

Grandes questions en stimulation

# Pacemaker en rythme sinusal : simple chambre vs double chambre

COEUR  
THORAX  
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# Liens d'intérêt

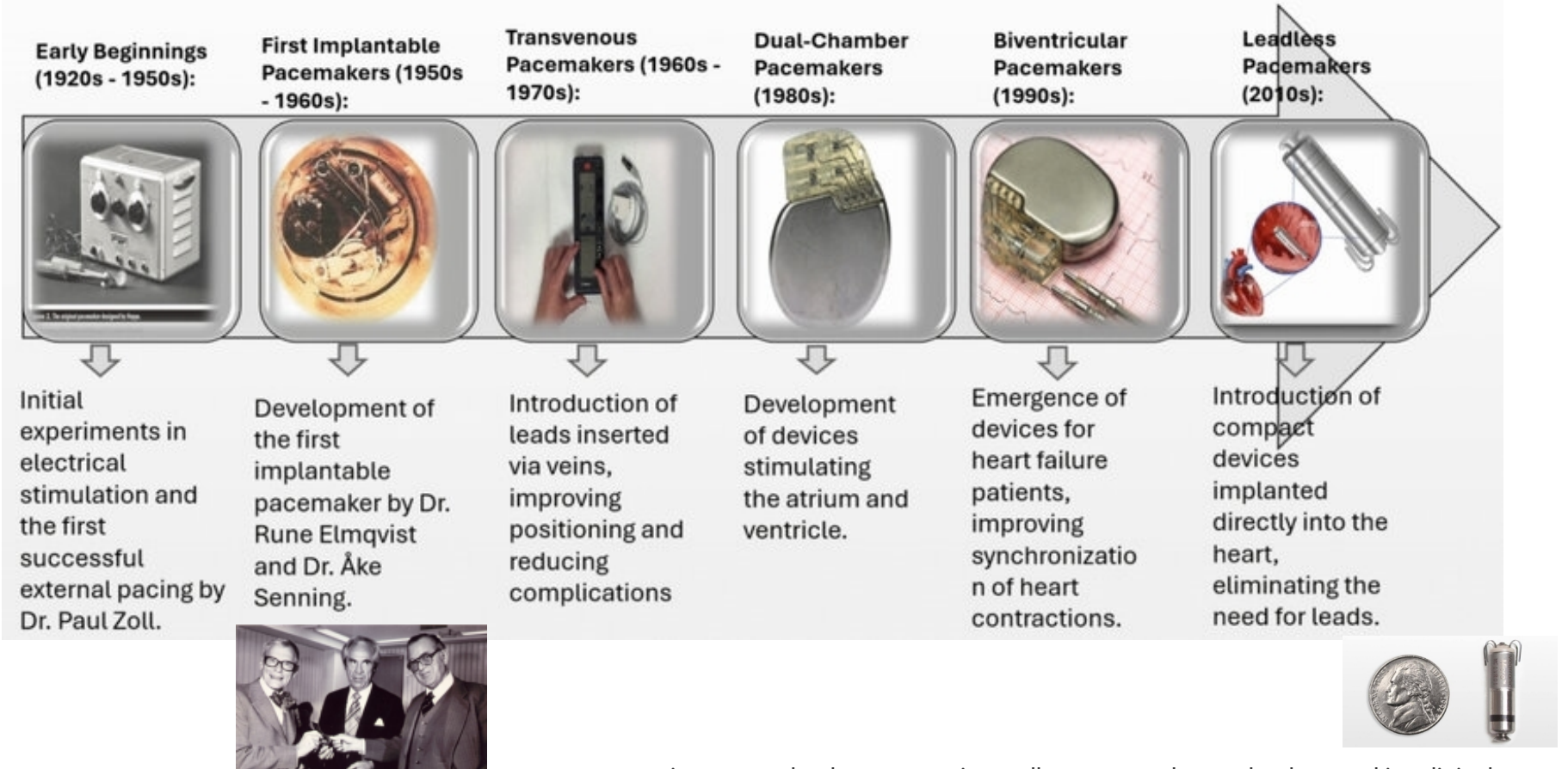
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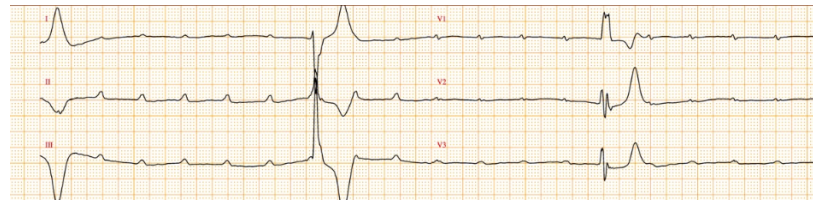
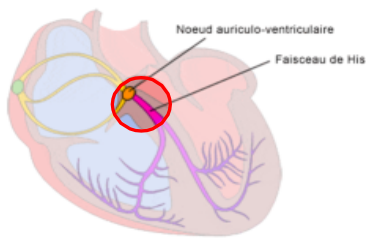
## **Laurent Fauchier:**

*Orateur ou consultant:* AstraZeneca, Bayer, BMS Pfizer,  
Boehringer Ingelheim, Boston Scientific, Medtronic,  
Novartis, Novo Nordisk, Zoll

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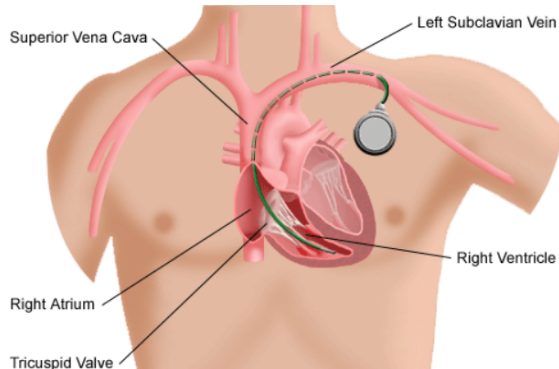
# Evolution of pacemaker technology



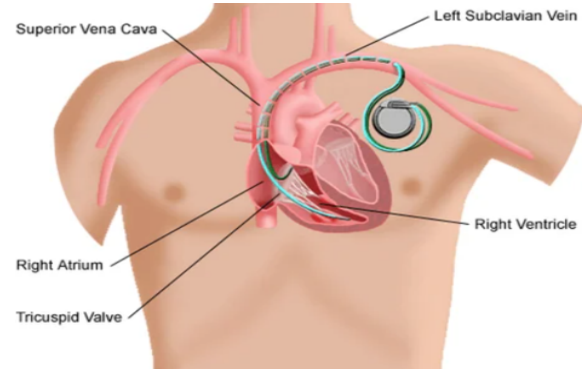


## BAV de haut degré : Prise en charge (dans les pratiques)

- Stimulateur cardiaque simple chambre (VVI)
  - En cas de fibrillation atriale sous-jacente
  - Chez les patients avec âge avancé et comorbidités



- Stimulateur cardiaque double chambre (DDD)
  - Chez tous les autres



# DDD vs VVI dans la littérature

## Différences significatives (DDD > VVI) :

- Hémodynamique
- Survenue moindre de syndrome du pacemaker (insuffisance cardiaque stimulo-induite)

## Différences non significatives :

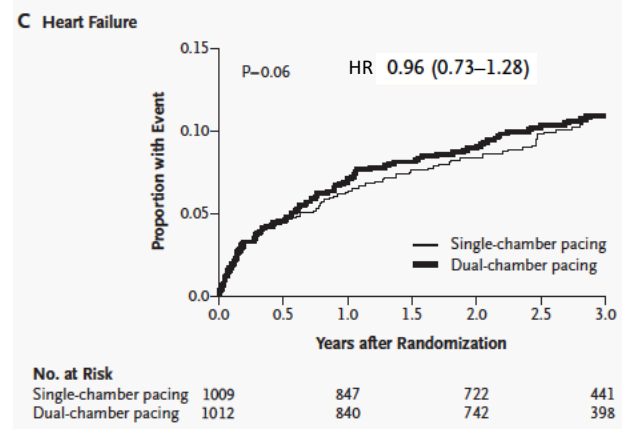
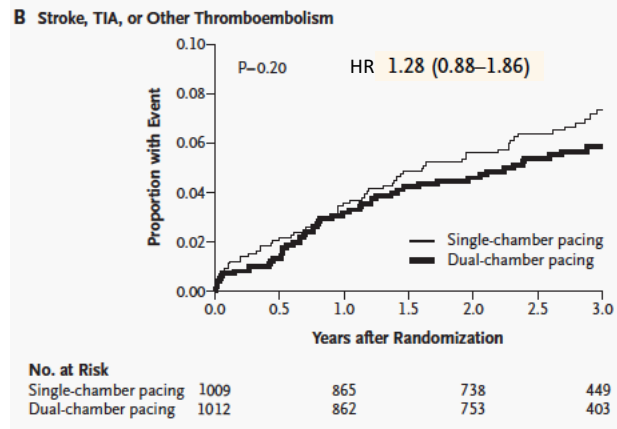
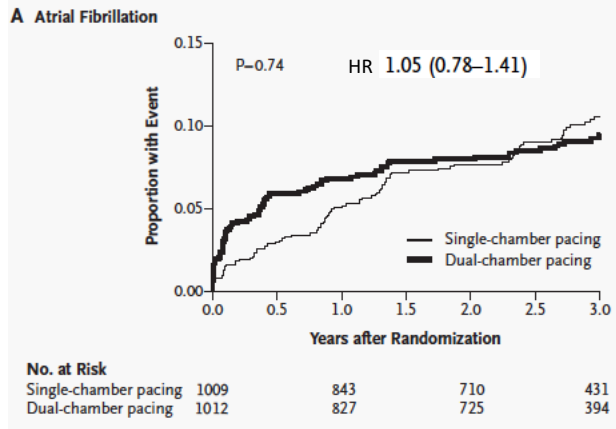
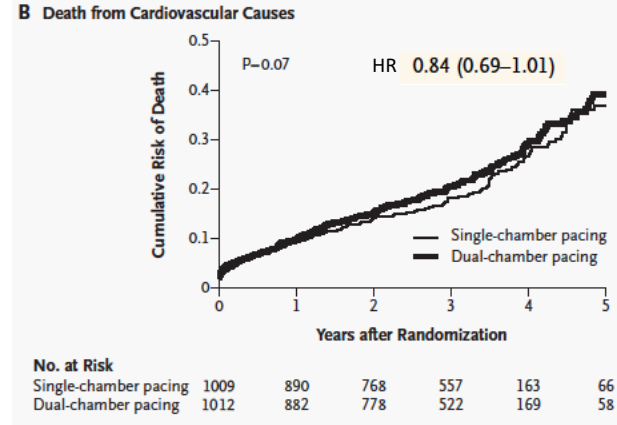
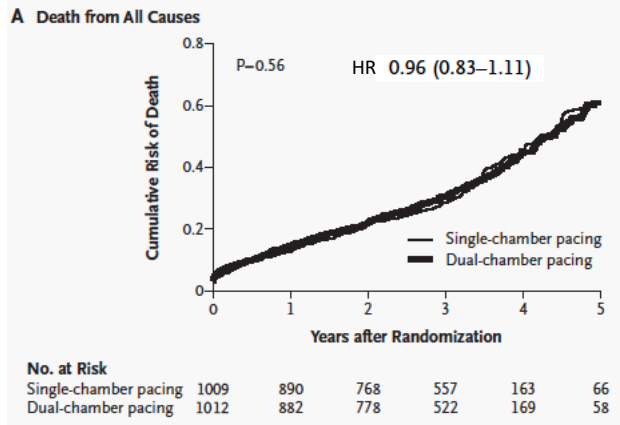
- Mortalité
- Morbidité
- Qualité de vie

Etudes incluant l'ensemble des troubles conductifs (bloc atrioventriculaire et dysfonction sinusale)

# VVI vs DDD in AV block : UK-PACE

<b>Table 1. Baseline Demographic and Clinical Characteristics of the Patients.*</b>			
<b>Characteristic</b>	<b>Single-Chamber Fixed-Rate Pacing Group (N=504)</b>	<b>Single-Chamber Rate-Adaptive Pacing Group (N=505)</b>	<b>Dual-Chamber Pacing Group (N=1012)</b>
Age (yr)	79.8±6.0	80.1±6.1	79.9±6.1
Male sex (%)	56.0	57.4	57.2
Second-degree atrioventricular block	26.2	25.1	26.6
Complete atrioventricular block	73.2	74.3	72.9
Other or unknown	0.6	0.6	0.5
Presenting bradycardia (%)			
Intermittent	38.7	38.2	38.0
Constant	60.7	61.2	61.6
Unknown	0.6	0.6	0.4
Symptoms of bradycardia (%)			
Symptomatic	79.2	81.4	84.7
Asymptomatic	20.2	18.0	15.0

# VVI vs DDD in AV block : UK-PACE

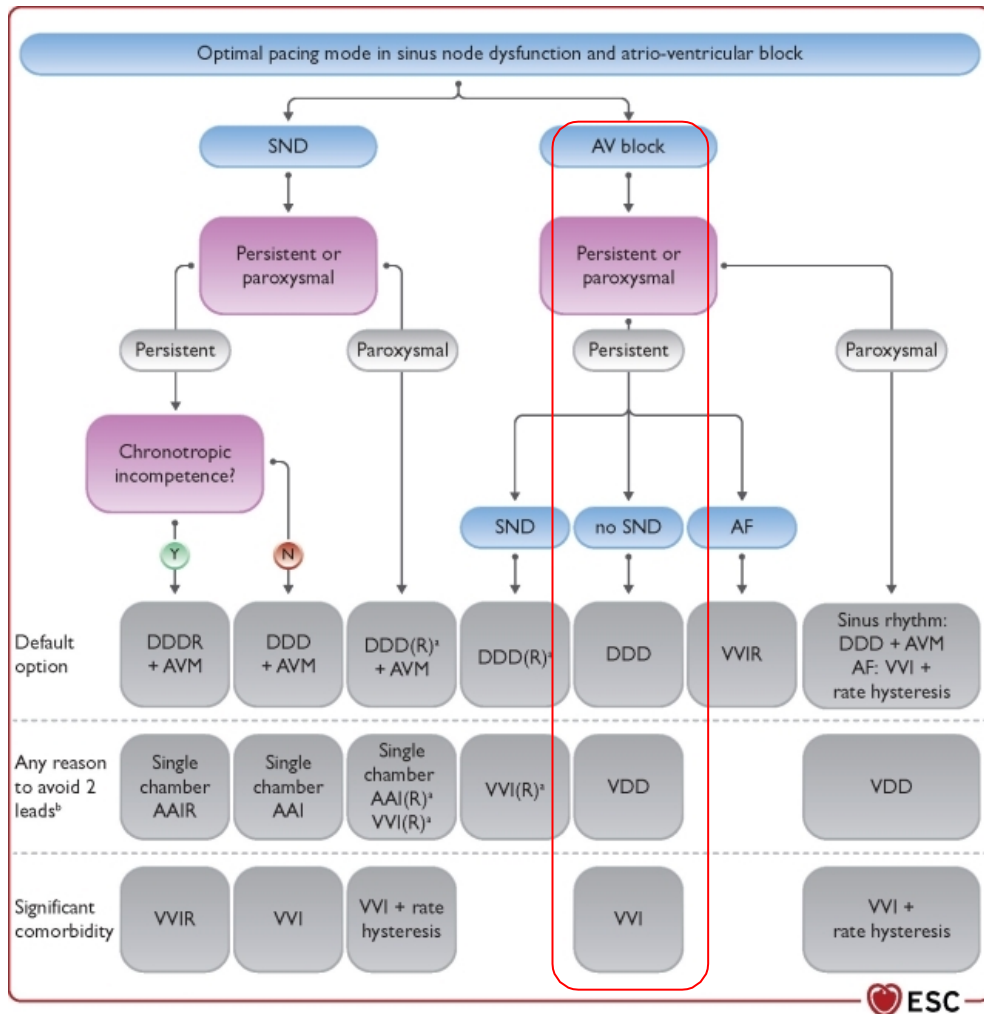


# Single-Chamber versus Dual-Chamber Pacing for High-Grade Atrioventricular Block

William D. Toff, M.D., A. John Camm, M.D., and J. Douglas Skehan, M.B., B.S. for the United Kingdom Pacing and Cardiovascular Events (UKPACE) Trial Investigators\*

## RESULTS

The median follow-up period was 4.6 years for mortality and 3 years for other cardiovascular events. The mean annual mortality rate was 7.2 percent in the single-chamber group and 7.4 percent in the dual-chamber group (hazard ratio, 0.96; 95 percent confidence interval, 0.83 to 1.11). We found no significant differences between the group with single-chamber pacing and that with dual-chamber pacing in the rates of atrial fibrillation, heart failure, or a composite of stroke, transient ischemic attack, or other thromboembolism.



## SND

In patients with SND, controlled studies found that **DDD** was superior to single-chamber ventricular pacing in reducing the incidence of AF. These studies also showed some effect of DDD pacing on the occurrence of stroke.<sup>140,141</sup> Dual-chamber pacing reduces the risk of pacemaker syndrome, which may occur in more than a quarter of patients with SND.<sup>27,142</sup> Pacemaker syndrome is associated with a reduction in quality of life and usually justifies the preference for **DDD** vs. ventricular rate-modulated pacing in SND, when reasonable.<sup>143</sup> Potential exceptions are very elderly and/or frail patients with infrequent pauses who have limited functional capacity and/or a short expected survival. In these patients, the benefit of DDD(R) vs. VVIR pacing is expected to have limited or no clinical impact, and the incremental risk of complications related to the second atrial lead required in DDD(R) implants should also be considered when

## AVB

In patients with AVB, **DDD** should be preferred over single-chamber ventricular pacing to avoid pacemaker syndrome and to improve quality of life.<sup>20,140,181,182</sup>

**IIa**







**A**

# Dual chamber versus single chamber pacemaker in patients with sinus rhythm and atrioventricular block : a nationwide cohort study

Thèse présentée par Ivann TEXIER

Dirigée par le Dr. A. BODIN et Pr L. FAUCHIER

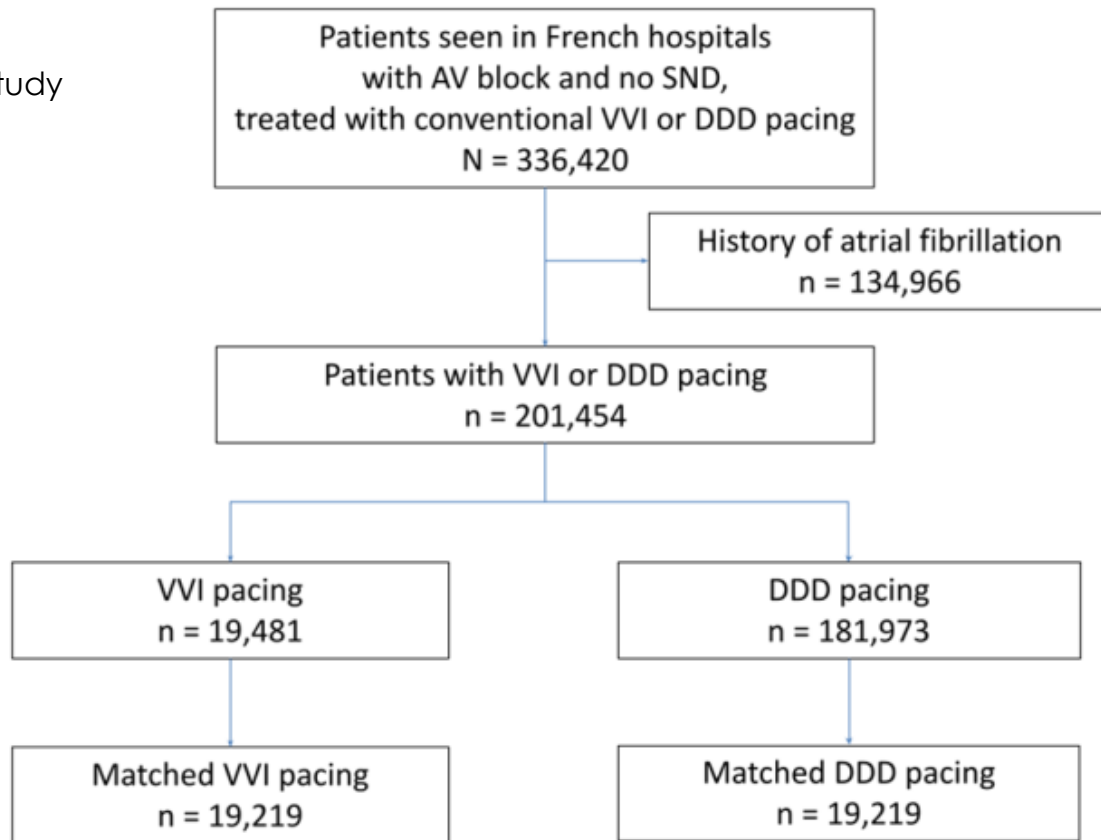
## Dual-chamber vs. single-chamber pacemaker in patients in sinus rhythm with an atrioventricular block: a nationwide cohort study

Alexandre Bodin <sup>1\*</sup>, Ivann Texier<sup>1</sup>, Arnaud Bisson <sup>1</sup>, Bertrand Pierre<sup>1</sup>, Julien Herbert <sup>1,2</sup>, Mathieu Jacobs <sup>1</sup>, Mathieu Nasarre <sup>1</sup>, Anne Bernard<sup>1</sup>, and Laurent Fauchier <sup>1</sup>

## ● Méthode

- Base de données : PMSI (cotation ICD-10 / CCAM)
- Rétrospective : entre le 1<sup>er</sup> janvier 2017 et le 1<sup>er</sup> septembre 2020
- Inclus : patients ayant une première implantation d'un stimulateur cardiaque en France dans l'indication BAV complet et rythme sinusal sous-jacent
- Non inclus : dysfonction sinusale, CRT, stimulateur sans sonde
- Exclus : antécédent de fibrillation atriale
- Appariement avec score de propension
  - Deux groupes comparables : simple chambre (VVI) vs double chambre (DDD)

**Figure 1:**  
Flow chart of the study  
patients



- Critères cliniques

- Mortalité toute cause
- Mortalité cardiovasculaire
- Fibrillation atriale
- AVC
- Insuffisance cardiaque
- Endocardite infectieuse (droite ou gauche)

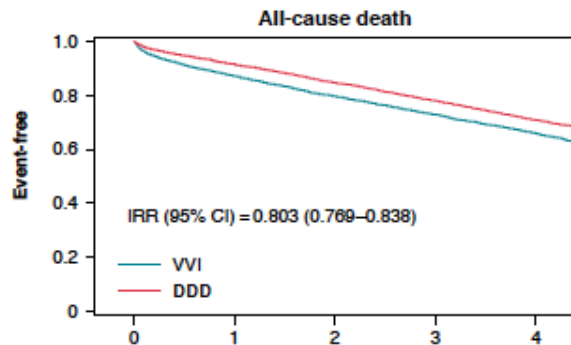
- Critères liés au dispositif

- Upgrading de VVI vers DDD ou VVI/DDD vers CRT
- Pneumothorax/hémithorax
- Tamponnades
- Complications non infectieuses de la loge (hématome, réintervention)
- Complications des sondes avec réintervention
- Infections de loge

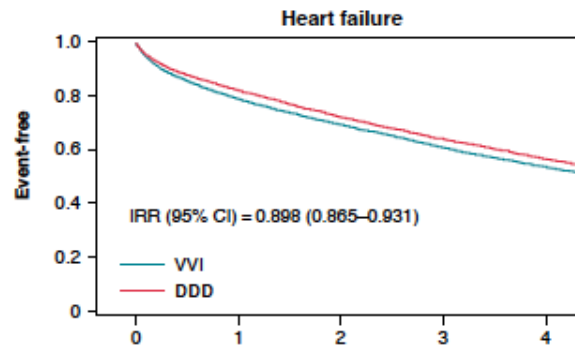
**Table 1** Baseline characteristics of unmatched and matched patients

	Before PS matching			Standardized difference (%)	After PS matching			Standardized difference (%)
	Dual-chamber pacemaker (n = 181 973)	Single-chamber pacemaker (n = 19 481)	P		Single-chamber pacemaker (n = 19 219)	Dual-chamber pacemaker (n = 19 219)	P	
<b>Dual-chamber pacemaker (n = 181 973)</b>								
<b>Single-chamber pacemaker (n = 19 481)</b>								
	77.9 ± 10.4	84.1 ± 10.7	<0.0001	-59.6	84.0 ± 10.4	84.0 ± 10.4	1.00	0.0
	113 915 (62.6)	10 033 (51.5)	<0.0001	22.9	9955 (51.8)	10 153 (52.8)	0.04	2.1
	110 585 (60.8)	11 790 (60.5)	0.49	0.5	11 627 (60.5)	11 704 (60.9)	0.43	0.8
Diabetes mellitus, n (%)	44 674 (24.6)	4033 (20.7)	<0.0001	9.0	4003 (20.8)	4088 (21.3)	0.29	1.1
Heart failure, n (%)	48 332 (26.6)	5994 (30.8)	<0.0001	-9.5	5871 (30.6)	5994 (31.2)	0.17	1.4
History of pulmonary oedema, n (%)	2275 (1.3)	343 (1.8)	<0.0001	-4.5	313 (1.6)	313 (1.6)	1.00	0.0
Valve disease, n (%)	32 118 (17.7)	3450 (17.7)	0.83	-0.2	3404 (17.7)	3433 (17.9)	0.70	0.4
Aortic stenosis, n (%)	22 692 (12.5)	2381 (12.2)	0.32	0.8	2362 (12.3)	2320 (12.1)	0.51	-0.7
Aortic regurgitation, n (%)	4822 (2.7)	569 (2.9)	0.03	-1.7	552 (2.9)	561 (2.9)	0.76	0.3
Mitral regurgitation, n (%)	8407 (4.6)	1011 (5.2)	0.0003	-2.7	992 (5.2)	1036 (5.4)	0.33	1.0
Previous endocarditis, n (%)	852 (0.5)	115 (0.6)	0.02	-1.8	107 (0.6)	88 (0.5)	0.17	-1.4
Dilated cardiomyopathy, n (%)	10 081 (5.5)	1048 (5.4)	0.36	0.7	1024 (5.3)	1026 (5.3)	0.96	0.0
Coronary artery disease, n (%)	47 604 (26.2)	4288 (22.0)	<0.0001	9.5	4245 (22.1)	4286 (22.3)	0.62	0.5
Previous MI, n (%)	8480 (4.7)	844 (4.3)	0.04	1.6	832 (4.3)	871 (4.5)	0.33	1.0
Previous PCI, n (%)	12 374 (6.8)	861 (4.4)	<0.0001	9.6	857 (4.5)	855 (4.5)	0.96	0.0
	1490 (0.8)	69 (0.4)	<0.0001	5.3	69 (0.4)	72 (0.4)	0.80	0.3
	29 498 (16.2)	2973 (15.3)	0.001	2.6	2935 (15.3)	3010 (15.7)	0.30	1.1
	15 049 (8.3)	1389 (7.1)	<0.0001	4.2	1374 (7.2)	1399 (7.3)	0.62	0.5
	13 284 (7.3)	1327 (6.8)	0.01	1.9	1307 (6.8)	1353 (7.0)	0.34	0.9
	5277 (2.9)	690 (3.5)	<0.0001	-3.8	673 (3.5)	663 (3.5)	0.80	-0.3
Intracranial bleeding, n (%)	2912 (1.6)	454 (2.3)	<0.0001	-5.7	440 (2.3)	450 (2.3)	0.79	0.3
Smoker, n (%)	11 992 (6.6)	764 (3.9)	<0.0001	11.0	751 (3.9)	800 (4.2)	0.20	1.3
Dyslipidaemia, n (%)	48 678 (26.8)	3900 (20.0)	<0.0001	15.3	3882 (20.2)	4036 (21.0)	0.05	2.0
Obesity, n (%)	27 205 (15.0)	2108 (10.8)	<0.0001	11.7	2083 (10.8)	2149 (11.2)	0.29	1.1
Alcohol-related diagnoses, n (%)	5932 (3.3)	540 (2.8)	0.0003	2.8	527 (2.7)	530 (2.8)	0.90	0.1
Chronic kidney disease, n (%)	12 210 (6.7)	1773 (9.1)	<0.0001	-9.4	1730 (9.0)	1830 (9.5)	0.08	1.8
Dialysis, n (%)	2202 (1.2)	273 (1.4)	0.02	-1.7	259 (1.4)	306 (1.6)	0.05	2.0
Lung disease, n (%)	18 507 (10.2)	2305 (11.8)	<0.0001	-5.5	2235 (11.6)	2231 (11.6)	0.96	-0.1
Sleep apnoea syndrome, n (%)	12 028 (6.6)	785 (4.0)	<0.0001	10.6	780 (4.1)	800 (4.2)	0.64	0.5
Chronic obstructive pulmonary disease, n (%)	11 282 (6.2)	1182 (6.1)	0.47	0.5	1167 (6.1)	1188 (6.2)	0.66	0.5
Liver disease, n (%)	4094 (2.3)	392 (2.0)	0.03	1.6	381 (2.0)	384 (2.0)	0.88	0.1
Cognitive impairment, n (%)	9044 (5.0)	2934 (15.1)	<0.0001	-43.0	2777 (14.5)	2752 (14.3)	0.72	-0.4
Charlson comorbidity index, mean ± SD	2.9 ± 2.8	3.2 ± 2.7	<0.0001	-11.5	3.2 ± 2.7	3.3 ± 2.8	0.02	2.4
<b>Single-chamber pacemaker (n = 19 219)</b>								
<b>Dual-chamber pacemaker (n = 19 219)</b>								

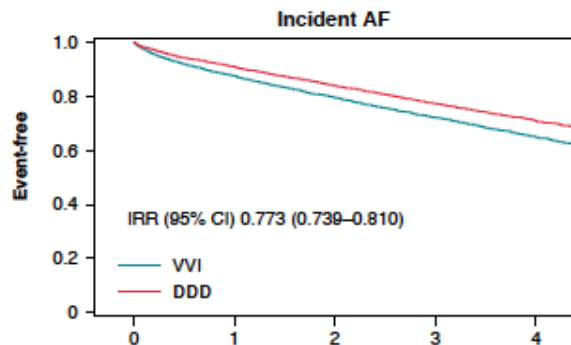
# VVI vs DDD in isolated AV block (no SND, no history of AF): clinical outcomes



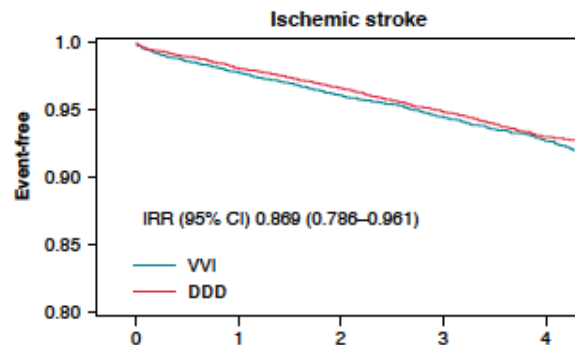
No. at risk	Time since diagnosis (years)				
	0	1	2	3	4
VVI	19 219	10 314	7640	5518	3808
DDD	19 219	10 933	8222	5926	4133



No. at risk	Time since diagnosis (years)				
	0	1	2	3	4
VVI	19 219	8988	6334	4366	2892
DDD	19 219	9689	6880	4806	3222



No. at risk	Time since diagnosis (years)				
	0	1	2	3	4
VVI	19 219	9412	6591	4528	2970
DDD	19 219	10 239	7375	5124	3464



No. at risk	Time since diagnosis (years)				
	0	1	2	3	4
VVI	19 219	10 215	7496	5382	3686
DDD	19 219	10 842	8102	5813	4034

# VVI vs DDD in isolated AV block (no SND, no history of AF)

**Table 3** Incident outcomes in matched patients

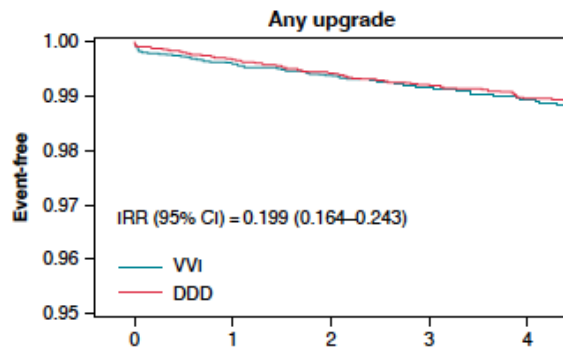
	Dual-chamber pacemaker			Single-chamber pacemaker			DDD vs VVI	
	(n = 19 219)			(n = 19 219)			Hazard ratio (95% CI)	P value
	Person-time (patient-year)	Number of events	Incidence, %/year (95% CI)	Person-time (patient-year)	Number of events	Incidence, %/year (95% CI)		
Clinical outcomes								
All-cause death	42 203	3890	9.22 (8.93–9.51)	39 652	4552	11.48 (11.15–11.81)	0.807 (0.773–0.842)	<0.0001
Cardiovascular death	42 203	1162	2.75 (2.60–2.91)	39 652	1447	3.65 (3.46–3.84)	0.766 (0.709–0.828)	<0.0001
Heart failure	35 699	5534	15.50 (15.09–15.91)	33 088	5714	17.27 (16.82–17.72)	0.908 (0.875–0.943)	<0.0001
Incident AF	37 719	3404	9.03 (8.72–9.33)	34 050	3973	11.67 (11.31–12.03)	0.778 (0.743–0.814)	<0.0001
Ischaemic stroke	41 570	732	1.76 (1.63–1.89)	38 935	789	2.03 (1.89–2.17)	0.873 (0.789–0.965)	0.008
Endocarditis	41 993	174	0.41 (0.35–0.48)	39 466	187	0.47 (0.41–0.54)	0.884 (0.719–1.087)	0.24

# VVI vs DDD in isolated AV block (no SND, no history of AF)

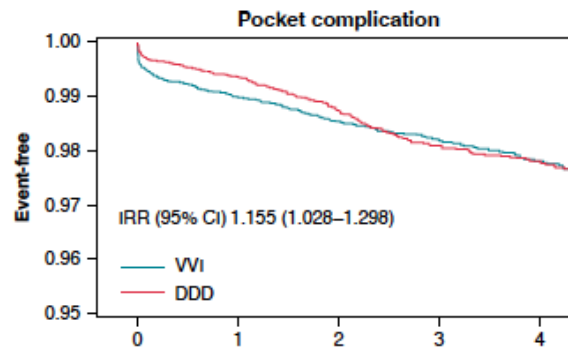
**Table 3** Incident outcomes in matched patients

	Dual-chamber pacemaker			Single-chamber pacemaker			DDD vs VVI	
	(n = 19 219)			(n = 19 219)			Hazard ratio (95% CI)	P value
	Person-time (patient-year)	Number of events	Incidence, %/year (95% CI)	Person-time (patient-year)	Number of events	Incidence, %/year (95% CI)		
<b>Device-related outcomes</b>								
Upgrade to DDD	42 220	0	—	38 409	423	1.10 (1.00–1.21)	—	—
Upgrade to CRT	41 991	120	0.29 (0.24–0.34)	39 395	132	0.34 (0.28–0.39)	0.860 (0.672–1.102)	0.23
Any upgrade to DDD or CRT	41 991	120	0.29 (0.24–0.34)	38 162	547	1.43 (1.31–1.55)	0.210 (0.172–0.256)	<0.0001
Pneumothorax/ haemothorax	42 135	66	0.16 (0.12–0.19)	39 595	70	0.18 (0.14–0.22)	0.901 (0.643–1.261)	0.54
Pocket complication	41 784	631	1.51 (1.39–1.63)	39 001	510	1.31 (1.19–1.42)	1.179 (1.049–1.325)	0.006
Lead complication requiring revision	40 787	670	1.64 (1.52–1.77)	38 345	589	1.54 (1.41–1.66)	1.123 (1.005–1.255)	0.04
Device-related infection	41 907	234	0.56 (0.49–0.63)	39 261	261	0.67 (0.58–0.75)	0.859 (0.720–1.025)	0.09
Tamponade	42 167	25	0.06 (0.04–0.08)	39 641	20	0.05 (0.03–0.07)	1.205 (0.670–2.171)	0.53

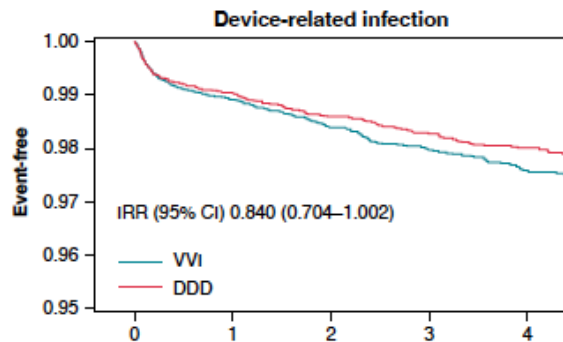
# VVI vs DDD in isolated AV block (no SND, no history of AF): device-related events



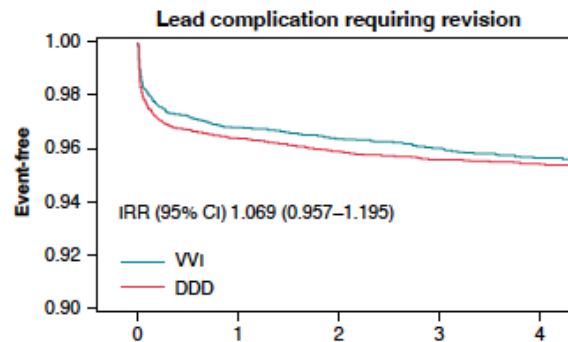
No. at risk	Time since diagnosis (years)				
	0	1	2	3	4
VVI	19 219	10 283	7 594	5 476	3 772
DDD	19 219	10 913	8 182	5 880	4 099



No. at risk	Time since diagnosis (years)				
	0	1	2	3	4
VVI	19 219	10 221	7 537	5 418	3 725
DDD	19 219	10 888	8 169	5 882	4 097



No. at risk	Time since diagnosis (years)				
	0	1	2	3	4
VVI	19 219	10 253	7 564	5 441	3 754
DDD	19 219	10 880	8 172	5 876	4 094



No. at risk	Time since diagnosis (years)				
	0	1	2	3	4
VVI	19 219	10 028	7 383	5 314	3 654
DDD	19 219	10 593	7 933	5 708	3 974

- 1. Le groupe DDD est associé à une incidence plus faible de décès toute cause ou cardiovasculaire, d'insuffisance cardiaque, de fibrillation atriale et d'AVC**
- 2. Le groupe DDD est associé à une incidence plus élevée de complication au niveau des sondes et de la loge sans pour autant avoir une incidence plus élevée d'endocardite ou d'infection du matériel**

# Limites

- Etude rétrospective et les biais associés
  - Utilisation d'un score de propension / Population importante / Plus d'études prospectives
- Données administratives partagées manuellement par les professionnels de santé
  - La cotation est liée au remboursement et donc régulièrement surveillée
- Données uniquement intra-hospitalières
  - La grande majorité des complications conduisent à des consultations ou hospitalisations
- Manque d'informations sur les données échographiques (FEVG) ou les traitements des patients
  - Altération de la FEVG équipé de CRT et donc non inclus
- Manque d'information sur la programmation et sur la position des sondes (notamment VD)
  - Majorité des patients en BAV complet programmés en DDD (reco ESC)
- Durée de suivi de 3 ans (2017 – 2020) limitant les informations sur les évènements à long terme
  - Bonne représentation des pratiques et moyens actuels dans la stimulation cardiaque

# Conclusion

- Dans une étude de cohorte française contemporaine, le traitement par PM DDD chez les patients avec BAV et rythme sinusal est associé à des taux plus faibles de mortalité totale, de mortalité cardiovasculaire, de FA, d'IC et d'AVC par rapport au VVI (ce qui n'a jamais été montré dans un essai randomisé)
- L'implantation d'un PM DDD : davantage de complications de loge (hématome) ou de complications de sonde (déplacement de sonde), mais aucune différence concernant les infections liées au dispositif ou l'endocardite.
- Élément relatif pour conforter les recommandations en faveur de la stimulation DDD et le bénéfice potentiel de la synchronisation AV chez ces patients.
- Peut éclairer certaines discussions autour des stimulateurs sans sonde (diminution des complications) avec nécessité de conserver la synchronisation AV (VDD ou double chambre sans sonde)