La CRT en 2014

Cardiac Resynchronisation Therapy

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INCCI

ASPECAF

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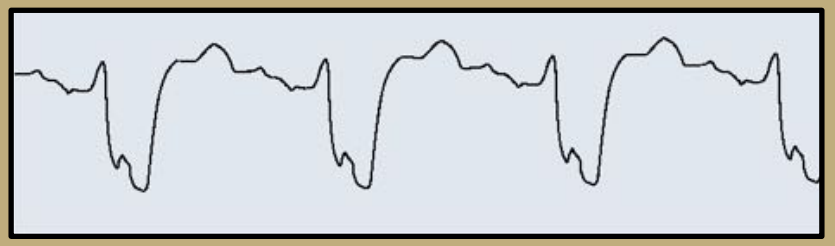
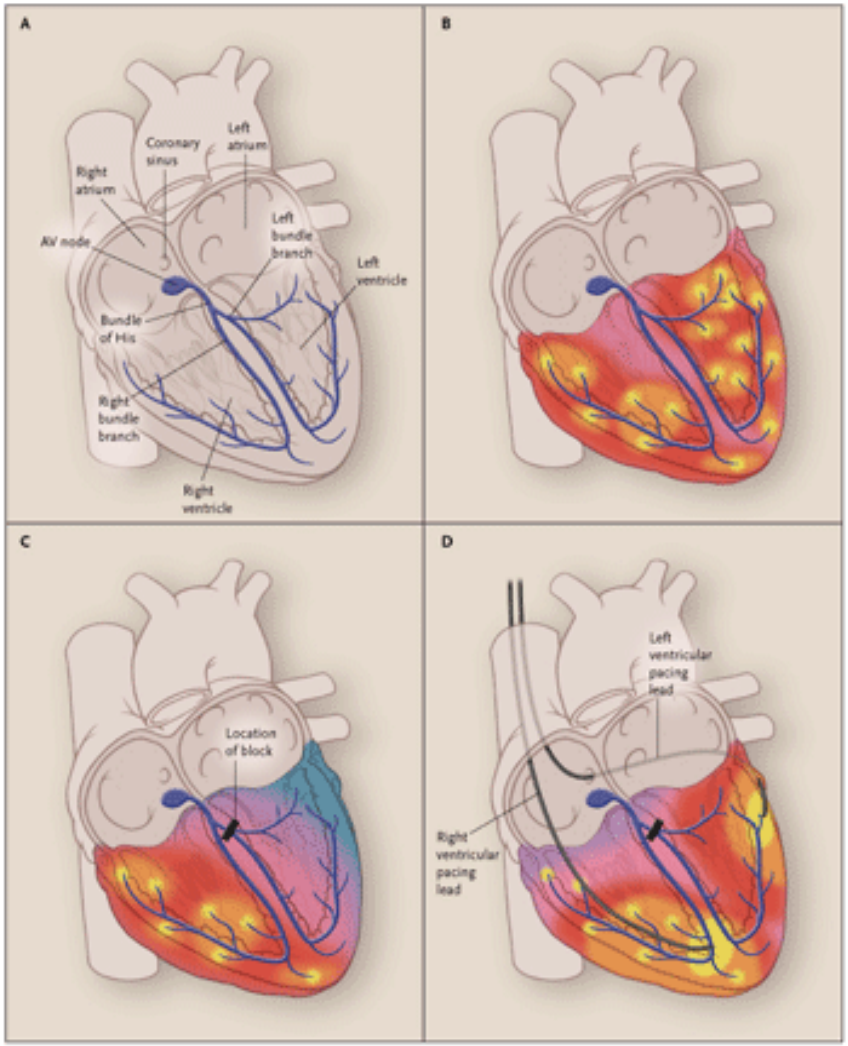
La désynchronisation est due à un délai de la conduction Intraventriculaire

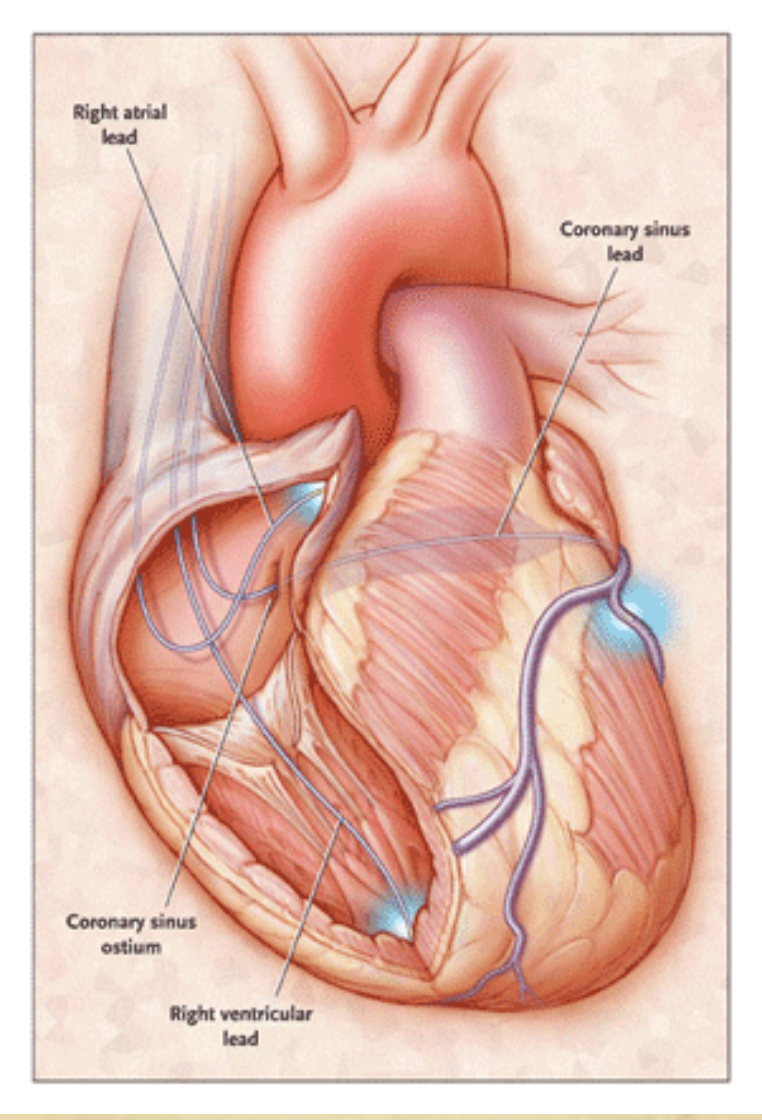
- ...et s'exprime svt sous forme d'un BBG entrainant une contraction anormale, retardée, inefficace du VG, consommatrice d'énergie et augmentant les tensions pariétales

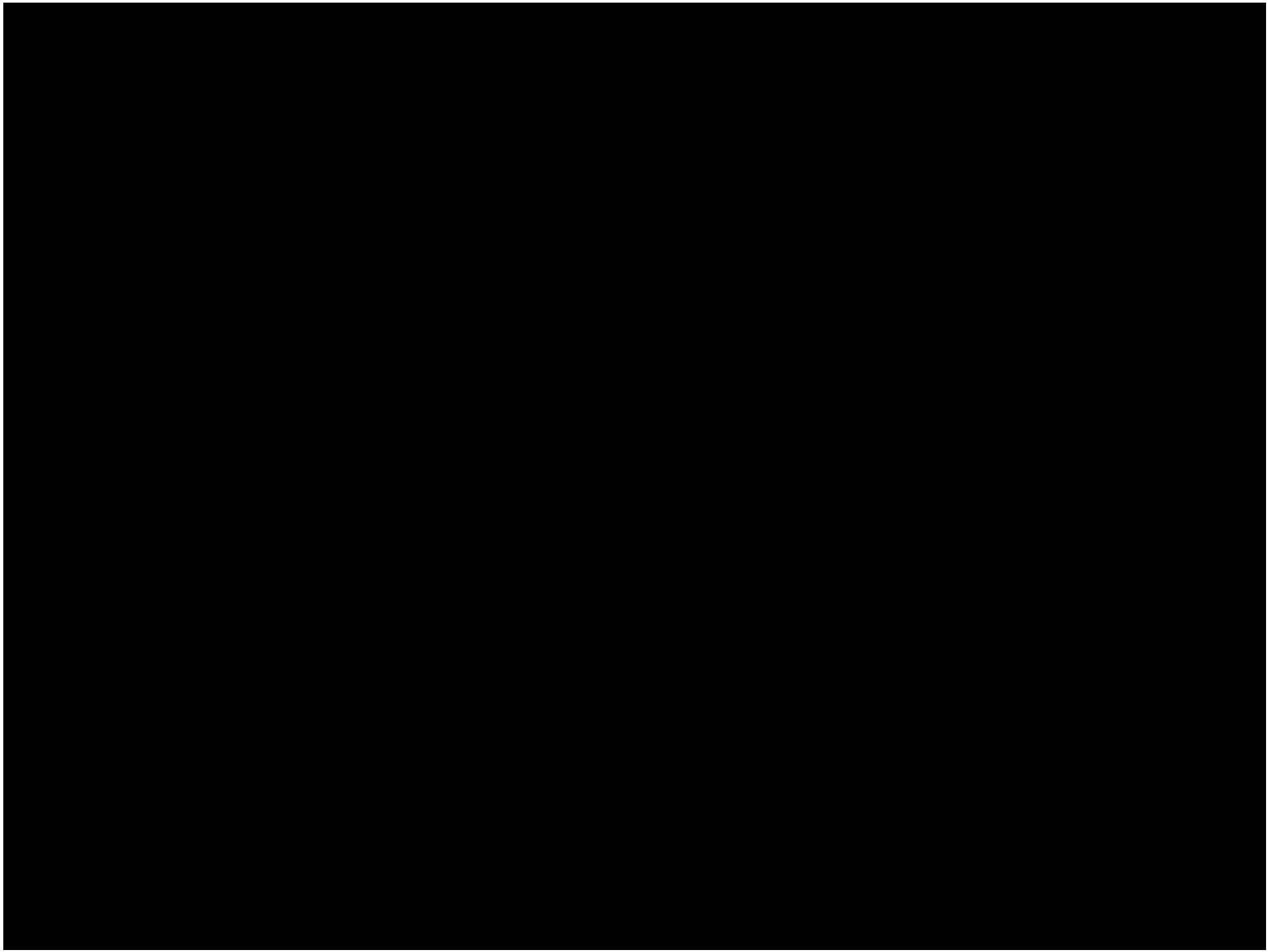


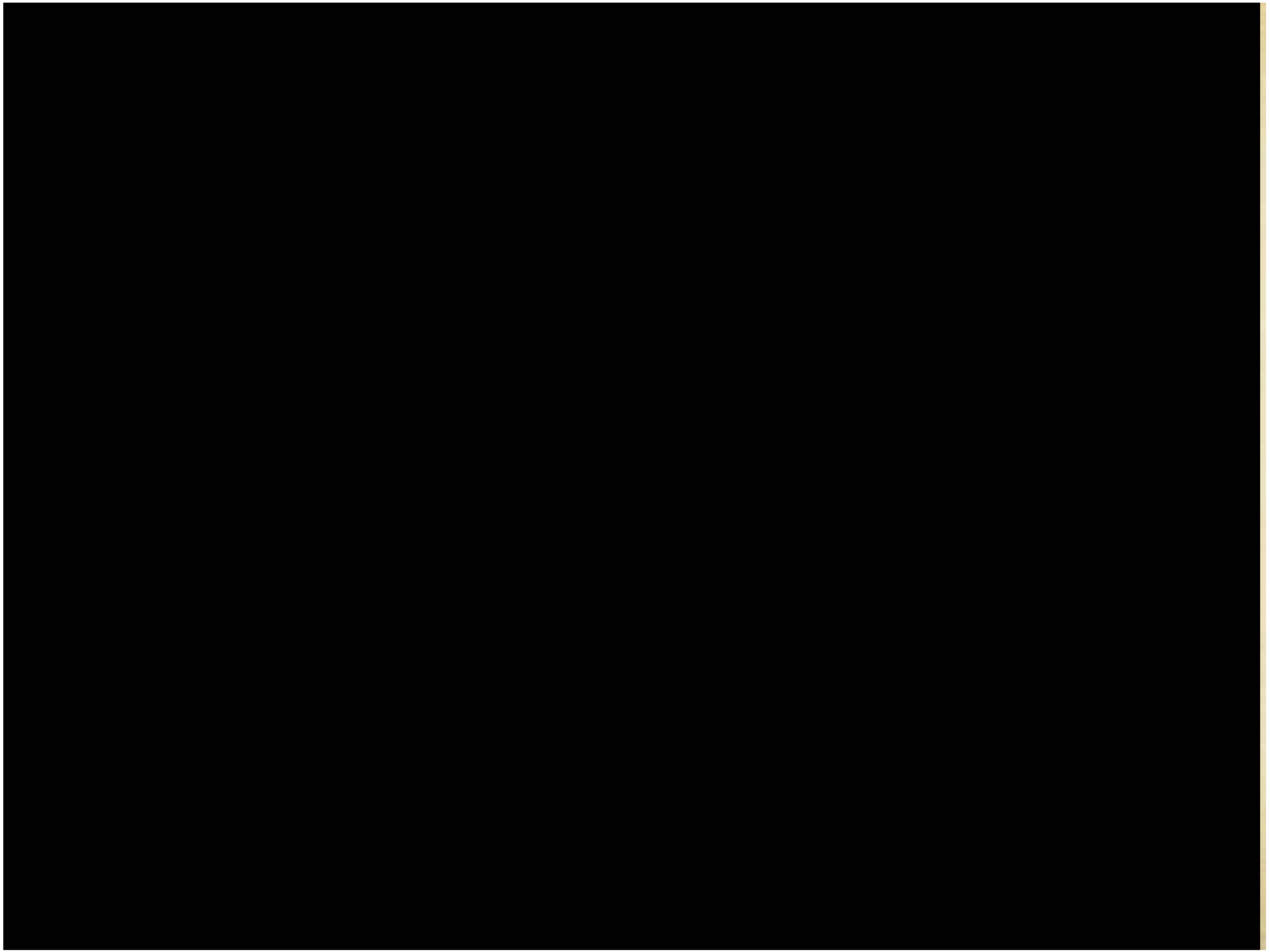
Activation électrique: Normale et BBG



Biventricular Stimulation







Épidémiologie

Epidémiologie

- ±2% de la population globale ont une IC
- EHF survey:
  - 36% des IC ont une FE≤35%
  - Dont 41% ont un QRS≥120ms (17%QRS≥150)
  - 7% de BBD
  - 34% de BBG ou autre trouble de la conduction i-v
- Indication CRT (Estimation ESC): 5-10% /an des patients IC
  - Soit, en principe, 400 pts/an pour une population de 1million
  - Chiffres ESC 2011: 140 CRT/million dont 107 CRT-D et 33 CRT-P/
- 2012: White Book (EHRA)
  - Belgique: 15000 ICD+PM; dont 858 CRT soit 5,7% des implantations
  - Luxembourg: 386 ICD+PM; dont 30 CRT soit 7,7% des implantations

Mortalité de l'Insuffisance Cardiaque

- La mortalité annuelle des patients hospitalisés pour IC est de:
  - ± 20% chez les <75 ans
  - ± 40% chez les >75 ans

- Chez les porteurs d'un CRT, la mortalité annuelle est < 10%

Etudes randomisées et résultats

Trial (ref)	No.	Design	NYHA	LVEF	QRS	Primary endpoints	Secondary endpoints	Main findings
MUSTIC-SR[12]	58	Single-blinded, crossover, randomized CRT vs. OMT, 6 months	III	<35%	≥150	6MWD	NYHA class, QoL, peak VO_2/LV volumes, MR hospitalizations, mortality	CRT-P improved 6MWD, NYHA class, QoL, peak VO_2, reduced LV volumes and MR and reduced hospitalizations
PATH-CHF[13]	41	Single-blinded, crossover, randomized RV vs. LV vs. Bi/V, 12 months	III–IV	NA	≥150	Peak VO_2, 6MWD	NYHA class, QoL hospitalizations	CRT-P improved NYHA class, QoL and 6MWD and reduced hospitalizations
MIRACLE[14]	453	Double-blinded, randomized CRT vs. OMT, 6 months	III–IV	≤35%	≥130	NYHA class, 6MWD , QoL	Peak VO_2, LVEDD, LVEF, MR clinical composite response	CRT-P improved NYHA class, QoL and 6MWD and reduced LVEDD, MR and increased LVEF
MIRACLE-ICD[15]	369	Double-blinded, randomized CRT-D vs. ICD, 6 months	III–IV	≤35%	≥130	NYHA class, 6MWD , QoL	Peak VO_2, LVEDD, LVEF, MR clinical composite response	CRT-D improved NYHA class, QoL, peak VO_2
CONTAK-CD[16]	490	Double-blinded randomized CRT-D vs. ICD, 6 months	II–III–IV	≤35%	≥120	NYHA class, 6MWD , QoL	LV volume, LVEF composite of mortality, VT/VF, hospitalizations	CRT-D improved 6MWD, NYHA class, QoL, reduced LV volume and increased LVEF
MIRACLE-ICD II[17]	186	Double-blinded, randomized CRT-D vs. ICD, 6 months	II	≤35%	≥130	Peak VO_2	VE/VCO_2, NYHA, QoL, 6MWD, LV volumes and EF, composite clinical endpoint	CRT-D improved NYHA, VE/CO_2 and reduced LV volumes and improved LVEF
COMPANION[11]	1520	Double-blinded randomized OMT vs. CRT-P / or vs. CRT-D, 15 months	III–IV	≤35%	≥120	All-cause mortality or hospitalization	All-cause mortality, cardiac mortality	CRT-P and CRT-D reduced all-cause mortality or hospitalization
CARE-HF[18]	813	Double-blinded randomized OMT vs. CRT-P 29.4 months	III–IV	≤35%	≥120	All-cause mortality or hospitalization	All-cause mortality, NYHA class, QoL	CRT-P reduced all-cause mortality and hospitalization and improved NYHA class and QoL
REVERSE[19]	610	Double-blinded, randomized CRT-ON vs. CRT-OFF, 12 months	I–II	≤40%	≥120	% worsened by clinical composite endpoint	LVESV index, heart failure hospitalizations and all-cause mortality	CRT-P/CRT-D did not change the primary endpoint and did not reduce all-cause mortality but reduced LVESV index and heart failure hospitalizations.
MADIT-CRT[20]	1820	Single-blinded, randomized CRT-D vs. ICD, 12 months	I–II	≤30%	≥130	All-cause mortality or heart failure hospitalizations	All-cause mortality and LVESV	CRT-D reduced the endpoint heart failure hospitalizations or all-cause mortality and LVESV. CRT-D did not reduced all-cause mortality
RAFT[21]	1798	Double-blinded, randomized CRT-D vs. ICD 40 months	II–III	≤30%	≥120	All-cause mortality or heart failure hospitalizations	All-cause mortality and cardiovascular death	CRT-D reduced the endpoint all-cause mortality or heart failure hospitalizations. In NYHA III, CRT-D only reduced significantly all-cause mortality

From: 20 Years of Cardiac Resynchronization Therapy

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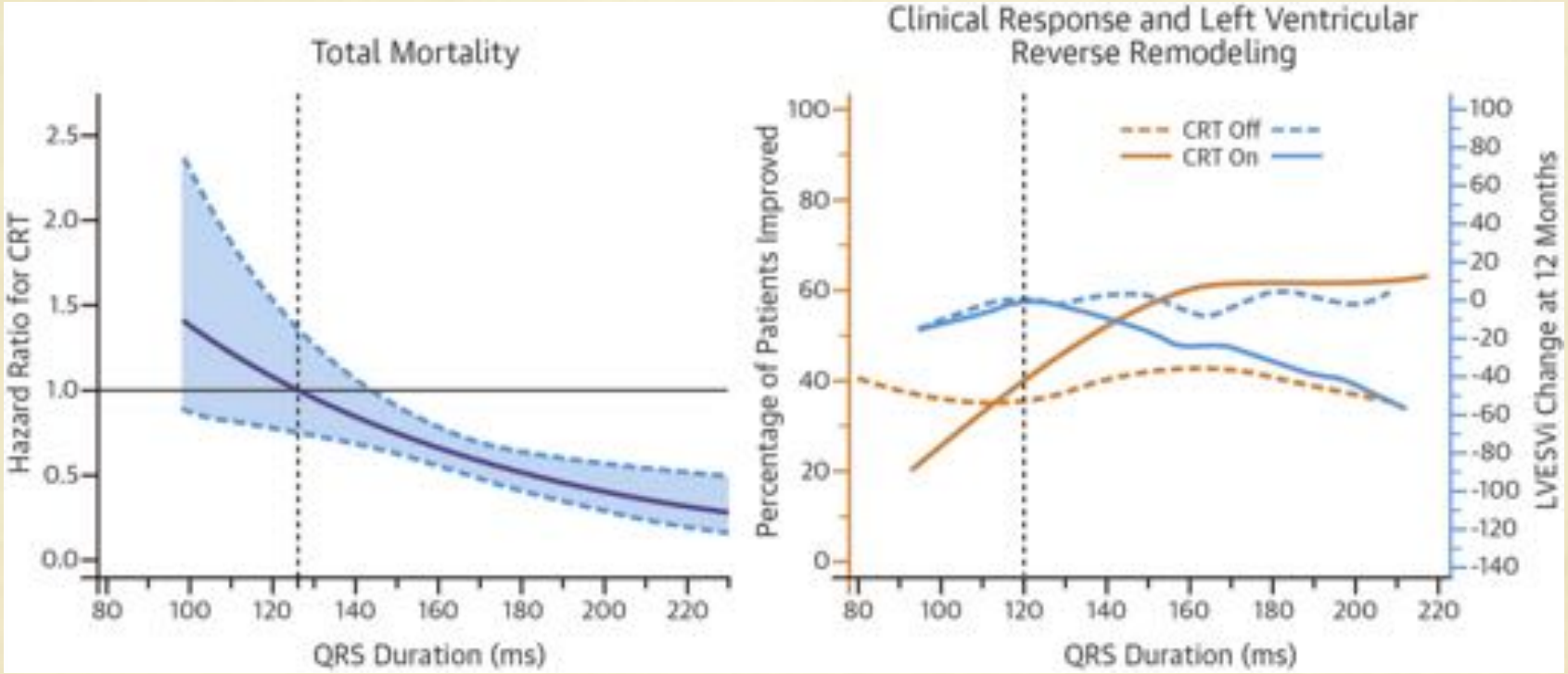
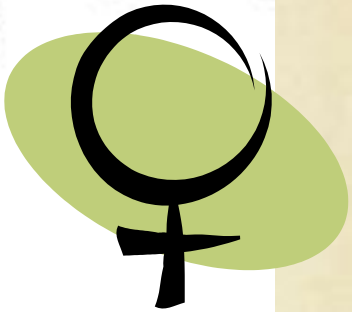


Relation Between QRS Duration and the Response and Outcome of Cardiac Resynchronization Therapy

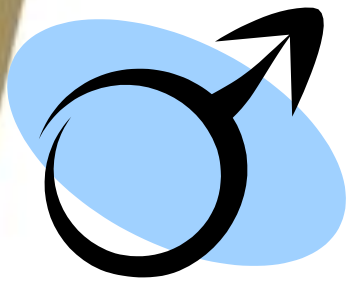
Magnitude of benefit from CRT

Highest (responders)

Wider QRS, left bundle branch block, females, non-ischaemic cardiomyopathy



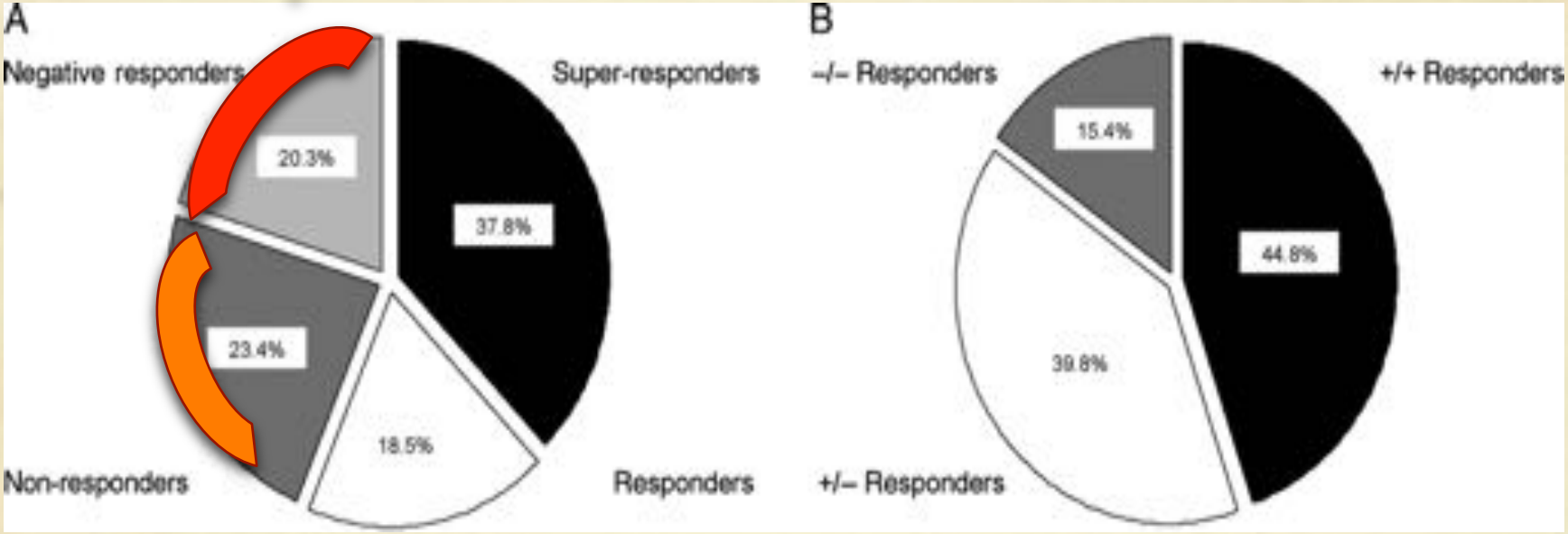
Males, ischaemic cardiomyopathy



Lowest (non-responders)

Narrower QRS, non-left bundle branch block

Les Répondeurs, Super-répondeurs, Non-répondeurs et Répondeurs négatifs



Percentage of responders, according to the extent of reduction in left ventricular end-systolic volume (*A) and the combination of clinical response and a reduction in left ventricular end-systolic volume ≥15% (B).*

Guidelines

Classes of recommendations	Definition	Suggested wording to use
Class I	Evidence and/or general agreement that a given treatment or procedure **is beneficial, useful, effective.**	Is recommended/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

Level of evidence A	Data derived from multiple randomized clinical trials or meta-analyses.
Level of evidence B	Data derived from a single randomized clinical trial or large non-randomized studies.
Level of evidence C	Consensus of opinion of the experts and/or small studies, retrospective studies, registries.

Recommandations en Rythme SINUSAL

Recommendations	Class [a]	Level [b]	Ref. [c]
1) LBBB with QRS duration >150 ms. CRT is recommended in chronic HF patients and LVEF ≤35% who remain in NYHA functional class II, III and ambulatory IV despite adequate medical treatment. [d]	I	A	48–64
2) LBBB with QRS duration 120–150 ms. CRT is recommended in chronic HF patients and LVEF ≤35% who remain in NYHA functional class II, III and ambulatory IV despite adequate medical treatment. [d]	I	B	48–64
3) Non-LBBB with QRS duration >150 ms. CRT should be considered in chronic HF patients and LVEF ≤35% who remain in NYHA functional class II, III and ambulatory IV despite adequate medical treatment. [d]	IIa	B	48–64
4) Non-LBBB with QRS duration 120–150 ms. CRT may be considered in chronic HF patients and LVEF ≤35% who remain in NYHA functional class II, III and ambulatory IV despite adequate medical treatment. [d]	IIb	B	48–64
5) CRT in patients with chronic HF with QRS duration <120 ms is not recommended.	III	B	65, 66

Remarques:

Ad 1) Top indication !!!

Ad 2)Concerne surtout les femmes car chez elles 130ms sont équivalent à 150 ms chez l'homme

Ad 3)+4): si PR<23/100, la CRT semble délétère

Ad5): peut-être délétère, même si désynchronisation mécanique à l'écho !!!

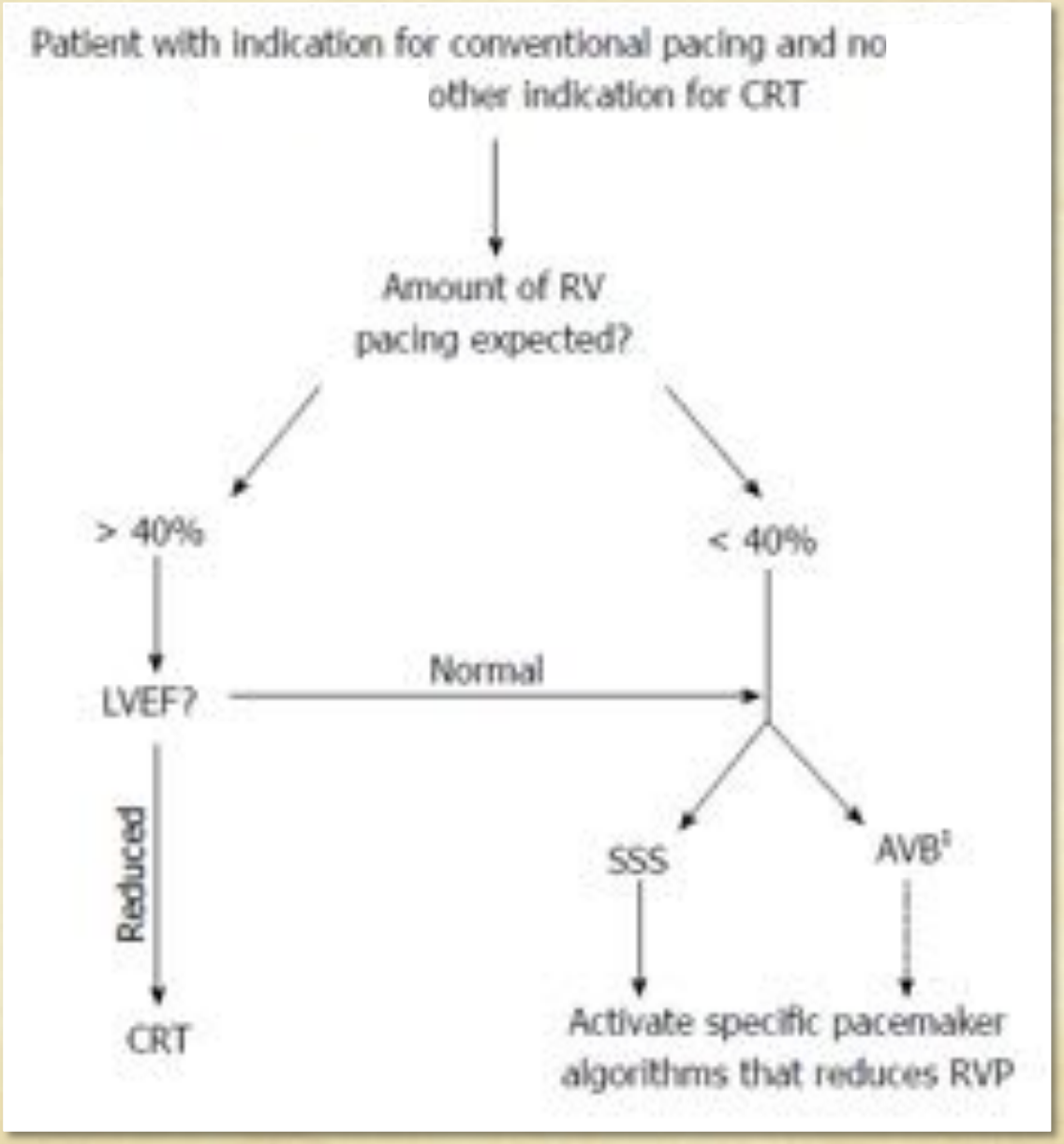
Indication for CRT in patients with permanent Atrial Fibrillation

Recommendations	Class[a]	Level[b]	Ref.[c]
1) Patients with HF, wide QRS and reduced LVEF:			
1A) CRT should be considered in chronic HF patients, intrinsic QRS ≥120 ms and LVEF ≤35% who remain in NYHA functional class III and ambulatory IV despite adequate medical treatment[d], provided that a BiV pacing as close to 100% as possible can be achieved.	IIa	B	62, 89–95
1B) AV junction ablation should be added in case of incomplete BiV pacing.	IIa	B	67–69, 90, 96–105
2) Patients with uncontrolled heart rate who are candidates for AV junction ablation. CRT should be considered in patients with reduced LVEF who are candidates for AV junction ablation for rate control.	IIa	B	89, 94, 105–107

Indication for upgraded or de novo CRT in patients with conventional PM indications and heart failure

Recommendations	Class[a]	Level[b]	Ref.[c]
1) Upgrade from conventional PM or ICD. CRT is indicated in HF patients with LVEF <35% and high percentage of ventricular pacing who remain in NYHA class III and ambulatory IV despite adequate medical treatment.[*]	I	B	47, 108–122
2) *De novo* cardiac resynchronization therapy. CRT should be considered in HF patients, reduced EF and expected high percentage of ventricular pacing in order to decrease the risk of worsening HF.	IIa	B	123–130

BUT= contrecarrer l'effet fréquemment délétère de la stimulation isolée du VD dans les indicat. Conventionelles
(la stim VD entraine aussi un retard de l'activation G)


Patient with indication for conventional pacing and no other indication for CRT
Amount of RV pacing expected?
> 40%
< 40%
LVEF?
Normal
Reduced
CRT
SSS
AVB
Activate specific pacemaker algorithms that reduces RVP

Indication for concomitant ICD (CRT-D)

Recommendations	Class [a]	Level [b]	Ref. [c]
1) When an ICD is planned,[d] a CRT is recommended when indicated.	I	A	50, 53, 54, 60, 62 (see also sections 3.2 and 3.3)
2) When a CRT is planned, implantation of CRT-D device should be considered in patients with clinical conditions listed in *Table 17*.	IIa	B	46, 55, 57, 131

Comparative results of CRT-D versus CRT-P

	CRT-D	CRT-P
Mortality reduction	Similar level of evidence but CRT-D slightly better	Similar level of evidence but CRT-P slightly worse
Complications	Higher	Lower
Costs	Higher	Lower

Choix CRT-P ou CRT-D

Plutôt CRT-P

- Patient fragile, âgé
- CMPNI
- FE≤35%
- NYHA 3-4
- BBG
- QRS≥150

Plutôt CRT-D

- Patient jeune
- CMPI
- FE<25%
- NYHA 1-2
- Non-BBG
- QRS 130-150

Optimisation de la CRT

CRT Optimisation

Parameter	Standard (current practice)	CRT optimization	Additional clinical benefit (compared to standard)	References
LV lead position	Posterolateral	• Avoid apical • Target latest activated area	Benefit likely (less hospitalization for HF) Benefit likely (one RCT more responders, less hospitalization for HF)	70–72 73
AV delay	Fixed empirical AV interval 120 ms (range 100–120 ms)	• Echo-Doppler: shortest AV delay without truncation of the A-wave (Ritter's method) or change in LV systolic function	• Uncertain or mild (one small RCT and several observational positive)	74
		• Device-based algorithms (SmartDelay, QuickOpt)	• Uncertain (two RCTs negative)	76, 79
VV delay	Simultaneous BiV	• Echo: residual LV dyssynchrony	• Uncertain or mild (one RCT showed mild benefit)	77
		• Echo-Doppler: largest stroke volume	• Uncertain (one RCT negative, one controlled positive)	78, 80
		• ECG: narrowest LV-paced QRS; difference between BiV and preimplantation QRS	• Unknown (no comparative study)	75
		• Device-based algorithms (Expert-Ease, Quick-Opt, Peak endocardial acceleration)	• Uncertain (three RCTs negative)	76, 82, 83
LV pacing alone	Simultaneous BiV	n.a.	Non-inferior	84–88

Le problème crucial de la sonde VG

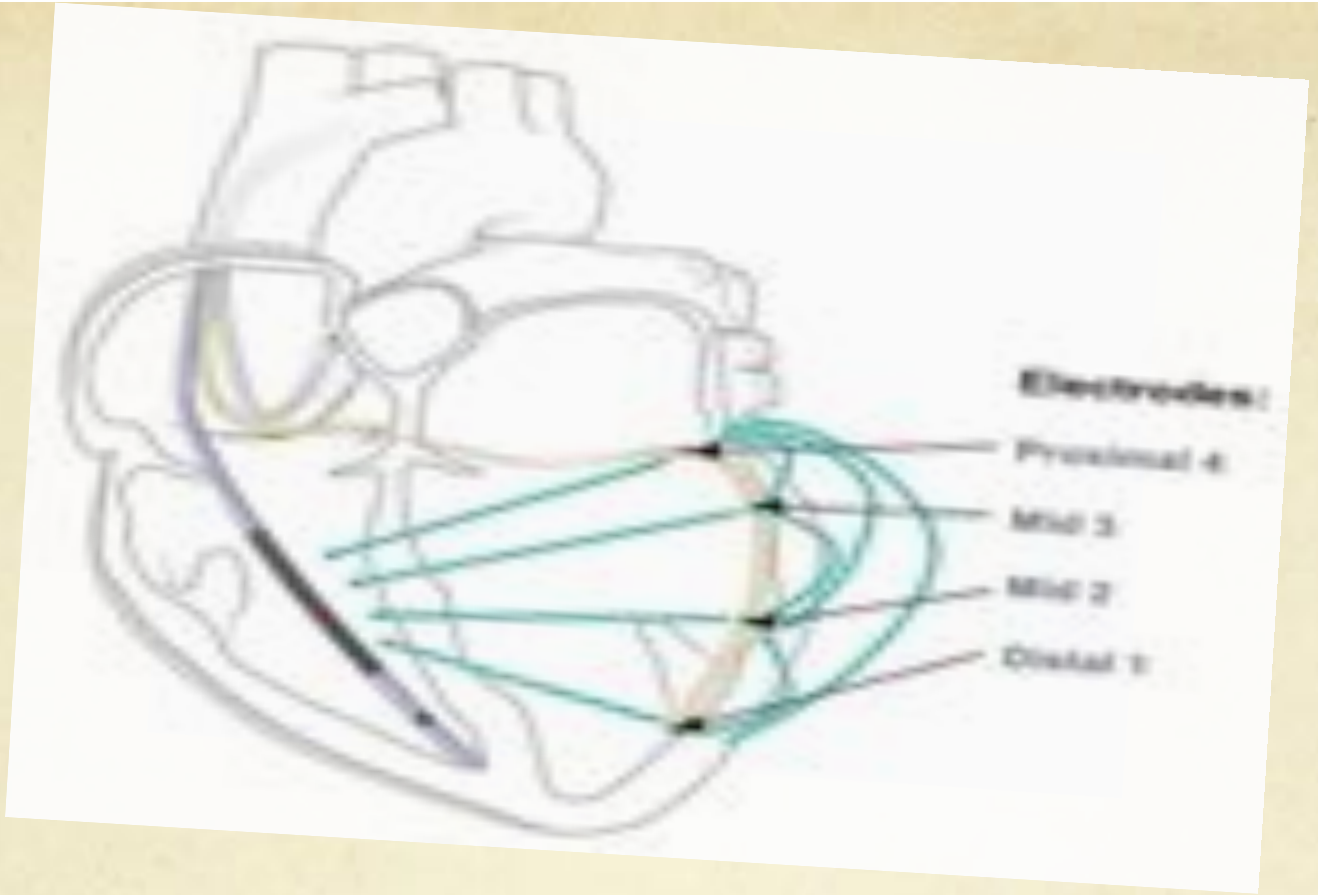
- La voie Endocavitaire classique par le sinus coronaire
  - Pas toujours facile et très time-consuming + dose RX+dissection du SC + Tamponnade!!!
  - Veine adéquate pour stim. post-latérale. Seuils convenables à trouver. Problèmes de stimulation du nerf phrénique .Stabilité de la sonde !!
  - Learning curve importante !!!

Les lois de LOVE

- 1) Curieusement les sondes de stimulation entrent toujours dans le sinus coronaire, sauf…si on veut y aller !
- 2) Si par hasard on arrive à la placer facilement dans une belle veine latérale du VG, la sonde se redéplacera tout aussi facilement !
- 3) Si tout a été difficile et qu'enfin après 3 heures de ramage et de sueurs on arrive à placer la sonde de façon stable, derrière un virage en S quasiment infranchissable dans une petite veine PL…soit on stimule le phrénique avec hoquets incessants…soit les seuils sont démesurément élevés !!!

Mais...

..heureusement il y a..?



Heureusement il y a … eu l'avènement de la sonde quadripolaire

- Eviter aisément la stimulation du phrénique (10 combinaisons)
- Préciser le meilleur pôle de stimulation avec délai VD-VG max
- Meilleure stabilité sans devoir avancer ou reculer la sonde

CRT Optimisation

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LV pacing alone	Simultaneous BiV	n.a.	Non-inferior	84–88

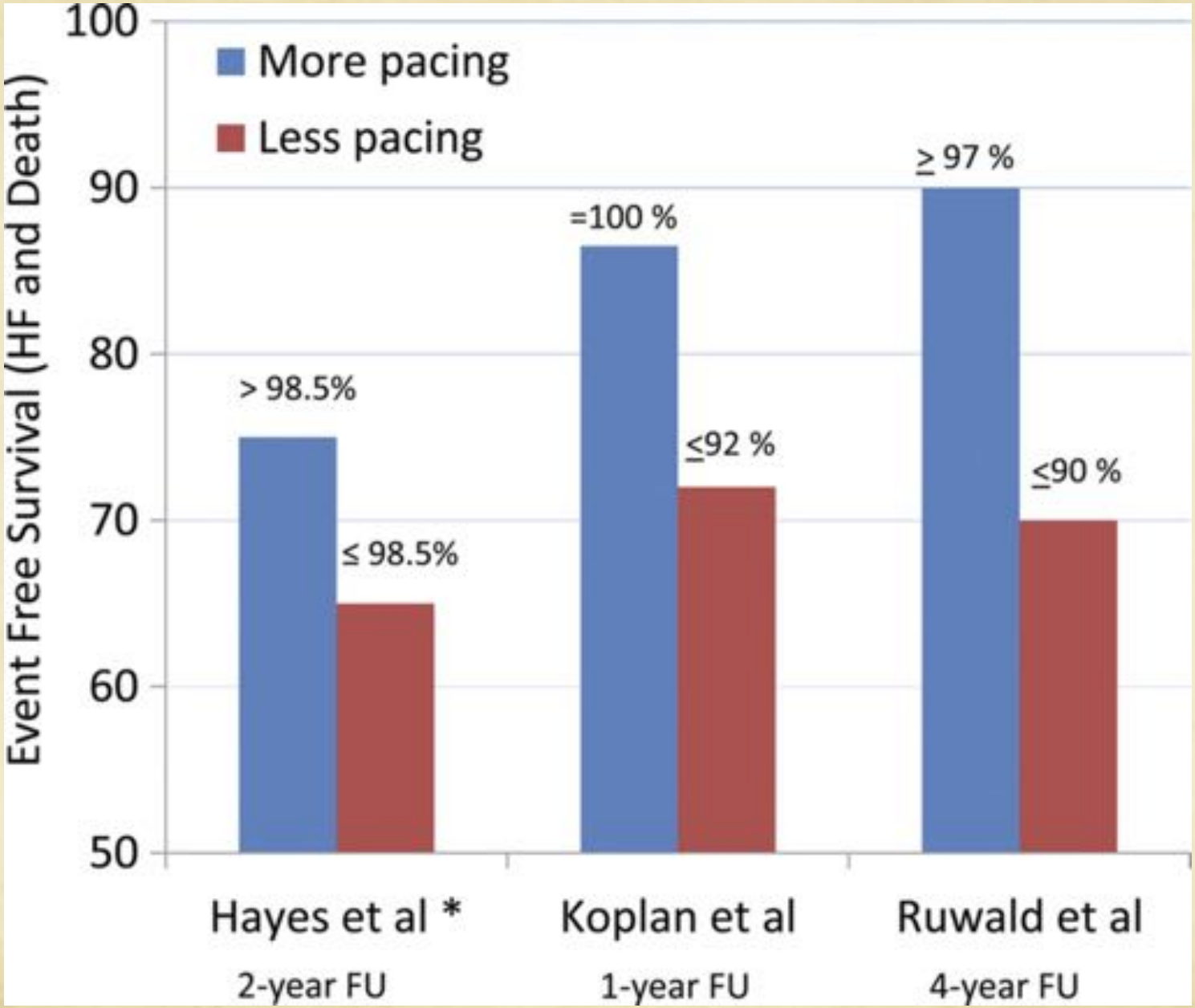
Taux de stimulation biventriculaire

More is better

and

too much is never enough.

(S.Lubitz&J.Singh)


100
90
80
70
60
50
Event Free Survival (HF and Death)
More pacing
Less pacing
> 98.5%
≤ 98.5%
=100 %
≤92 %
≥ 97 %
≤90 %
Hayes et al *
2-year FU
Koplan et al
1-year FU
Ruwald et al
4-year FU

Comment maximaliser la stimulation BIV ?

- Régler le Upper-rate à 220-âge et non réglage standard 120-130bpm
- Faire EE pour vérifier que le délai AV programmé reste < AV spontané
- Activer l'autocapture VG car fluctuations des seuils avec défaut de stimulation possibles
- Si incompétence chronotrope, sensibiliser RR pour augmenter le débit cardiaque
- Si ACFA:
  - Proposer CRT selon critères classiques
  - Holter : évaluer le taux de pseudofusions chez Non-Répondeurs
  - AVNode ablation si stim BIV<90% (ou<99% prop.récente)

Messages à emporter

- CRT uniquement pour patient IC et FE≤35%
- Durée QRS large≥120ms (de *préférence >150ms)* +Morpho BBG (slurring +crochetage)
- Uniquement comme supplément à 1 traitement médical bien conduit ≥3 mois,
- Aucune indication pour QRS<120ms même si présence d'une désynchronisation à l'échographie cardiaque.
- Meilleurs résultats pour rythme sinusal
- Moins évident pour ACFA et primo-implantation pour BSA ou BAV
- Ne pas trop attendre

Il se joue tellement de cet élément , que ces réalisations sont faites en 3D... avec un ...

râteau

Cas clinique 1

- Femme, 50 ans, CMNI, BBG avec QRS=160ms, FE=30%, OMT, NYHA 2-3,
- Question: CRT?
  - Oui
  - Non
  - OUI uniquement si désynchro mécanique (echo)
  - Non si pas de désynchro mécanique

Cas clinique 2

- Femme de 50 ans
- CMNI; FE=30% ;QRS =115ms; NYHA 2-3
- Désynchronisation présente à l'écho

- Question:
  - CRT? oui/non ?