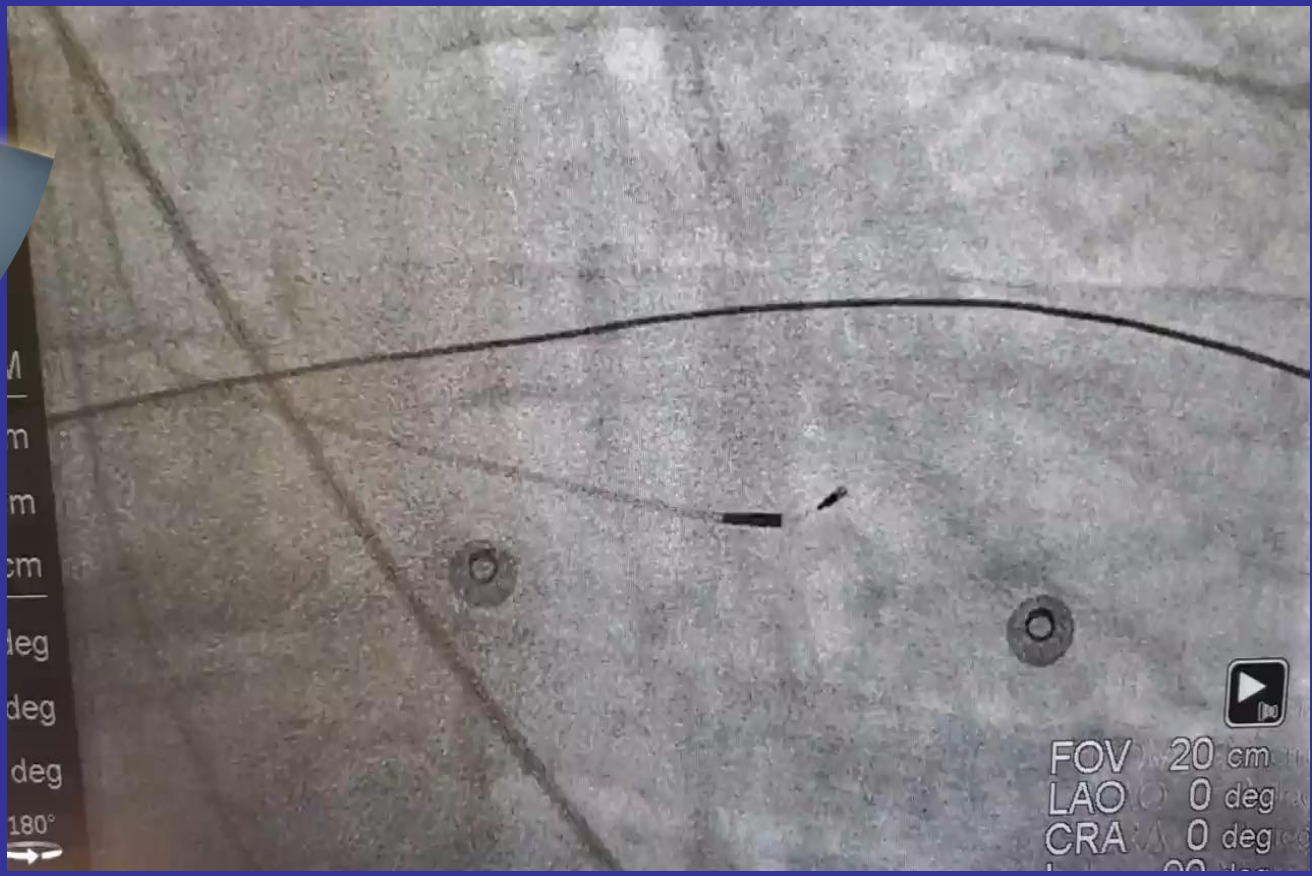


Montée d'impédance puis baisse

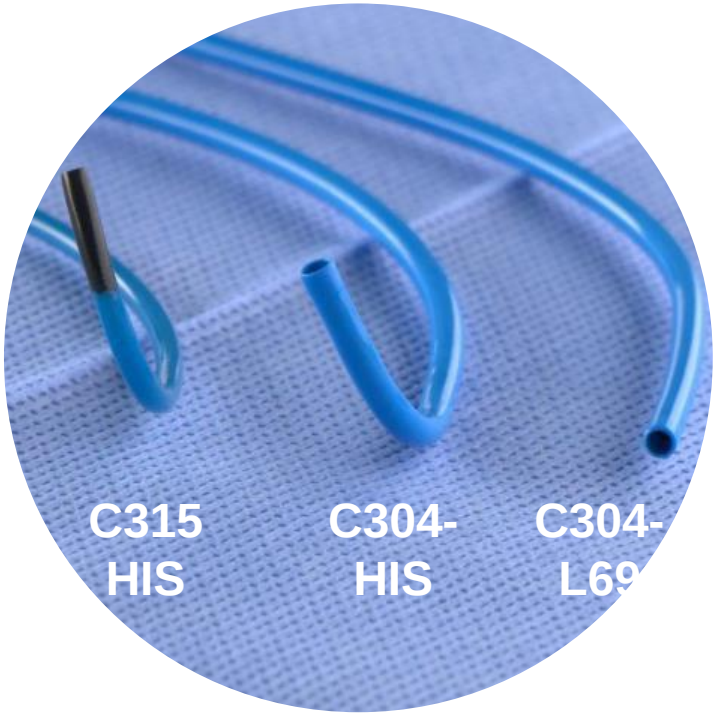
SONDES PARTICULIERES

Medtronic 4F: 3830

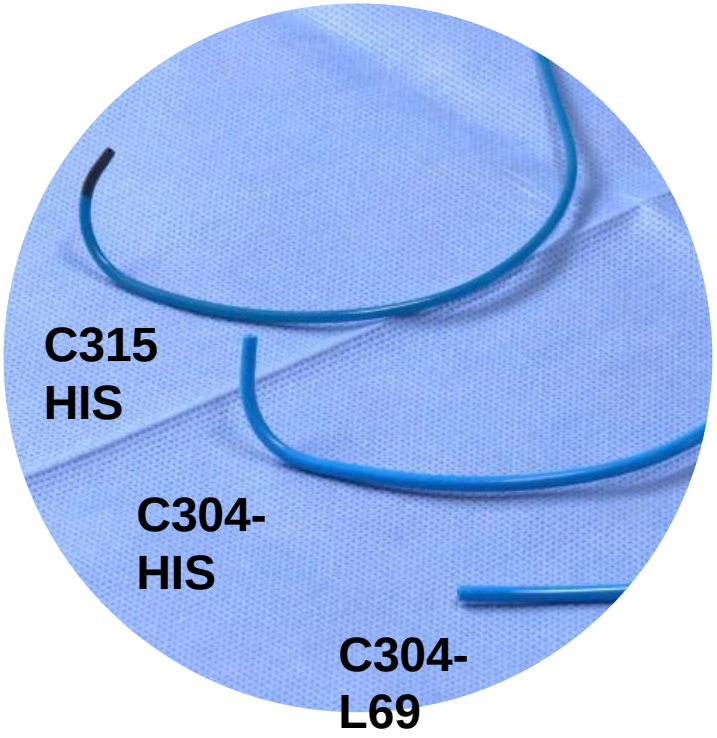




Utilisation de gaines spécifiques



Extrémité distale – Vue de face



Extrémité distale – Vue de côté

HRS, 2022

Registre prospectif sur 477 patients

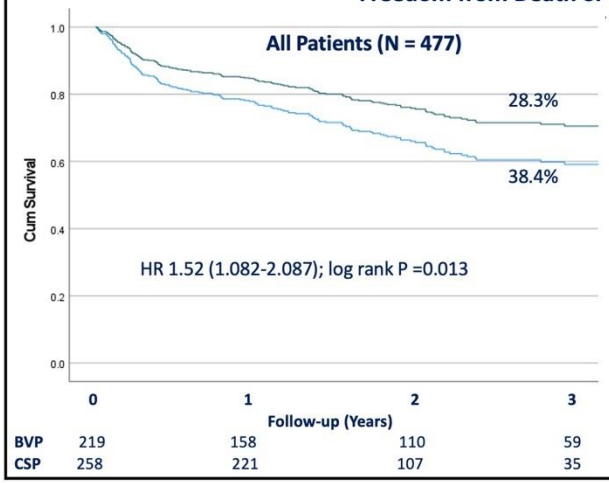
Baseline Characteristics of All Patients

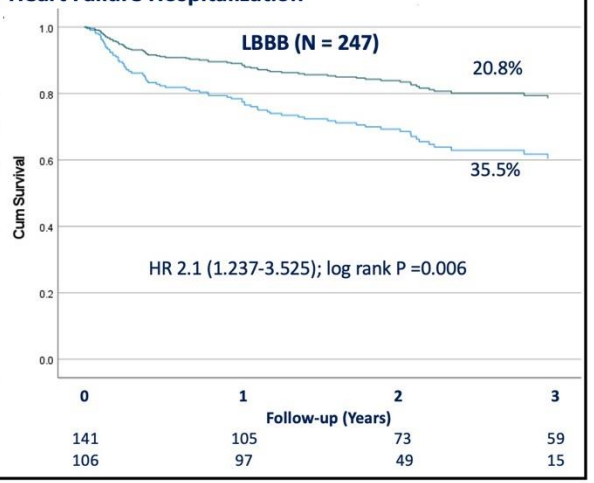
	All patients (n=477)	BVP (n=219)	CSP (n=258)	P value
Age	72±12	72±12	72±13	0.96
Female	151 (32)	63 (29)	88 (34)	0.21
Hypertension	332 (70)	141 (64)	191 (74)	0.2
Diabetes	216 (45)	111 (50)	105 (41)	0.03
Coronary artery disease	247 (52)	116 (53)	131 (51)	0.63
Atrial fibrillation	247 (52)	109 (50)	138 (54)	0.05
BMI, Kg/m2	29.6±6.3	29.7±6.2	29.6±6.3	0.75
Type of cardiomyopathy				0.39
Ischemic	187 (39)	92 (42)	95 (37)	
Nonischemic	258 (54)	115 (52.5)	143 (55.4)	
Mixed	32 (6.7)	12 (5.5)	20 (7.8)	
Baseline NYHA class	2.81±0.6	2.86±0.5	2.75±0.6	0.03
LV Ejection Fraction (%)	26.0±6.4	26.1±6.3	26.4±6.5	0.45
LVEDD (mm)	59.0±9.6	59.7±7.8	58.4±11	0.06
Baseline QRS (ms)	155±28	160.7±23	150.5±30	0.001
QRS morphology				0.01
LBBB	247 (52)	141 (64)	106 (41)	
RBBB	44 (9)	24 (11)	20 (8)	
IVCD	44 (9)	6 (3)	38 (15)	
RVP	93 (20)	34 (16)	59 (23)	
Normal	49 (10)	14 (6)	35 (13)	
Medications				
Betablockers	429 (90)	203 (93)	226 (88)	0.04
ACEI/ARB	247 (52)	117 (54)	130 (50)	0.48
ARNI	89 (19)	41 (19)	48 (19)	0.97
Spironolactone	180 (38)	91 (42)	89 (35)	0.11
Diuretics	349 (73)	164 (75)	185 (72)	0.44
Amiodarone	94 (20)	38 (17)	56 (22)	0.23

Baseline Characteristics of Patients with LBBB

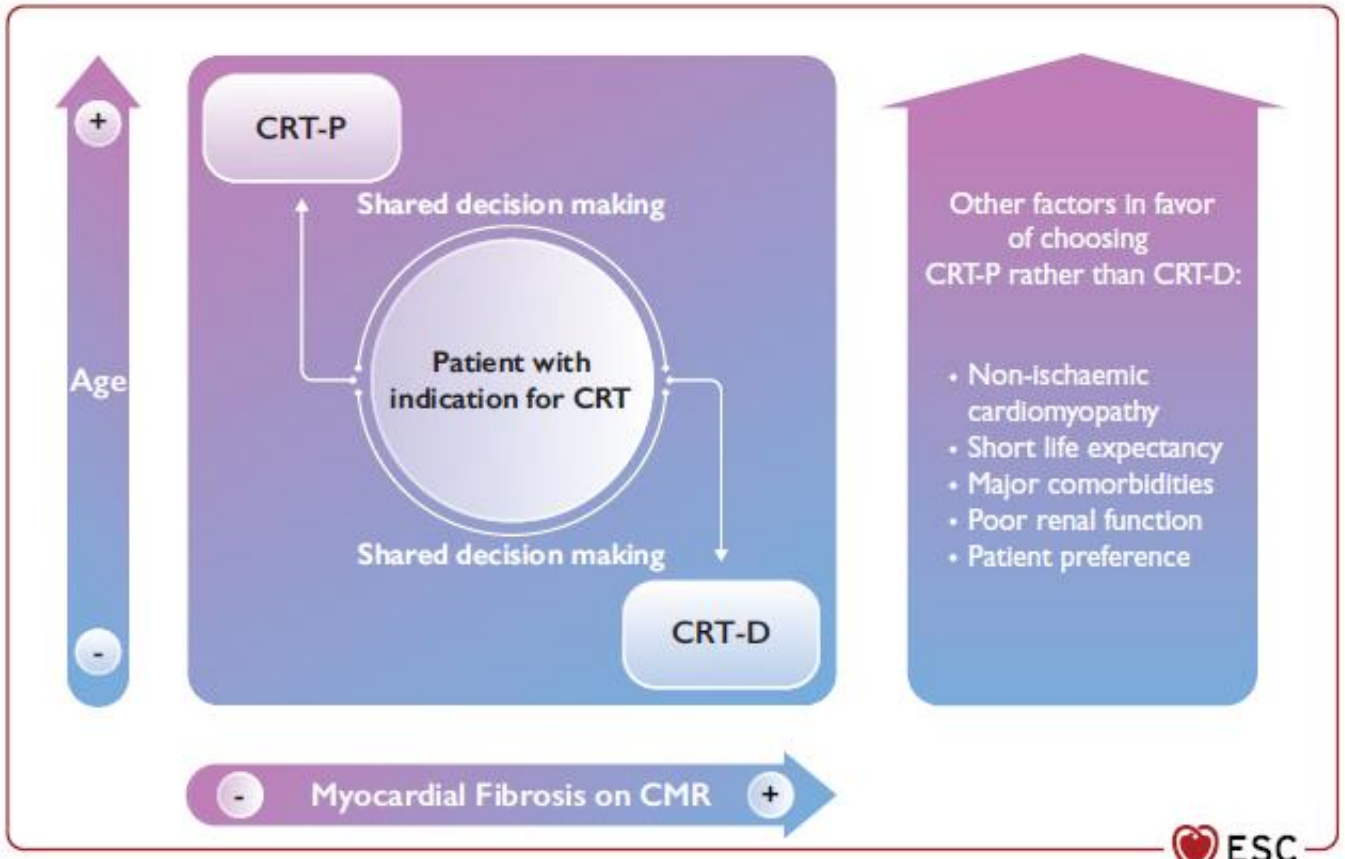
	All patients (n=247)	BVP (n=141)	CSP (n=106)	P value
Age	71±12	71±12	71±13	0.76
Female	85 (34)	42 (30)	43 (40)	0.08
Hypertension	167 (68)	86 (61)	81 (76)	0.01
Diabetes	120 (49)	71 (50)	49 (46)	0.52
Coronary artery disease	116 (47)	67 (48)	49 (46)	0.84
Atrial fibrillation	99 (40)	62 (44)	37 (45)	0.15
BMI, Kg/m2	29.6±6.3	30.2±5.7	30.4±7.1	0.77
Ischemic Cardiomyopathy	92 (37)	59 (42)	33 (31)	0.15
Baseline NYHA class	2.91±0.6	2.91±0.5	2.92±0.6	0.80
LV Ejection Fraction (%)	25.8±6.4	25.5±6.4	26.1±5.7	0.24
Baseline QRS (ms)	161±16	163±17	159±18	0.07
Medications				
Betablockers	232 (94)	136 (97)	96 (91)	0.06
ACEI/ARB	125 (51)	72 (51)	53 (50)	0.14
ARNI	47 (19)	25 (18)	22 (21)	0.55
Spironolactone	97 (39)	61 (43)	36 (34)	0.14
Diuretics	188 (76)	111 (78)	77 (73)	0.27
Amiodarone	48 (20)	28 (20)	20 (19)	0.85

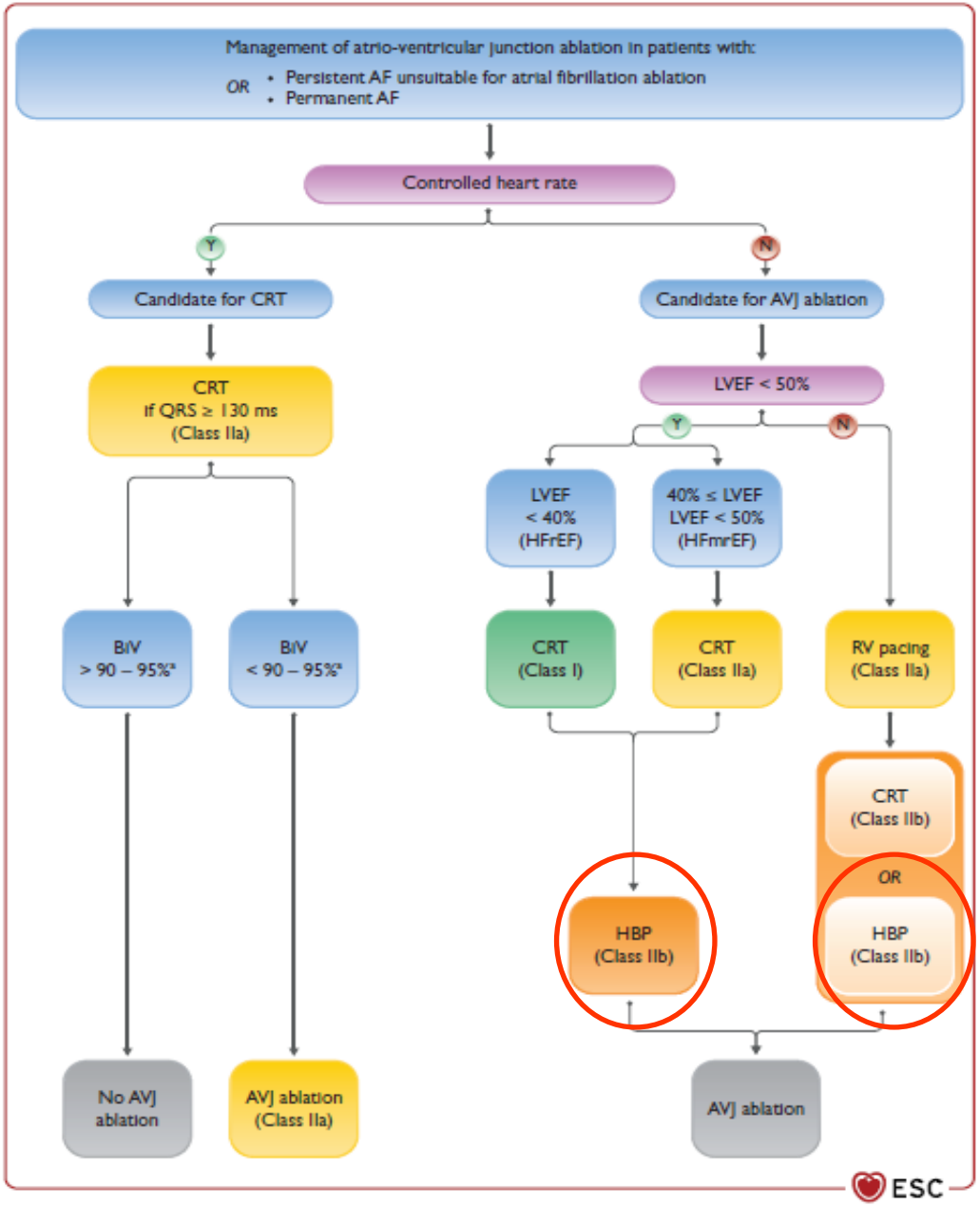
Freedom from Death or Heart Failure Hospitalization





Pace-Maker ou DAI associé à la CRT




Management of atrio-ventricular junction ablation in patients with:
OR
• Persistent AF unsuitable for atrial fibrillation ablation
• Permanent AF
Controlled heart rate
Y
N
Candidate for CRT
Candidate for AVJ ablation
CRT
If QRS ≥ 130 ms
(Class IIa)
LVEF < 50%
Y
N
LVEF
< 40%
(HFrEF)
40% ≤ LVEF
LVEF < 50%
(HFmrEF)
BiV
> 90 – 95%a
BiV
< 90 – 95%a
CRT
(Class I)
CRT
(Class IIa)
RV pacing
(Class IIa)
CRT
(Class IIb)
OR
HBP
(Class IIb)
HBP
(Class IIb)
No AVJ
ablation
AVJ ablation
(Class IIa)
AVJ ablation
ESC

Pace-maker sans sonde

Recommendations for using leadless pacing (leadless pacemaker)

Recommendations	Class[a]	Level[b]
Leadless pacemakers should be considered as an alternative to transvenous pacemakers when no upper extremity venous access exists or when risk of device pocket infection is particularly high, such as previous infection and patients on haemodialysis.[45,47–50,450]	IIa	B
Leadless pacemakers may be considered as an alternative to standard single-lead ventricular pacing, taking into consideration life expectancy and using shared decision-making.[45,47–50]	IIb	C

[a]Class of recommendation.
[b]Level of evidence.

ESC European Society of Cardiology

European Heart Journal (2021) **00**, 1–9
https://doi.org/10.1093/eurheartj/ehab767

FASTTRACK CLINICAL RESEARCH
Arrhythmias

Leadless vs. transvenous single-chamber ventricular pacing in the Micra CED study: 2-year follow-up

Mikhael F. El-Chami[1]*, Lindsay Bockstedt[2], Colleen Longacre[2], Lucas Higuera[2], Kurt Stromberg[2], George Crossley[3], Robert C. Kowal[2], and Jonathan P. Piccini [4]

[1]Emory University School of Medicine, 550 W Peachtree St NE, Atlanta, GA 30308, USA; [2]Medtronic, Inc, 710 Medtronoc PKW NE, Minneapolis, MN 55432, USA; [3]Vanderbilt University Medical Center, 1161 21ST Ave S, Nashville, TN 37232, USA; and [4]Duke University Medical Center & Duke Clinical Research Institute, 40 Duke Medicine Circle Clinic 2F/2 G, Durham, NC 27710, USA

Received 4 August 2021; revised 19 August 2021; editorial decision 20 October 2021; accepted 20 October 2021

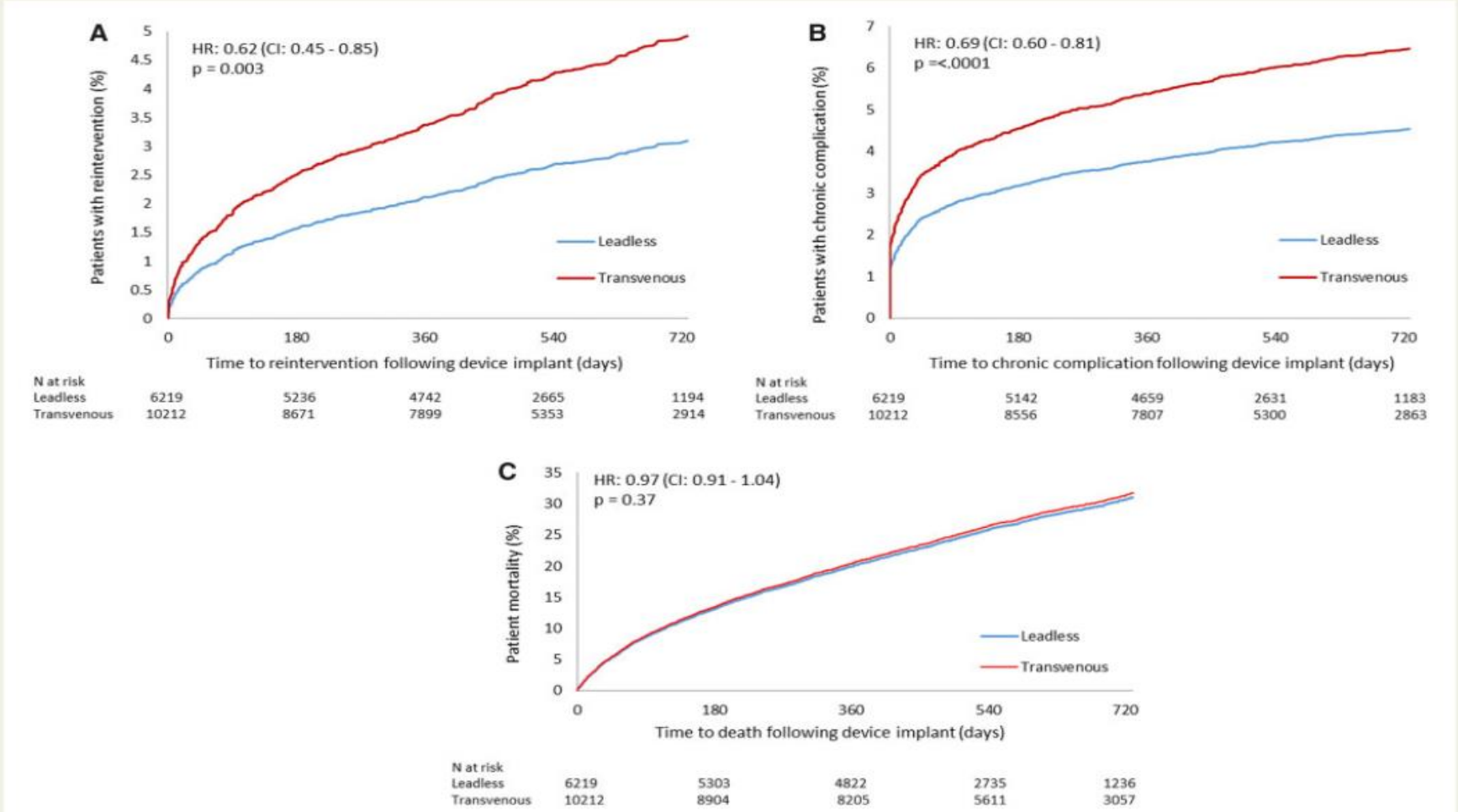
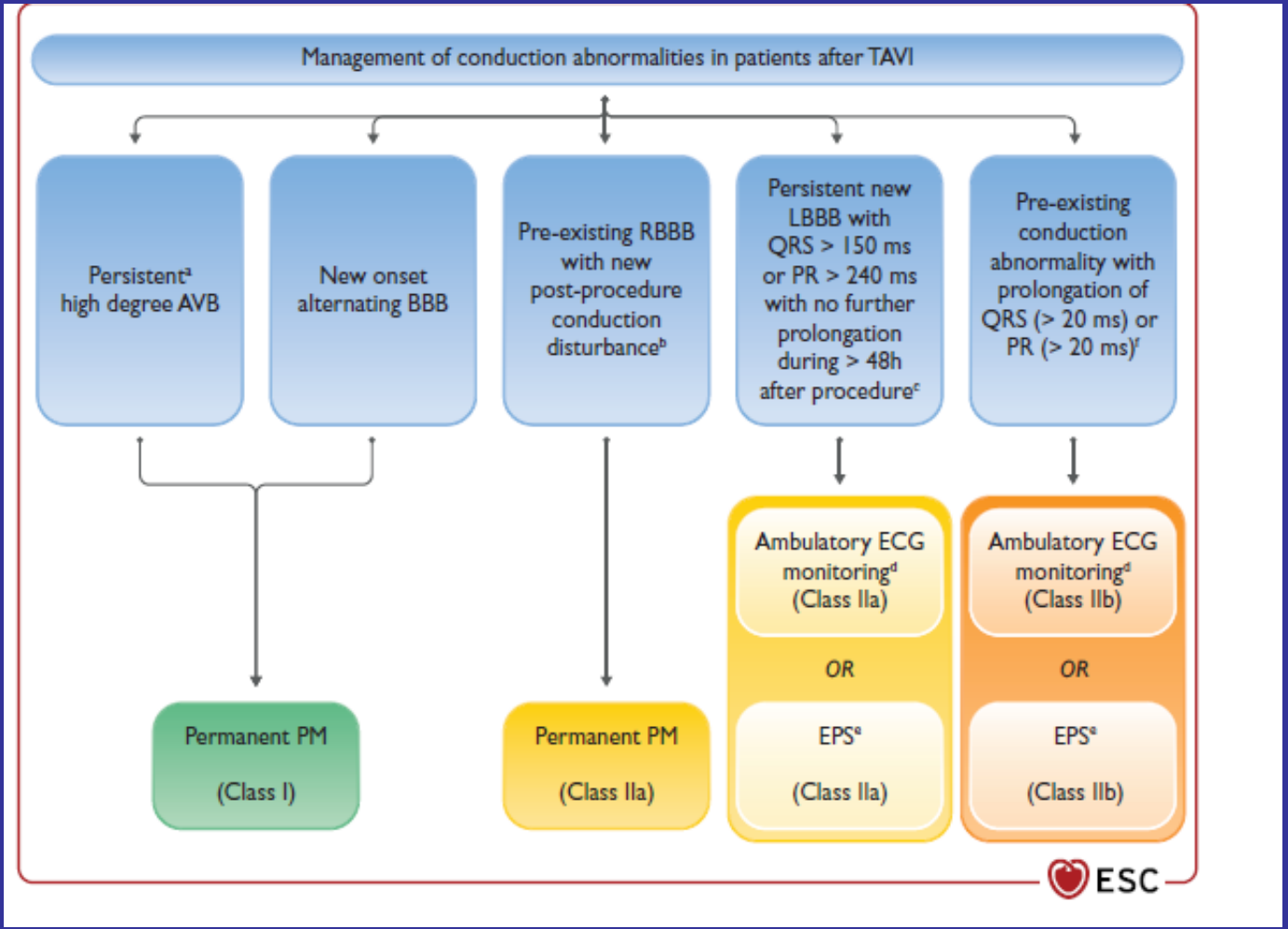
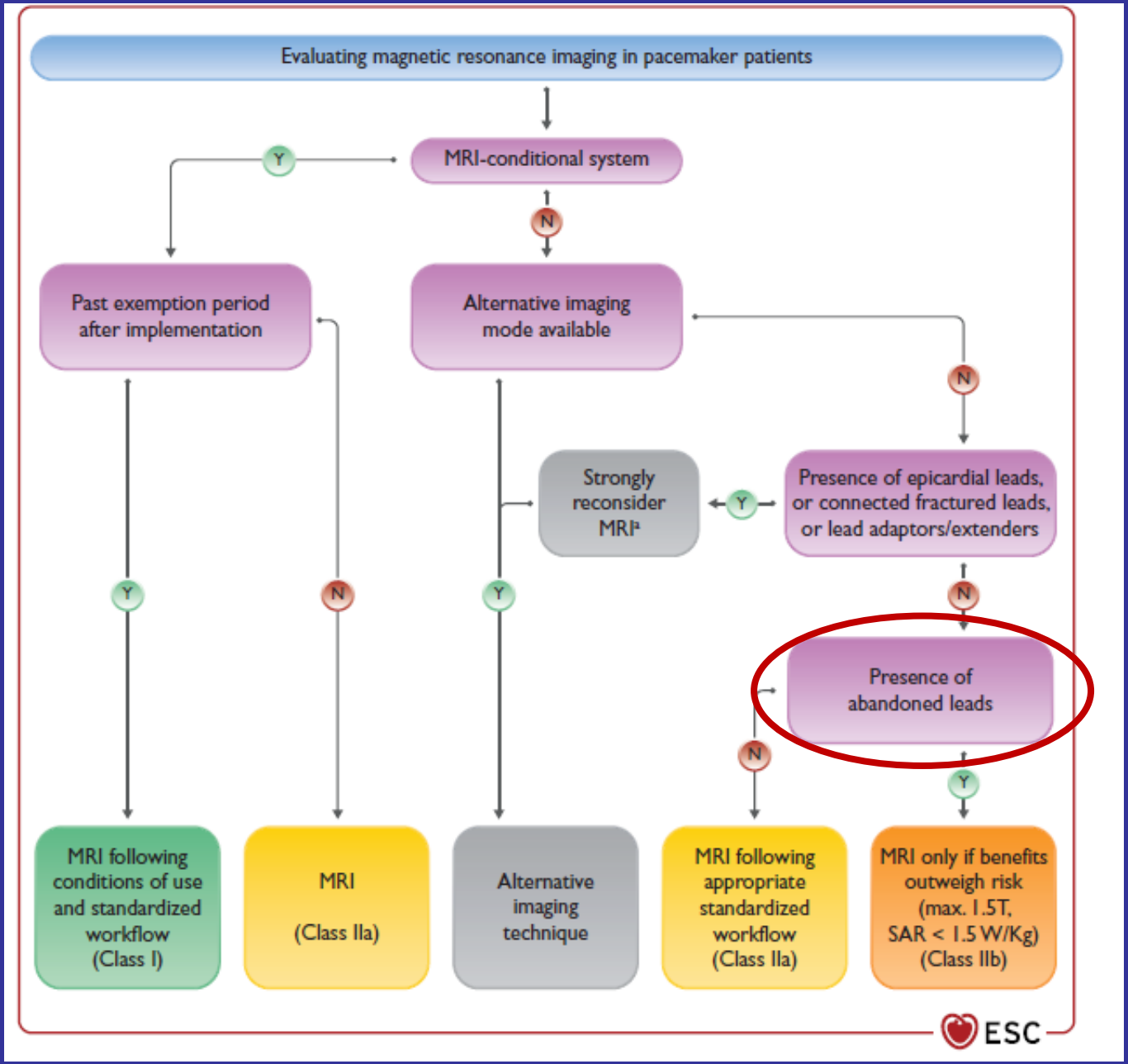


Figure 2 Adjusted time to event plots for device reinterventions, chronic complications and mortality out to 2 years of follow-up in patients treated with leadless VVI vs. transvenous VVI pacing. (*A*) Hazard ratio and cumulative incidence function for 2-year device reintervention based on the Fine–Gray competing risk model. (*B*) Hazard ratio and cumulative incidence function for 2-year chronic complications based on the Fine–Gray competing risk model. (*C*) Hazard ratio and patient mortality rates based on the Cox proportional hazards model. CI, confidence interval.

Indication de PM post-TAVI



PM et IRM


Evaluating magnetic resonance imaging in pacemaker patients
MRI-conditional system
Y
N
Past exemption period after implementation
Alternative imaging mode available
N
Strongly reconsider MRI[a]
Y
Presence of epicardial leads, or connected fractured leads, or lead adaptors/extenders
Y
N
Y
N
Presence of abandoned leads
N
Y
MRI following conditions of use and standardized workflow (Class I)
MRI (Class IIa)
Alternative imaging technique
MRI following appropriate standardized workflow (Class IIa)
MRI only if benefits outweigh risk (max. 1.5T, SAR < 1.5 W/Kg) (Class IIb)
ESC

CONCLUSION

-Pas de grandes nouveautés pour les indications de stimulation

-Pour la CRT: apparition de la stimulation physiologique en cas d'échec de la CRT

-Apparition du PM sans sonde: probable indication qui vont d'élargir++