Groupe de Rythmologie et de Stimulation Cardiaque
de la Société Française de Cardiologie
24es Journées de Rythmologie
27/29 septembre 2023
Avignon
Palais des Congrès
Cité des Papes

Indications à la stimulation cardiaque

Dr Cécile DUPLANTIER DUCHENE

Société Française de Cardiologie
Rythmologie - Stimulation cardiaque
Société Française de Cardiologie

Conflits d'interêt

- aucun

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)

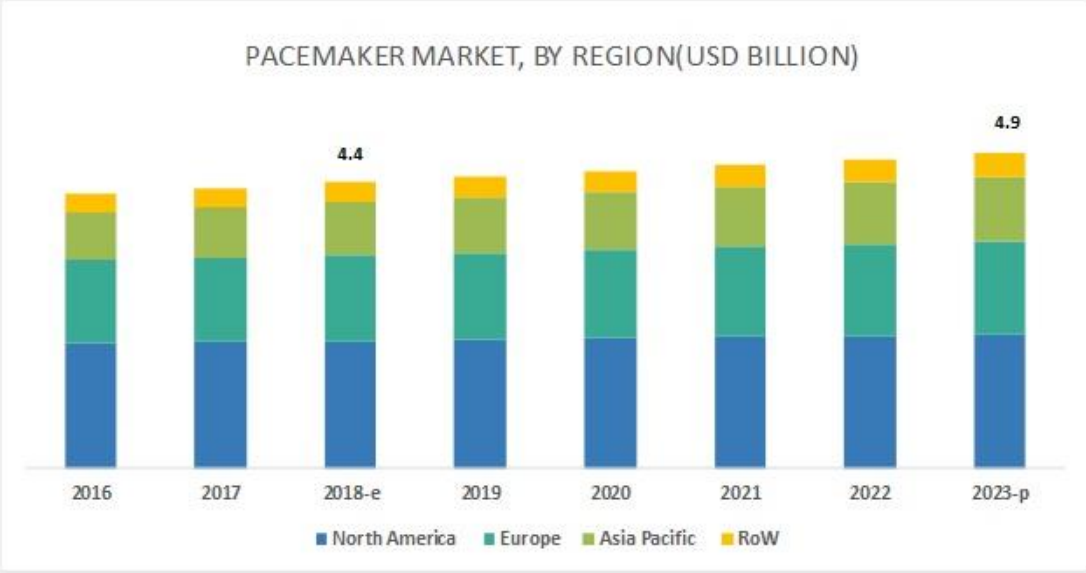
Table I Classes of recommendations

Classes of recommendations	Definition	Wording to use
Class I	Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.	Is recommended or is indicated
Class II	Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure.	
Class IIa	Weight of evidence/opinion is in favour of usefulness/efficacy.	Should be considered
Class IIb	Usefulness/efficacy is less well established by evidence/opinion.	May be considered
Class III	Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.	Is not recommended

Depuis 1958 (épicardique)
1965 (endocavitaire)

1 MILLION de PM /an
70000 en france

¾ primo implantation



Indications

- Troubles conductifs : BAV et dysfonction sinusale
- Resynchronisation cardiaque

Troubles conductifs

Évaluation patient avec bradycardie et symptômes évocateurs

- Fréquence sévérité durée circonstances
- Facteurs déclenchants: activité, stress,

Contexte infectieux
Anomalies biologiques
Maladie de système (Sclérodermie, lupus, sarcoidose)

- Cardiopathie
- CMI, valvulopathie
- CMH Amylo
- Endocardite

…orders

	Sinus node bradycardia	AVB
…eta-blockers	+	+
…ntihypertensives		
…on-dihydropyridine calcium channel …ockers	+	+
…ethyldopa	+	–
…onidine	+	–
…ntiarrhythmics		
…miodarone	+	+
…ronedarone	+	+
…talol	+	+
…ecainide	+	+
…opafenone	+	+
…ocainamide	–	+
…isopyramide	+	+
…denosine	+	+
…goxin	+	+
…abradine	+	–
…sychoactive and neuroactive drugs		
…onepezil	+	+
…thium	+	+
…pioid analgesics	+	–
…henothiazine	+	+
…henytoin	+	+
…lective serotonin reuptake inhibitors	–	+
…ricyclic antidepressants	–	+
…arbamazepine	+	+

Continued

	Sinus node bradycardia	AVB
Others		
Muscle relaxants	+	–
Cannabis	+	–
Propofol	+	–
Ticagrelor	+	+
High-dose corticosteroids	+	–
Chloroquine	–	+
H_2 antagonists	+	+
Proton pump inhibitors	+	–
Chemotherapy		
Arsenic trioxide	+	+
Bortezomib	+	+
Capecitabine	+	–
Cisplatin	+	–
Cyclophosphamide	+	+
Doxorubicin	+	–
Epirubicin	+	–
5-fluorouracil	+	+
Ifosfamide	+	–
Interleukin-2	+	–
Methotrexate	+	–
Mitroxantrone	+	+
Paclitaxel	+	–
Rituximab	+	+
Thalidomide	+	+
Anthracycline	–	+
Taxane	–	+

AVB = atrioventricular block.

© ESC 2021

Recommendations for laboratory tests

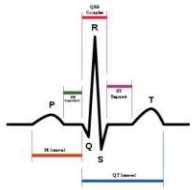
Recommendations	Class[a]	Level[b]
In addition to pre-implantation laboratory tests,[c] specific laboratory tests are recommended in patients with clinical suspicion for potential underlying causes of reversible bradycardia (e.g. thyroid function tests, Lyme titre, digitalis level, potassium, calcium, and pH) to diagnose and treat these conditions.[90–94]	I	C

© ESC 2021

	Sinus bradycardia or SND	AVJ disturbances
Intrinsic		
Idiopathic (ageing, degenerative)	+	+
Infarction/ischaemia	+	+
Cardiomyopathies	+	+
Genetic disorders	+	+
Infiltrative diseases		
Sarcoidosis	+	+
Amyloidosis	+	+
Haemochromatosis	+	+
Collagen vascular diseases		
Rheumatoid arthritis	+	+
Scleroderma	+	+
Systemic lupus erythematosus	+	+
Storage diseases	+	+
Neuromuscular diseases	+	+
Infectious diseases		
Endocarditis (perivalvular abscess)	–	+
Chagas disease	+	+
Myocarditis	–	+
Lyme disease	–	+
Diphtheria	–	+
Toxoplasmosis	–	+
Congenital heart diseases	+	+

Troubles conductifs

ECG



Troubles de la conduction:
Nœud sinusal

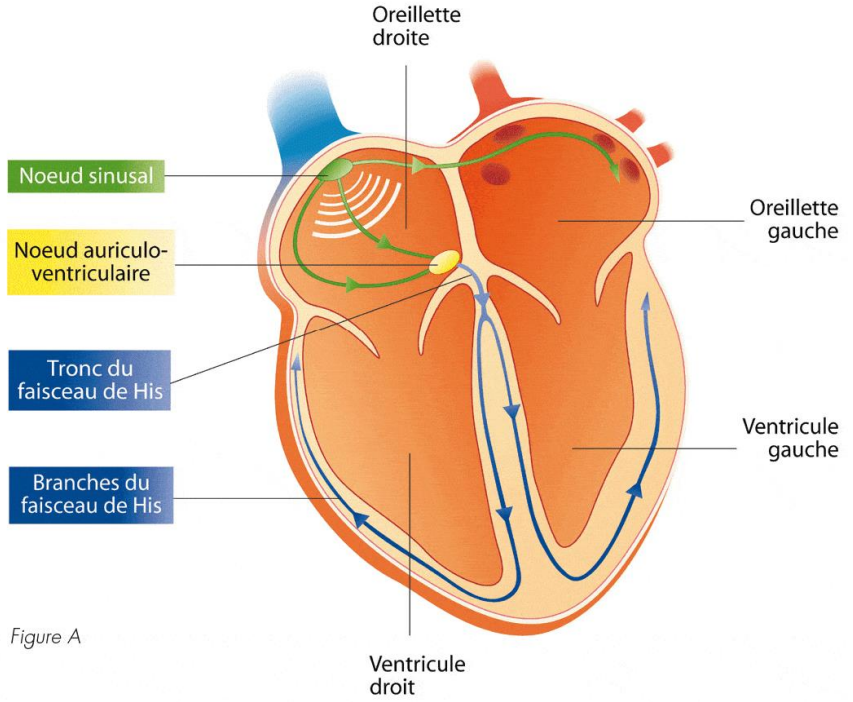
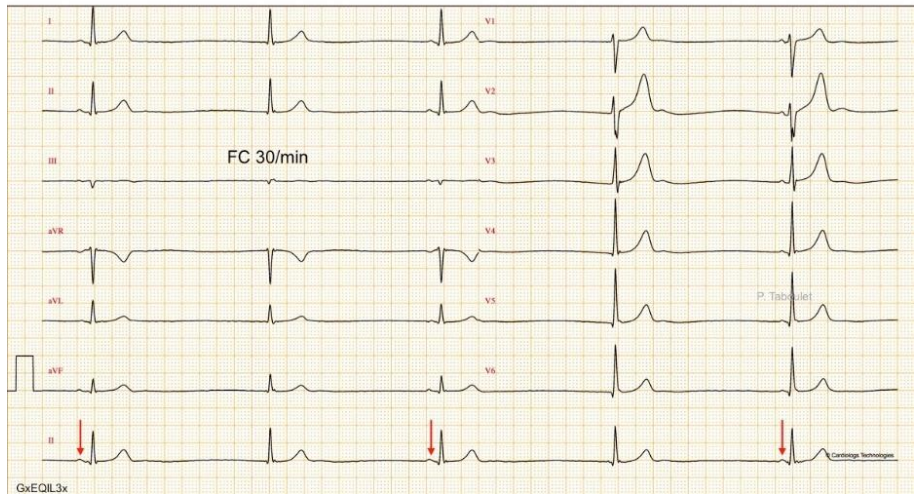


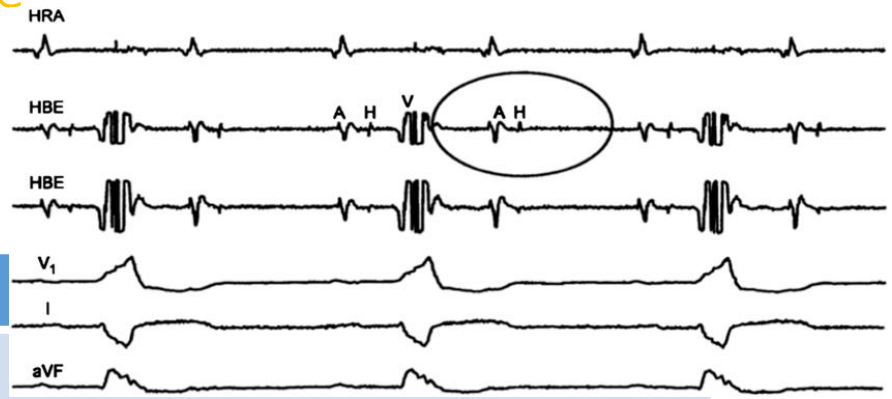
Figure A

-Dysfonction Sinusale symptomatique *Spontanée ou induite par un traitement nécessaire (maladie de l'oreillette)	I
-Syncope inexpliquée avec TRSC >800 ms	IIa
-Insuffisance chronotrope (80% de la FMT) symptomatique Spontanée ou induite par un traitement	IIa



Troubles conductifs

Nœud auriculo ventriculaire



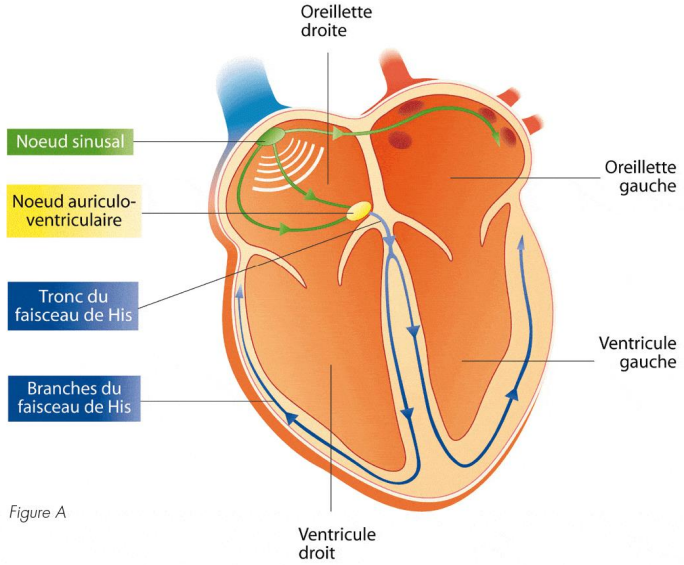
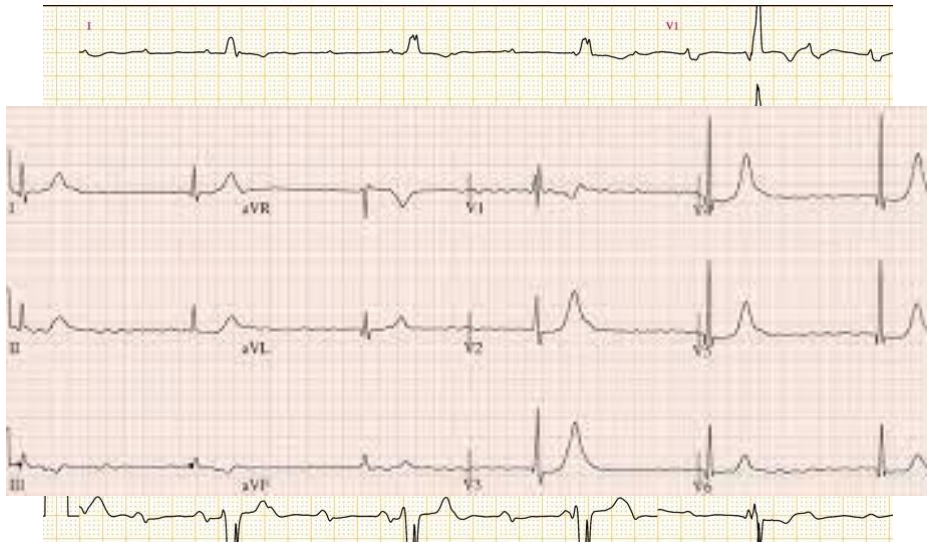


Figure A

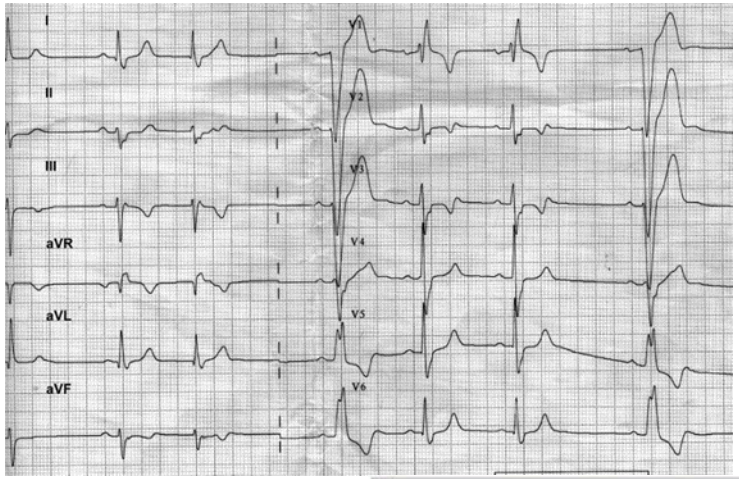
BAV 3rd or 2nd degré type 2 (mobitz) *Paroxystique ou permanent *Symptomatique ou non	I
FA avec BAV 3rd degré *Symptomatique ou non	I
BAV 2nd degré type 1 (luciani wenckebach) Symptomatique /si infra ou intra hissien	IIa

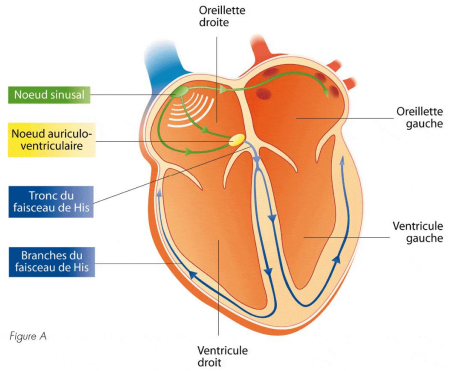


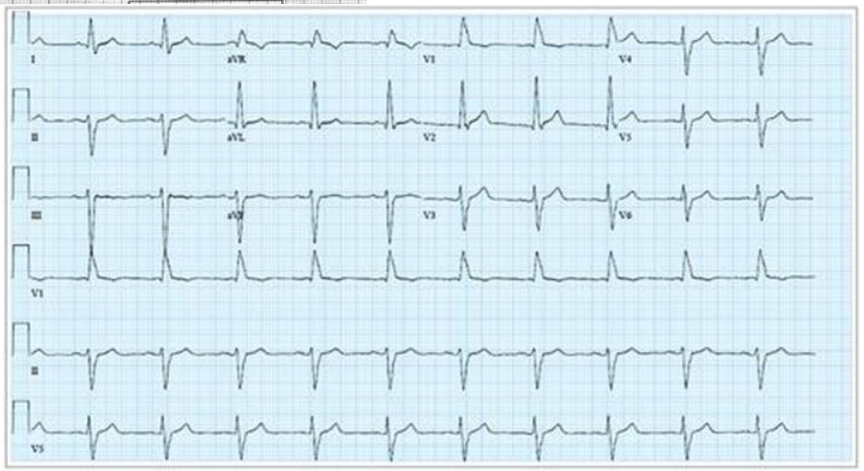
Troubles conductifs

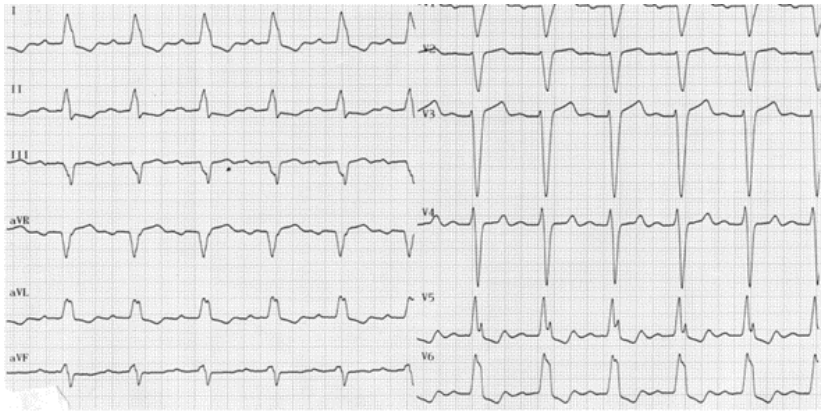
Recommendations for pacing in patients with bundle branch block

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









Troubles conductifs

Fonction de la cardiopathie

Laminopathie LMNA	
BAV 1er et BBG	I +/- DAI

Maladies neuro musculaires (myotonie dystrophique)	
PR long, BBG : HV>70ms Symptomatique ou non	I

Sarcoidose	**Malgré le TTT immuno supresseur**
BAV permanent ou parox Si FEVG< 50% CRT-P	IIa

Post TAVI	
BAVc persistant 24-48h post op BB alternant post TAVI	I
BBD préexistant et aggravation BB	IIa

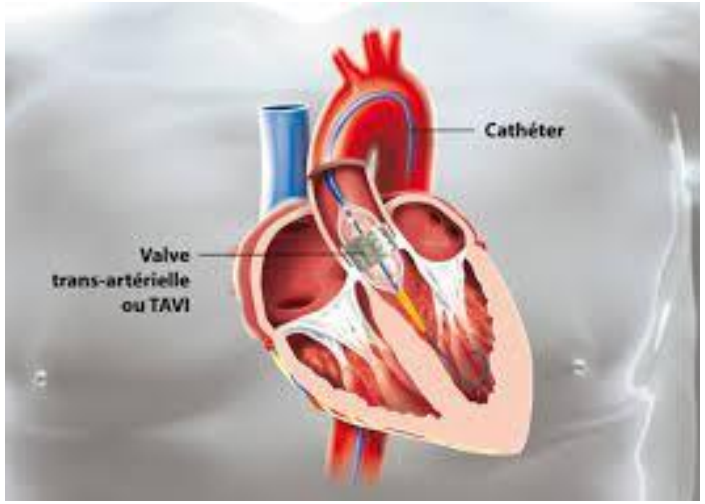


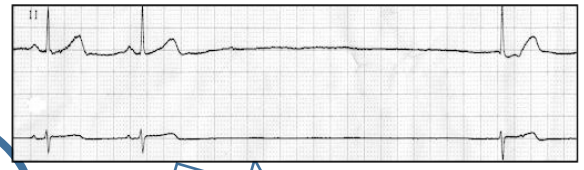
Table 8 Choice of ambulatory electrocardiographic monitoring depending on symptom frequency

Frequency of symptom	
Daily	24-h Holter ECG or in-hospital telemetric monitoring
Every 48–72 h	24–48–72 h Holter ECG
Every week	7-day Holter ECG/external loop recorder/ external patch recorder
Every month	External loop recorder/external patch recorder/handheld ECG recorder
<1 per month	ILR

ECG = electrocardiogram; ILR = implantable loop recorder.

Recommendation	Class[a]	Level[b]
Ambulatory ECG monitoring is recommended in the evaluation of patients with suspected bradycardia to correlate rhythm disturbances with symptoms.[73]	I	C

Recommendations	Class[a]	Level[b]
Exercise testing is recommended in patients who experience symptoms suspicious of bradycardia during or immediately after exertion.[62,74–80]	I	C
In patients with suspected chronotropic incompetence, exercise testing should be considered to confirm the diagnosis.[74,75]	IIa	B
In patients with intraventricular conduction disease or AVB of unknown level, exercise testing may be considered to expose infranodal block.[76,77,79]	IIb	C



Massage sino carotidien :

- 3sec symptomatique
- 6 sec asymptomatique

DDD
Classe II

Holter

SYNCOPE
Age> 40 ans

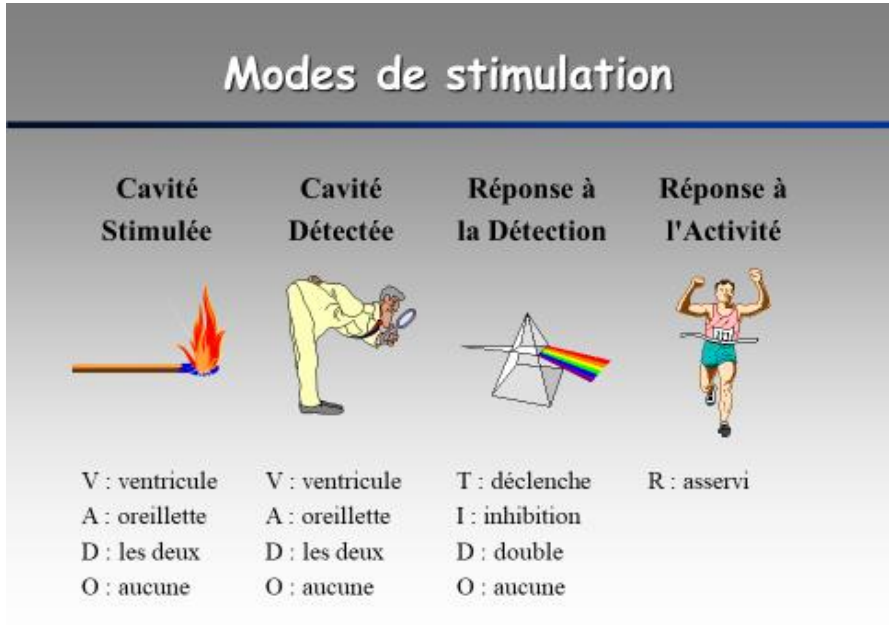
Epreuve d'effort

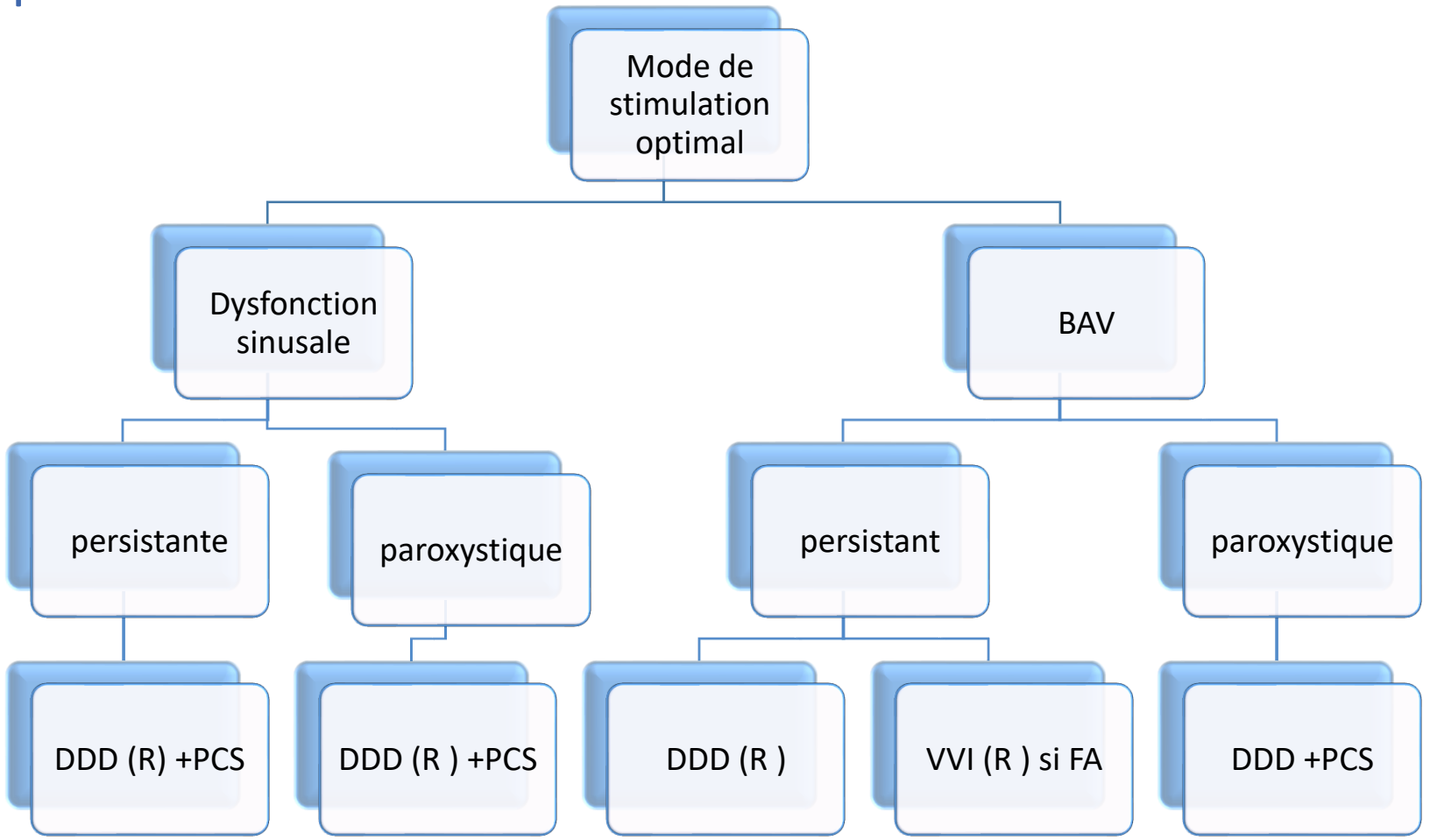
DDD
Classe I

TILT TEST : réponse cardio inibitrice

Troubles conductifs

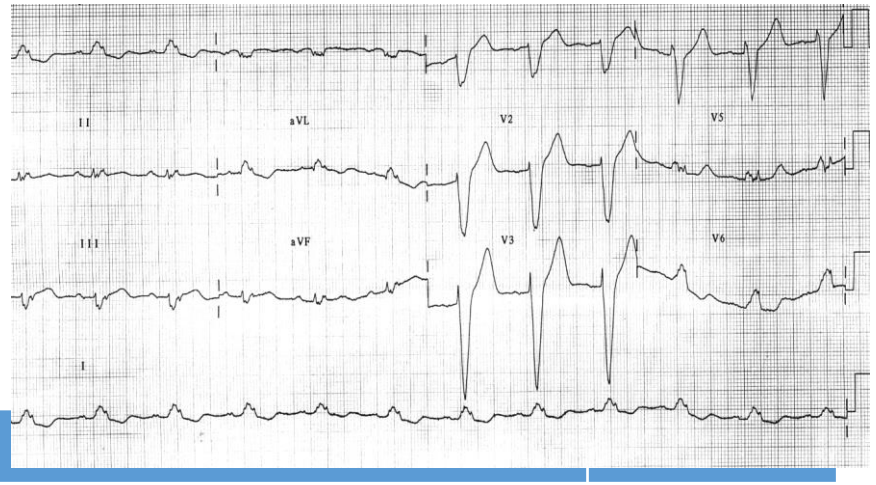
Modes de stimulation

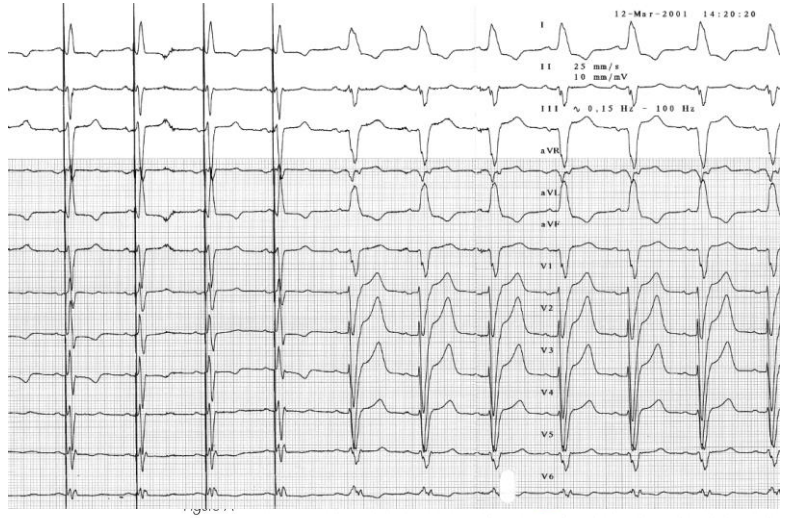




* PCS : préservation de la conduction spontanée

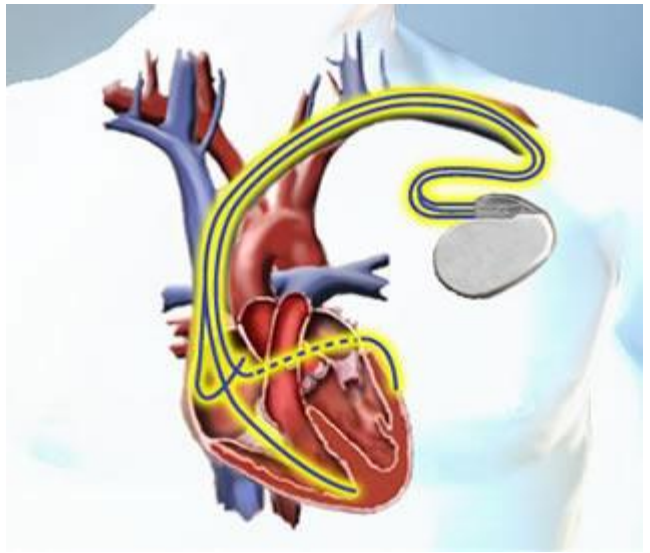
Resynchronisation cardiaque : CRT-P

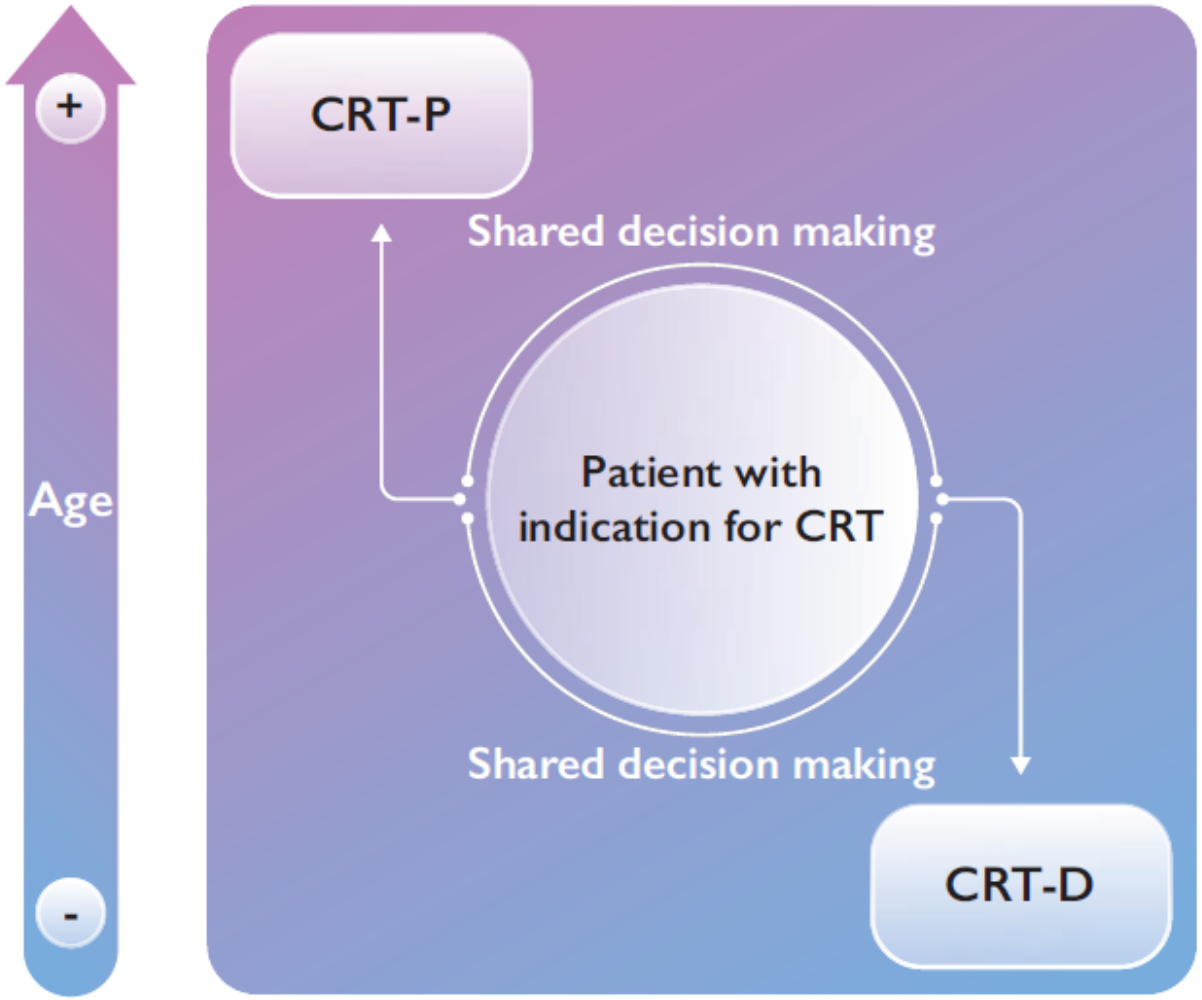




Ventricule droit

-BAV (indication à PM) *FEVG< 40% Quelque soit le stade NYHA	I
-INSUFFISANCE CARDIAQUE *FEVG<35% *QRS >150 ms et BBG	I
QRS >130 ms et BBG QRS> 150 ms et BBD	IIa
FA et ablation NAV *FEVG < 40% *FEVG < 50%	 I IIa





Other factors in favor of choosing CRT-P rather than CRT-D:

- Non-ischaemic cardiomyopathy
- Short life expectancy
- Major comorbidities
- Poor renal function
- Patient preference

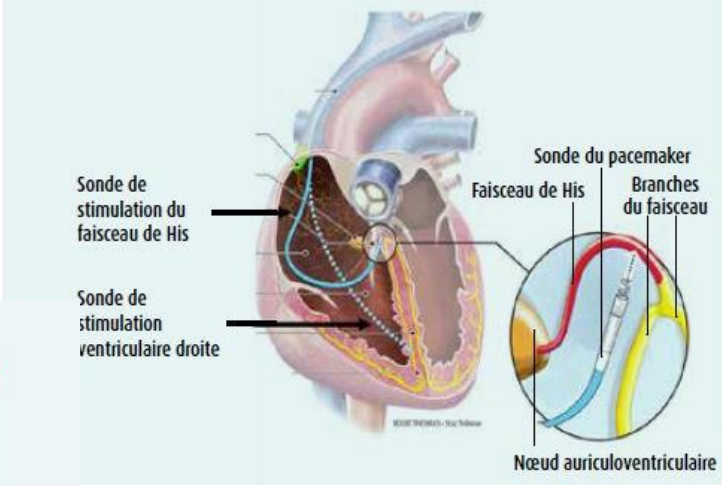
Nouvelles techniques : stimulation des systèmes des conduction

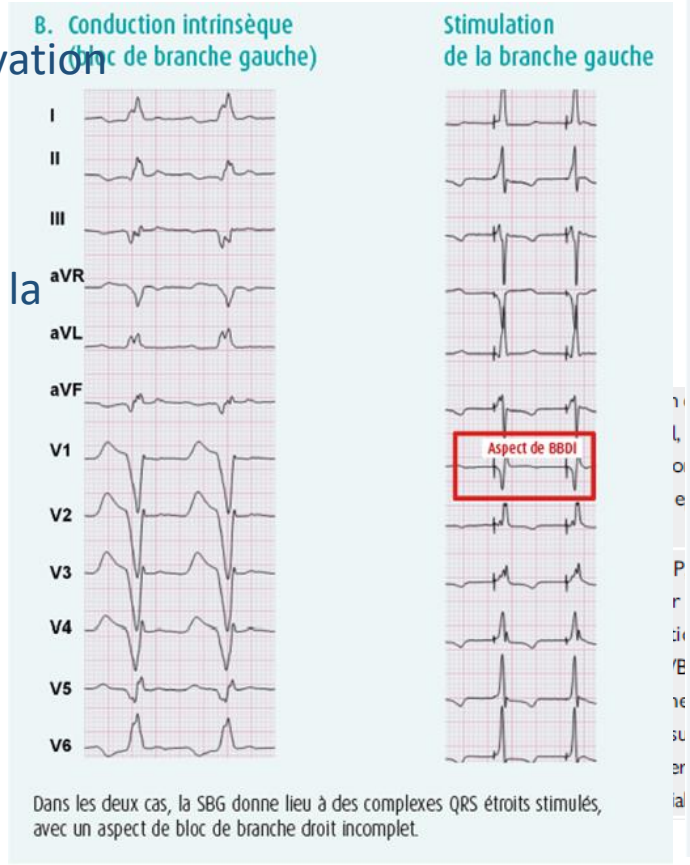
- Stimulation hissienne :

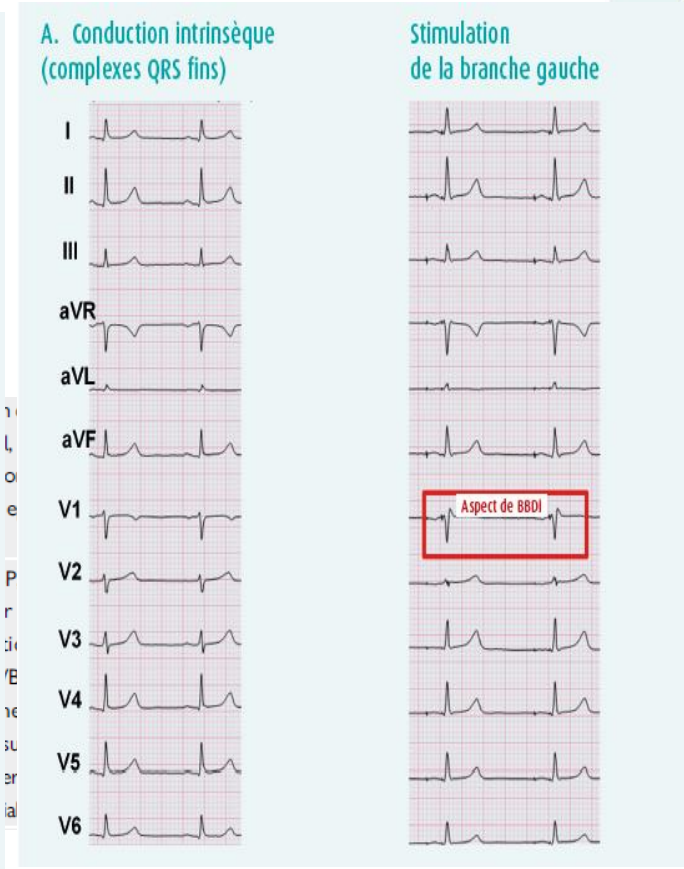
• Stimulation branche gauche

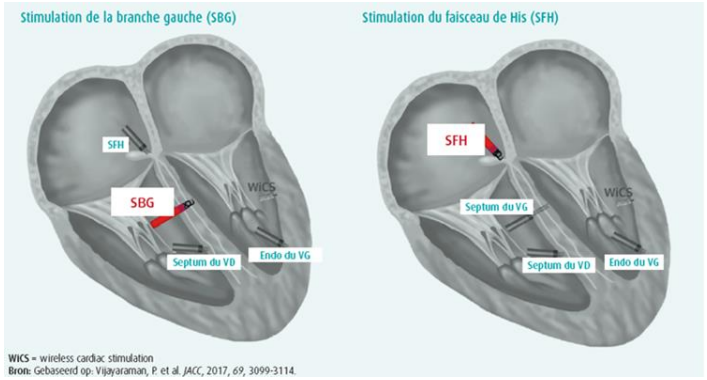
Préservation de l'activation physiologique

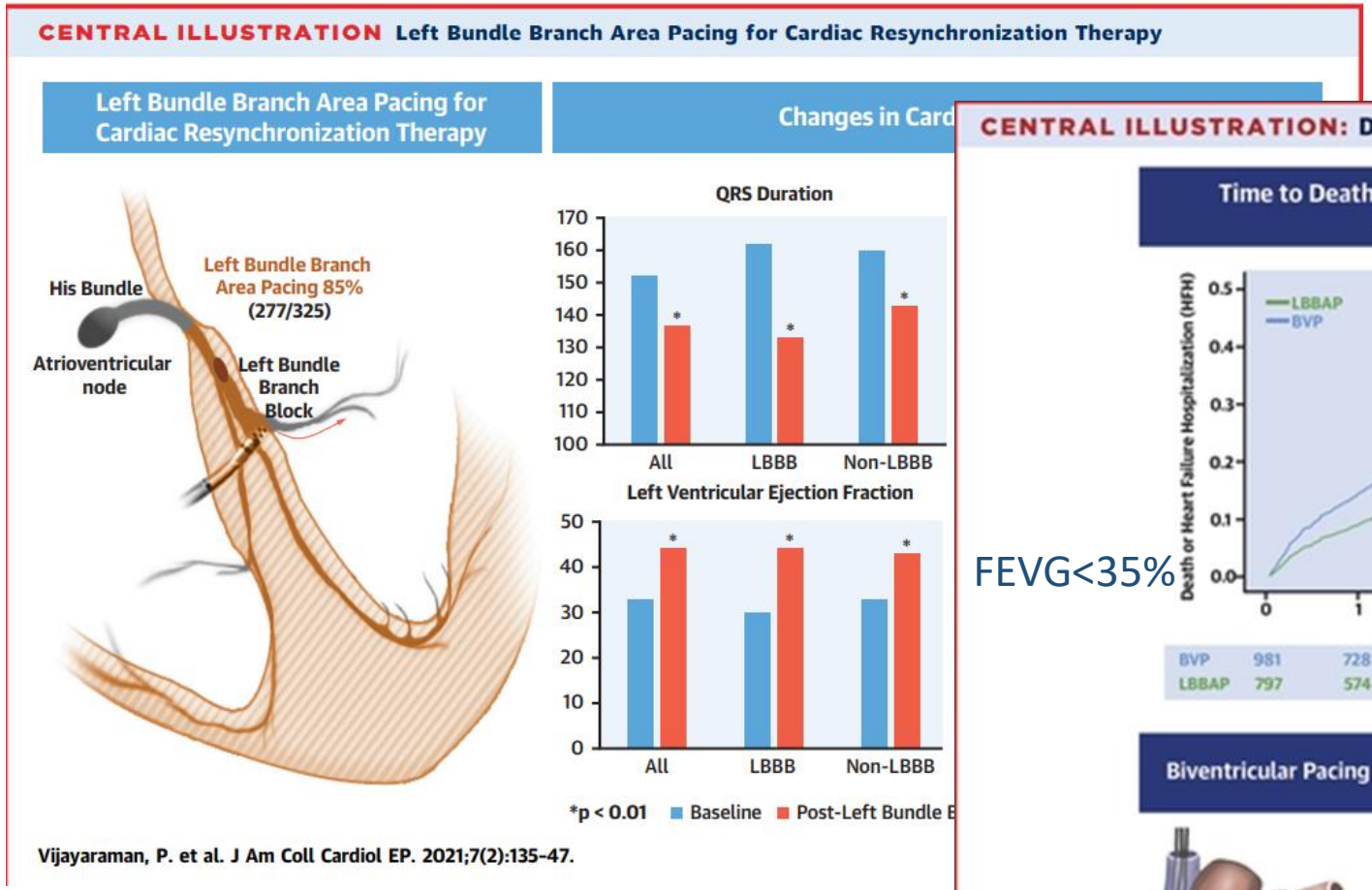
Evite l'asynchronisme mécanique induit par la stimulation VD





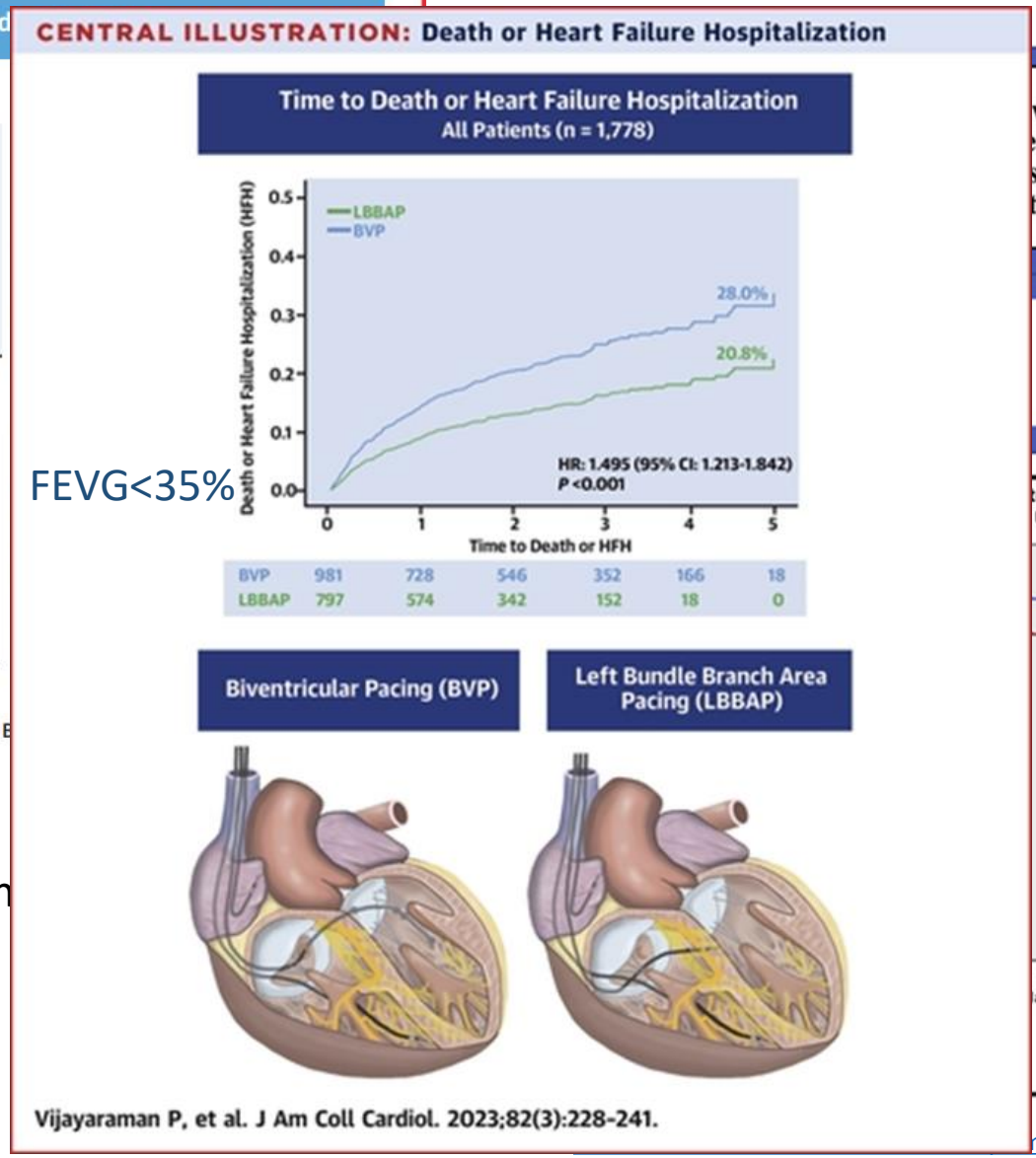




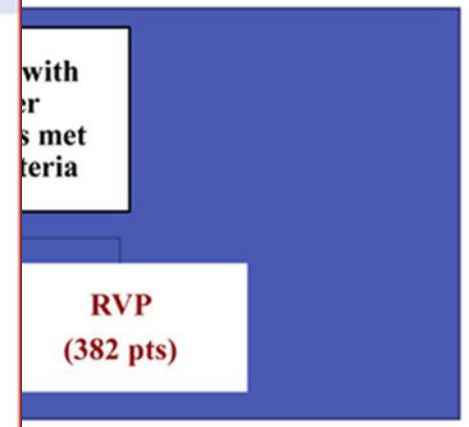


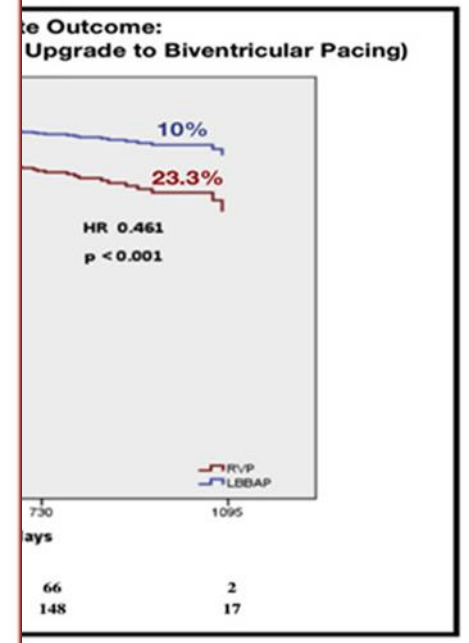
BBG : facteur prédictif indépendan

Clinical Outcomes Of Left Bundle Branch Area Pacing Compared To Right Ventricular Pacing: Results From The Geisinger-Rush Conduction System Pacing Registry



FEVG<35%





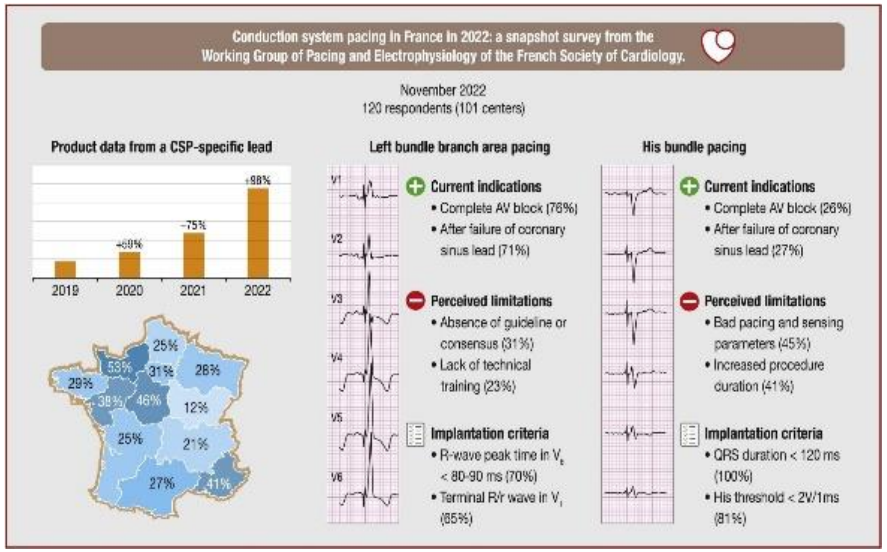
n. 2022;19 (1) :3-11

Recommendations for substantial ventricular pacing

COR	LOE	Recommendations	References
2a	B-R (CRT)	1. In patients with an indication for permanent pacing with an LVEF 36%–50% who are anticipated to require substantial ventricular pacing, CPP is reasonable to reduce the risk of PICM.	CRT[9,10,34–39] HBP[9,10,16,40–44] LBBAP[45–48]
	B-NR (HBP, LBBAP)		
2b	B-NR	2. In patients with normal LVEF who are anticipated ventricular pacing, it may be reasonable to treat p risk of PICM.	

Recommendations for LBBB, sinus rhythm, QRS duration ≥ 150 ms, NYHA class I–IV symptoms

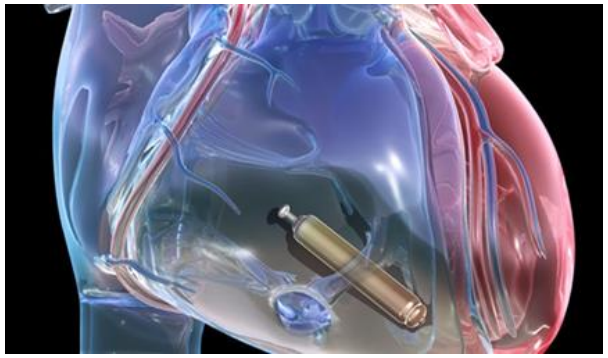
COR	LOE	Recommendations	References
1	A	1. In patients with LVEF ≤ 35%, sinus rhythm, LBBB with QRS duration ≥ 150 ms, and NYHA class II–IV symptoms on GDMT, CRT with BiV pacing is indicated to improve symptoms and reduce morbidity and mortality.	9,88–97
2a	C-LD	2. In patients with LVEF ≤35%, sinus rhythm, LBBB with QRS duration ≥150 ms, and NYHA class II–IV symptoms on GDMT, CSP with HBP with LBBB correction or LBBAP is reasonable if effective CRT cannot be achieved with BiV pacing based on anatomical or functional criteria.	HBP[42,98–103] LBBAP[24,45,47,58,65,104]



2023 HRS/APHRS/LAHRS guideline on cardiac physiologic pacing for the avoidance and mitigation of heart failure

PM sans sonde : pace maker monochambre
Micra * ou VDD Micra AV*

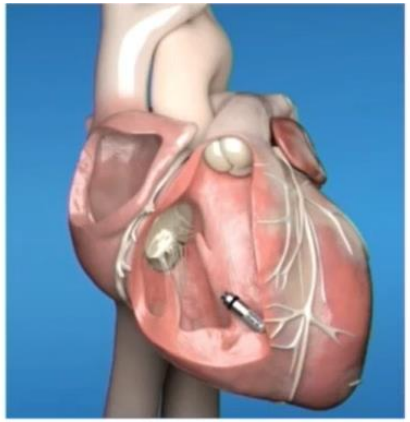
Impossibilité d'abord veineux
Infection de loge
Dialysé avec ATCD infectieux

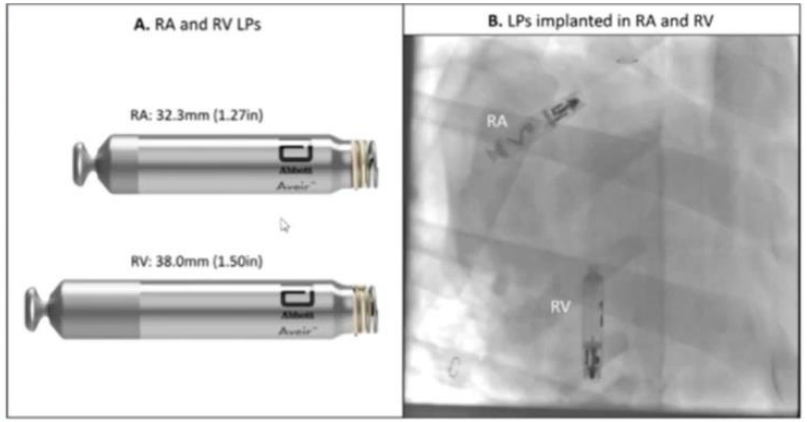


Recommendations for using leadless pacing (leadless pacemaker)

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

© ESC 2021





Micra AV >> VDD mode

AVEIR DR study (n=550) >> DDD mode

Conclusion

- La stimulation cardiaque est une technique mature dont les indications relèvent d'un bilan cardiologique exhaustif
- Les nouveautés technologiques permettent d'améliorer les modes de stimulation


WHEN WE ASKED YOU TO TURN OFF ALL ELECTRONIC DEVICES, WE DIDN'T MEAN YOUR HUSBAND'S PACEMAKER...

MERCI

Supplementary Table 5 Genes responsible for inherited bradyarrhythmia

Gene name	Inheritance mode	Atrial phenotypes	Conduction disease	Ventricle phenotypes	Additional phenotypes
Ion channels					
HCN4	AD	Sinus bradycardia		LVNC, BrS	
SCN5A	AD/AR	Sinoatrial block, AF, atrial standstill	PCCD, AVB	LQT3, BrS, DCM	
SCN10A	AD	AF?		BrS?	
SCN1B	AD		BBB	BrS	
KCNJ2	AD			LQT7 (ATS), SQT, BrS	Periodic paralysis Dysmorphic features
CACNA1D	AD	Sinus bradycardia			Congenital deafness
KCNK17	AD		PCCD, AVB, BBB		
TRPM4	AD		PCCD, AVB, BBB		
POPDC1	AR		AVB		Limb-girdle muscular dystrophy
POPDC2[16]	AR		AVB		
Calcium-handling proteins on the sarcoplasmic reticulum					
RYR2	AD	Sinus bradycardia		CPVT, ARVC	
CASQ2	AR	Sinus bradycardia		CPVT	
Gap junction channel					
GJA5	AD		PCCD, AVB, BBB		
Cardiac hormone					
NPPA	AD	Atrial standstill, Bi-atrial dilatation			
Transcription factors					
TBX5	AD	ASD, AF	AVB	VSD	Hand anomalies (heart-hand syndrome)
Nuclear membrane component					
LMNA	AD	Sinus bradycardia	PCCD, AVB	DCM	Laminopathies including muscular dystrophy and Hutchinson-Gilford progeria syndrome
Membrane adaptor protein					
ANK2	AD	Sinus bradycardia	PCCD	LQT4	
Sarcomere protein					
MYH6	AD	Sinus bradycardia, AF, ASD		HCM, DCM	
MYH7		Sinus bradycardia, AF		HCM, DCM	