

# Fonction et dysfonction des stimulateurs cardiaques

Peter G. Guerra, MD, FRCP(C)  
Institut de Cardiologie de Montréal



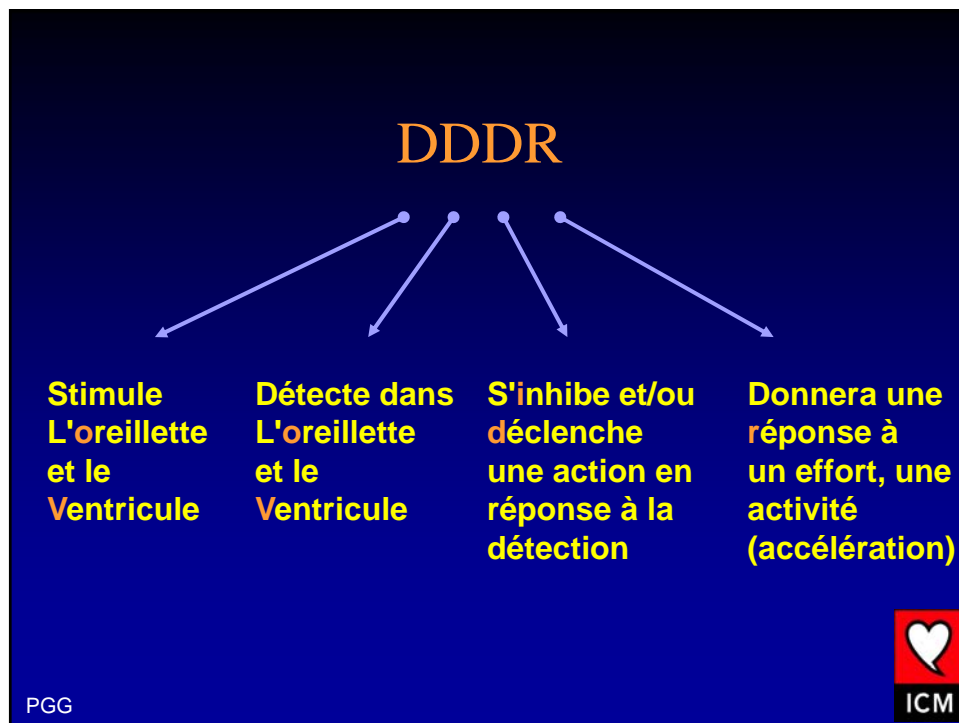
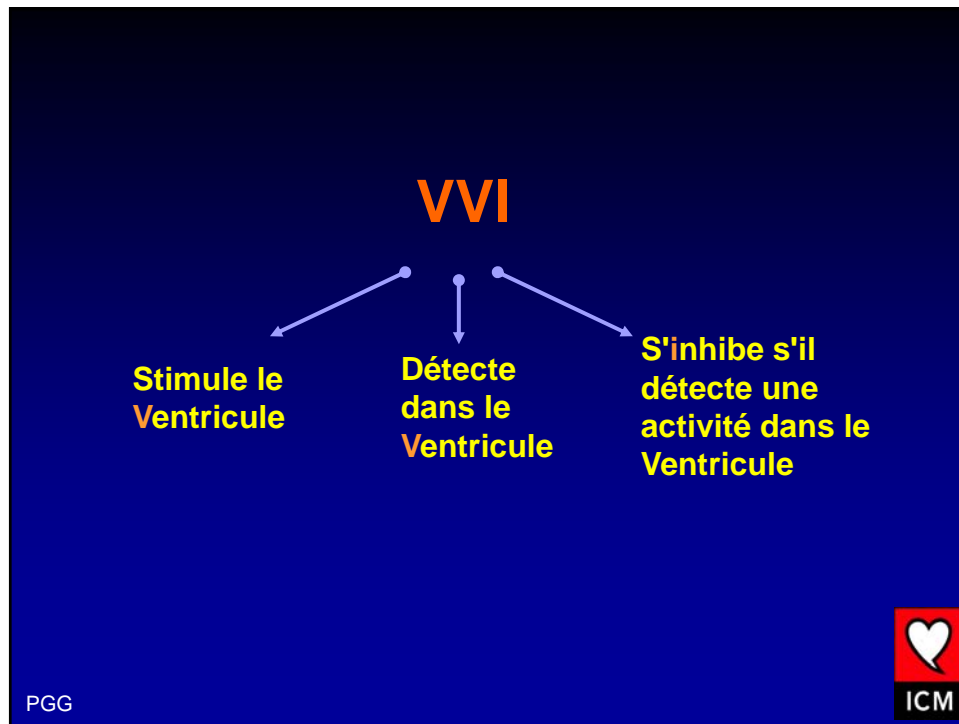
## NBG CODE - 1987

North American Society Pacing and Electrophysiology and  
British Pacing Group

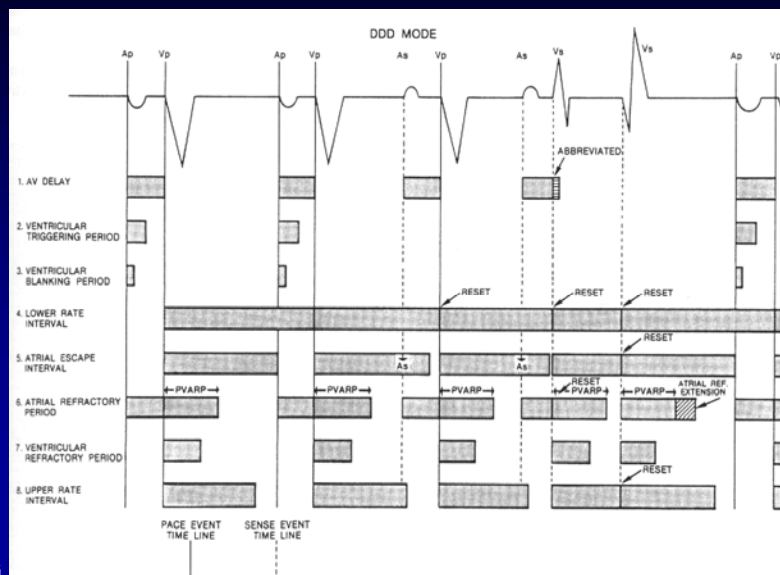
I	II	III	IV	V
Chamber Paced	Chamber Sensed	Mode of Response	Program Functions	Antitachyarrhythmia
V (Ventricle)	V (Ventricle)	T (Triggered)	P (Simple-Prog)	P (Pacing Anti-Tach)
A (Atrium)	A (Atrium)	I (Inhibited)	M (Multi-Prog)	S (Shock)
D (Dual A + V)	D (Dual A + V)	D (Dual, T + I)	C (Communicating)	D (Dual, P + S)
O (None)	O (None)	O (None)	R (Rate Modulating)	O (None)
			O (None)	

\* Manufacturer may designate an "S" in category one or two for Single (A or V).





## DDD Mode



## “Troubleshooting” de l’ECG Pacemaker

- Questions:
  - Rythme sous-jacent?
  - Sensing ?
    - Approprié?
  - Pacing?
    - Approprié?
  - Fréquence de base du Pacemaker?
  - Circonstances Particulières?
    - Magnet
    - EMI
    - Rate response
    - Autres caractéristiques du Pacemaker

## La clé de l'analyse

- Les pacemakers ne font que 2 choses!

• **Pace** 

Sense 

PGG

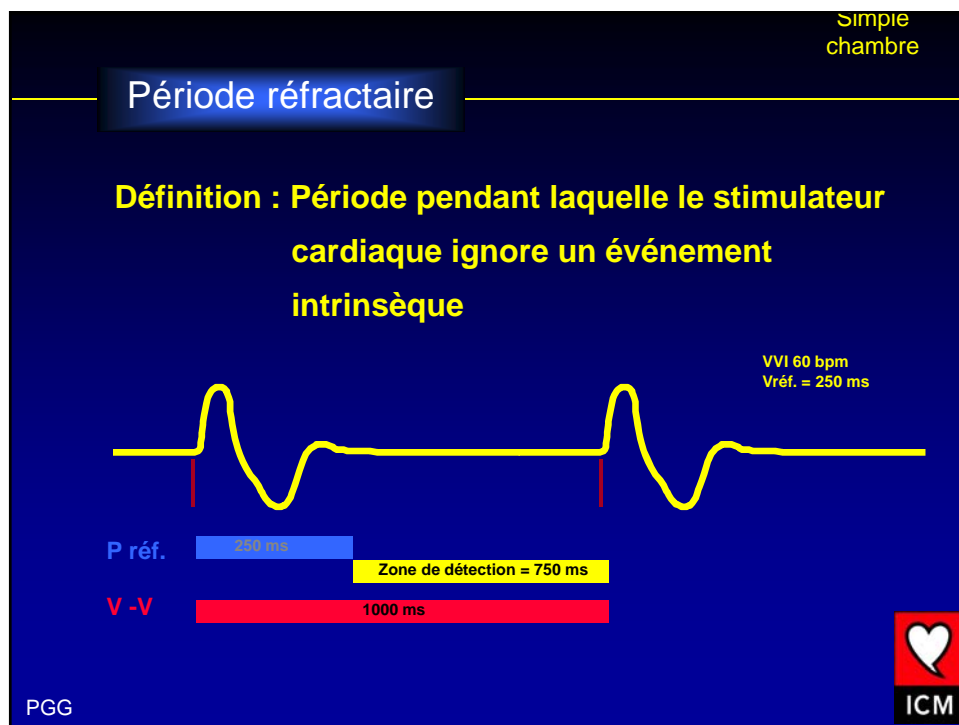
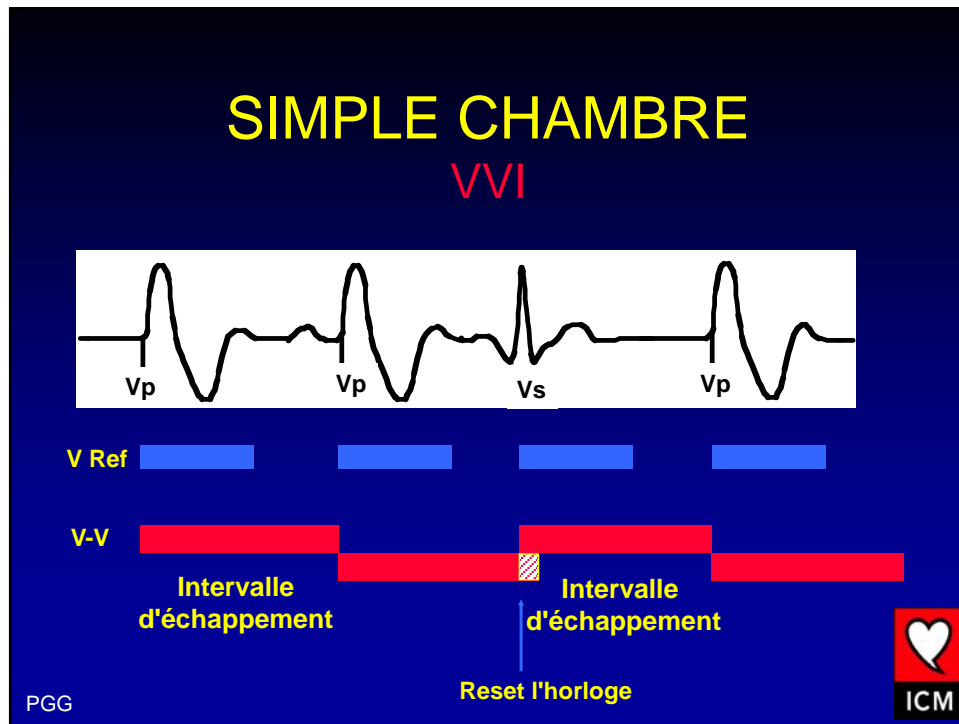


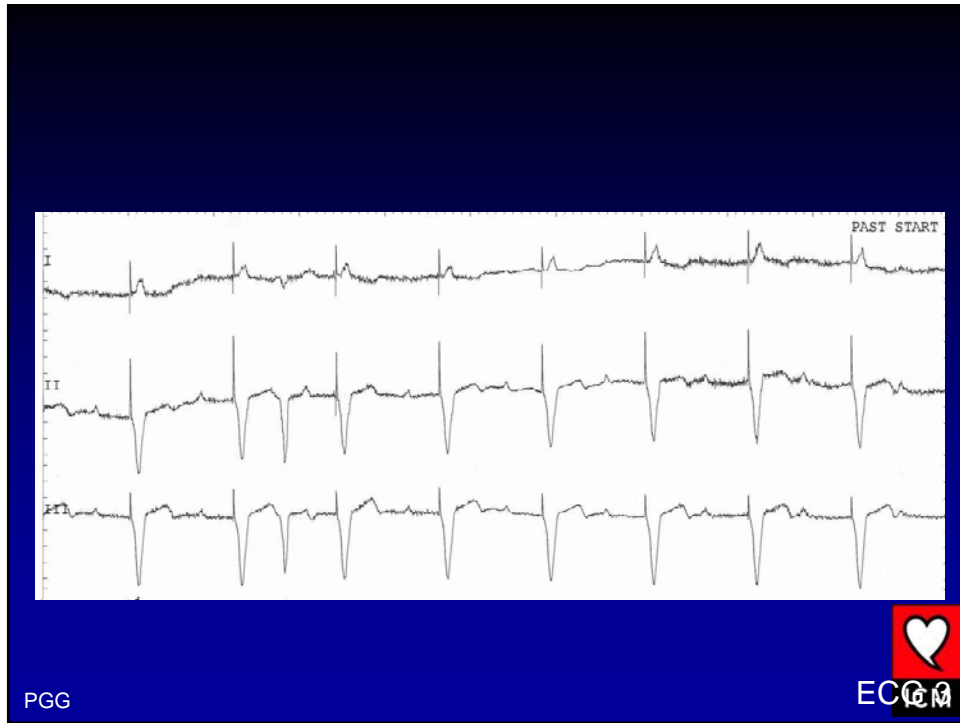
## Sensing

- **Definition:**
  - Ability of the pacemaker to sense an intrinsic electrical signal
  - Depends upon the amplitude and slew rate
- **Programmed (pacemaker) sensitivity setting**
  - Indicates the minimum intracardiac signal that will be sensed by the pacemaker to initiate the pacemaker response (inhibited or triggered).

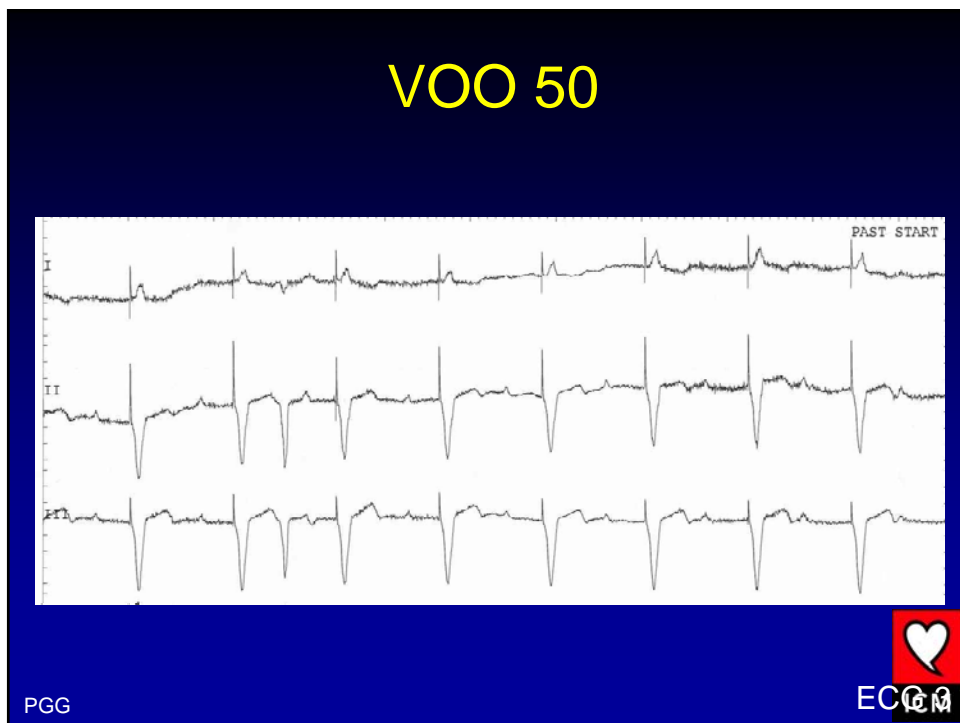
PGG





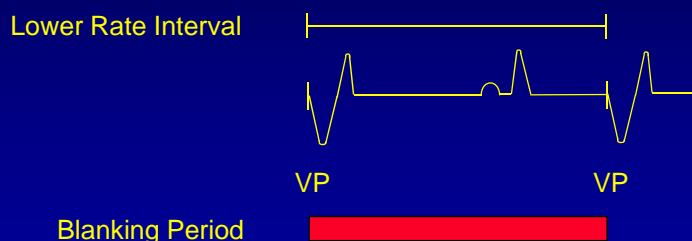


## VOO 50



## VOO Mode

- Asynchronous pacing delivers output regardless of intrinsic activity



VOO / 60

PGG

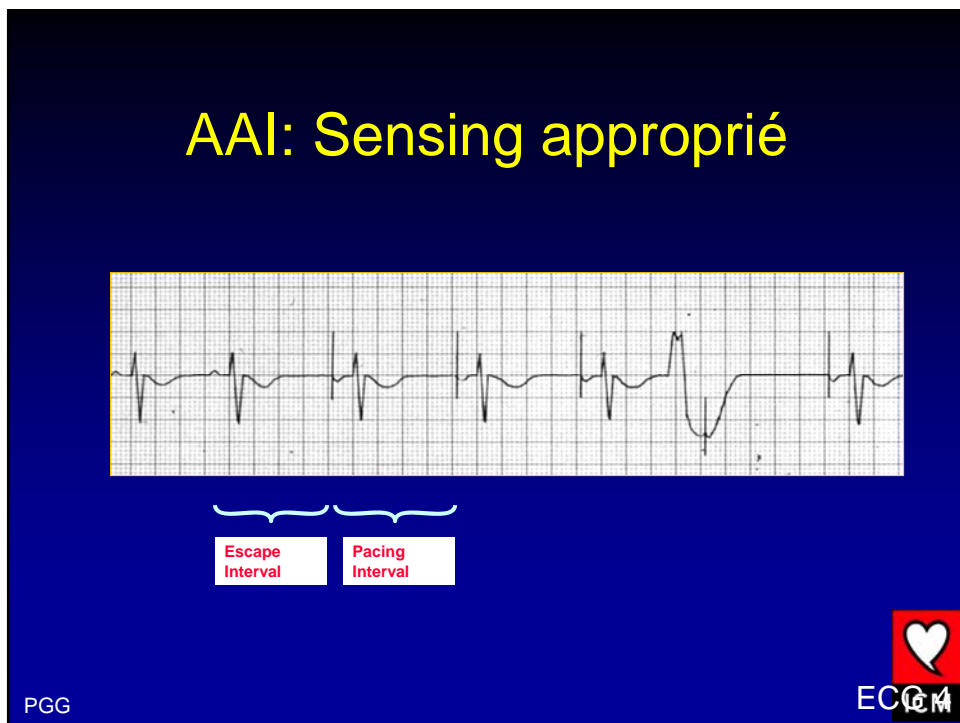
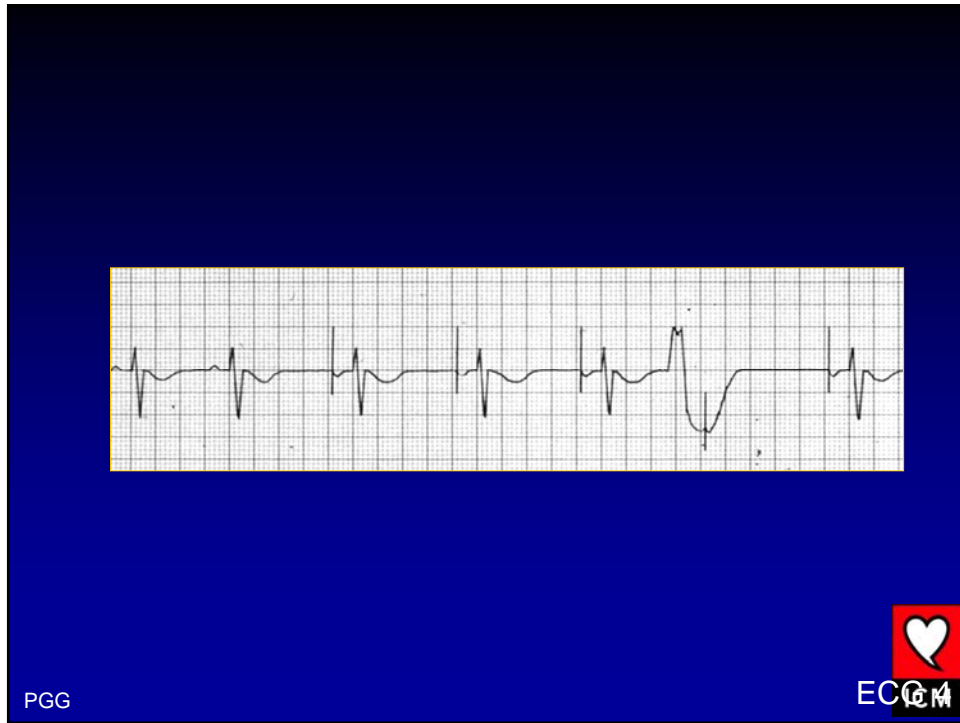


## Undersensing

- Definition:** Failure of the pacemaker circuitry to sense intrinsic P- or R-waves
- Undersensing may cause the pacemaker to emit inappropriately-timed, asynchronous, or competitive output pulses
- Undersensing** leads to **Overpacing**

PGG







# VVI 70

Free Running



Magnet



PGG



# VVI 70: Oversensing

Free Running



Magnet



PGG



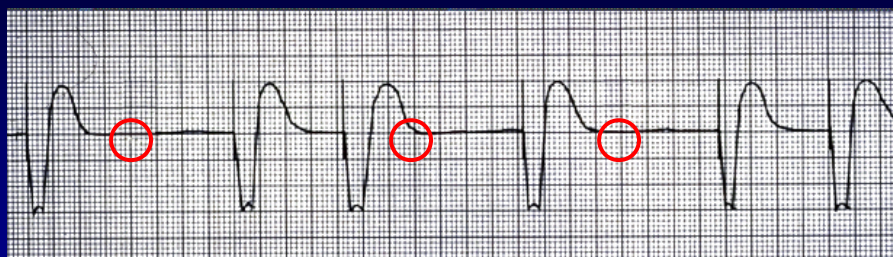
## Oversensing

- **Definition:** The sensing of events other than P or R-waves by the pacemaker circuitry
- **Oversensing** leads to **Underpacing**

PGG



## Ventricular Oversensing

Pacing  
intervalPacing  
intervalPacing  
intervalPacing  
intervalPacing  
interval

PGG



## Oversensing Causes

- Insulation Break
- Intermittent Lead Fracture
- Myopotentials
- **EMI**

PGG



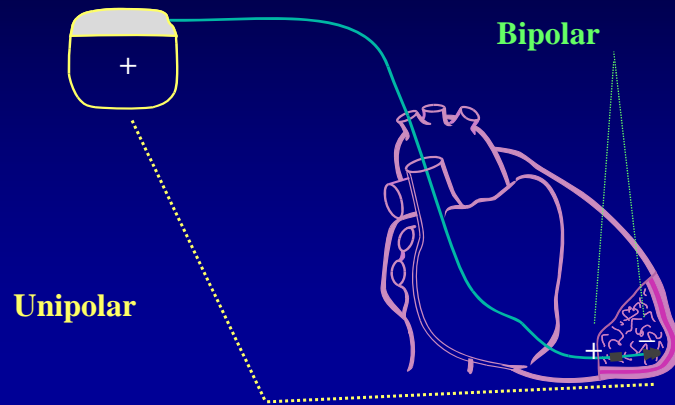
## Possible Solutions

- Program sensitivity to a higher number
- Program the refractory period longer
- Reprogram polarity

PGG



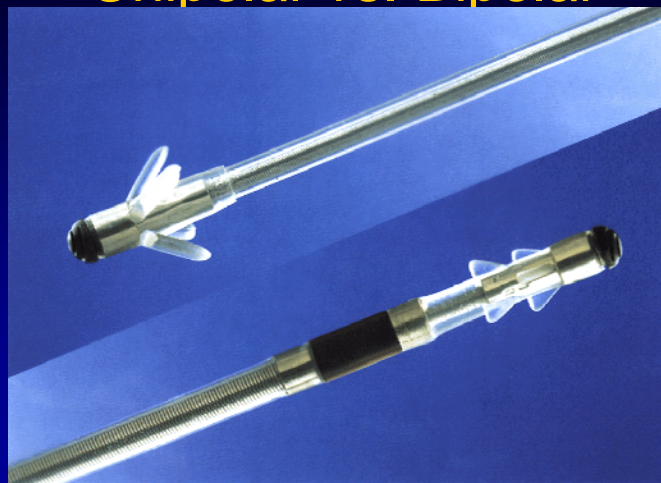
# Polarity



PGG



# Unipolar vs. Bipolar



PGG



# VVI



PGG



# VVI défaut capture et sensing



PGG



## Loss of Capture

- **Definition:** The emitted pacemaker stimulus does not cause depolarization and resultant cardiac contraction
- Loss of capture occurs when the pacemakers programmed energy is less than the stimulation threshold

PGG



## VVI



PGG



# Ventricular Loss of Capture



Programmed Rate

Programmed Rate

PGG



PGG





## Fusion et Pseudofusion



PGG



## Fusion Beat

- **Definition:** The combination of an intrinsic beat and a paced beat
- The morphology varies, a fusion beat doesn't really look like a paced beat or an intrinsic beat
- Fusion beats contribute to the contraction of the chamber being paced

PGG





## Pseudofusion Beat

- **Definition:** A pacing pulse falls on an intrinsic beat. The pacing pulse is ineffective and the intrinsic complex is not altered

PGG



## Questions importantes en pré-op!

- Pourquoi le patient est-il porteur de pace ou défib?
  - dépendent ou non?
  - sondes uni ou bipolaires
- Quel modèle – simple vs double, compagnie
- À quand la dernière interrogation?
- Est-ce qu'on a un programmeur disponible?
- Est-ce qu'on va faire de l'électrocautère?

PGG



## Actions en périopératoire

- Précautions pour électrocautère:
  - le plus loin possible du pacemaker
  - “short burst” – applications brèves
  - si problème, cesser application

PGG



## Actions en périopératoire

- Pacemaker, patient dépendant:
  - aimant – sensing inhibé, mode asynchrone
    - pacing forcé – exemple VOO
  - programmation – VOO ou DOO
    - danger potentiel car sera en mode asynchrone!
- Pacemaker, patient non-dépendant:
  - observation, avoir aimant près
  - danger de programmer VOO ou mettre aimant d'emblée car sera en mode asynchrone!

PGG



## Actions en périopératoire

- Défibrillateur:
  - aimant: va suspendre la détection de TV, donc évite le choc inapproprié
  - NB...ne **FORCERA PAS LE PACING!**
  - reprogrammation: pouvons fermer les détections et thérapies (chocs)
  - NB...ne pas oublier de les **RÉACTIVER** en post-op

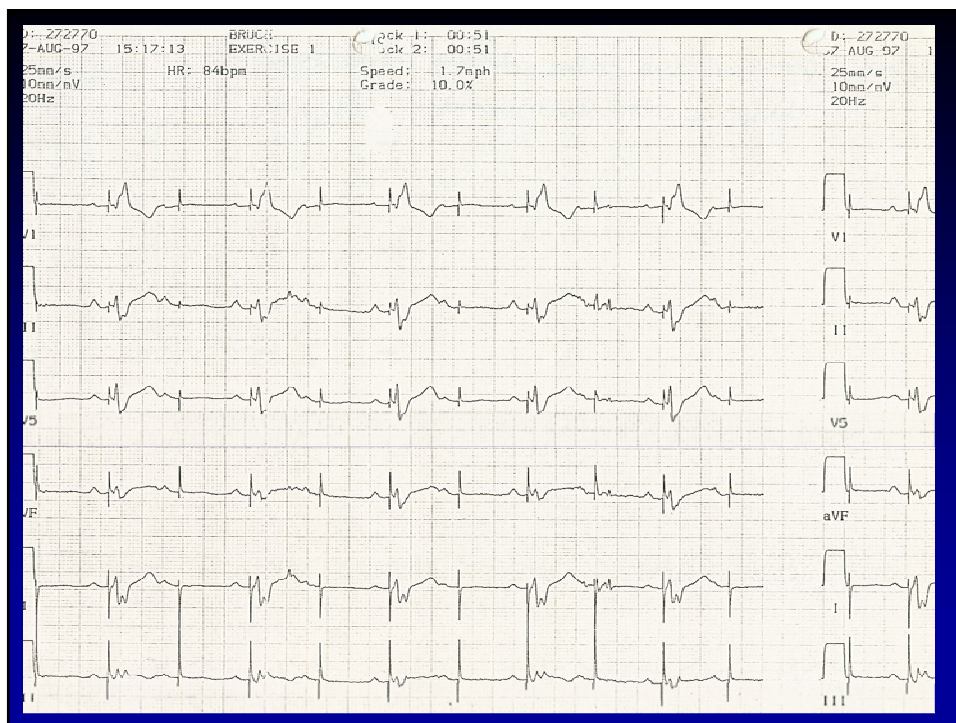
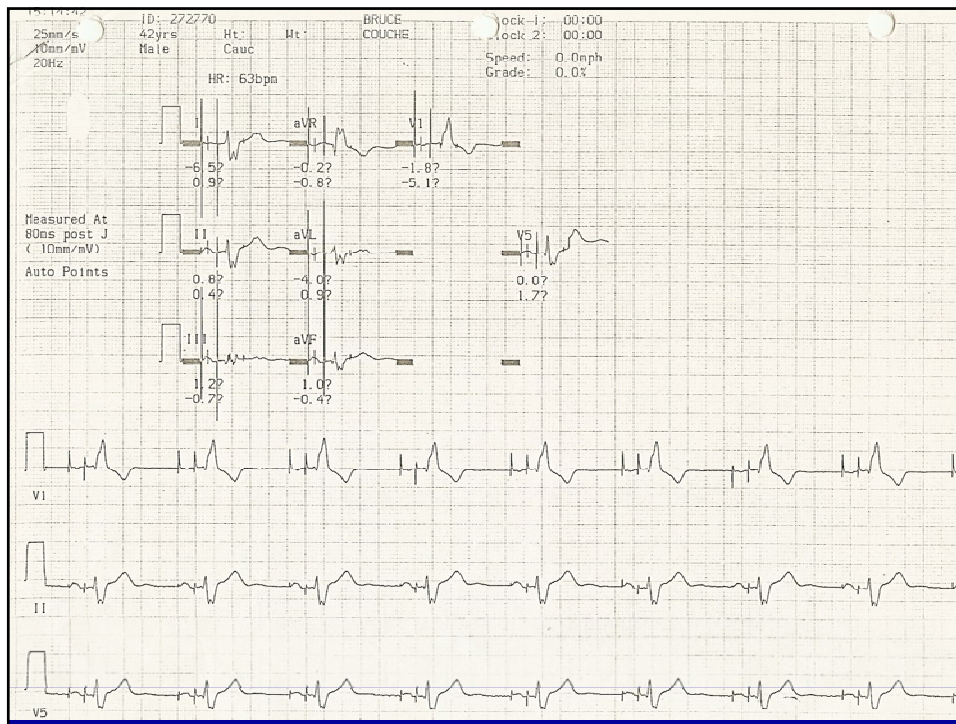
PGG



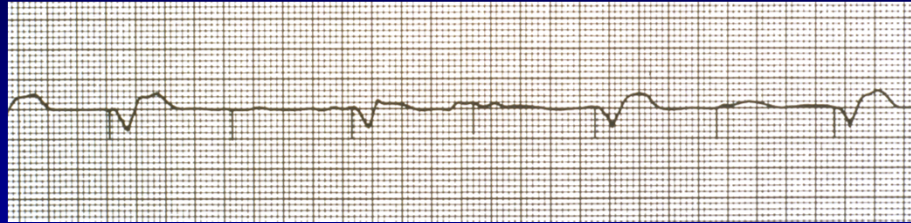
## Exemples de tracés et ECGs

PGG

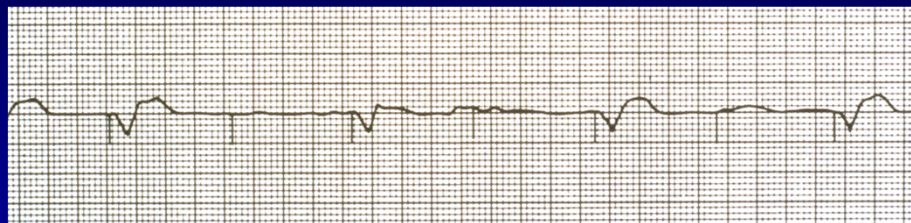




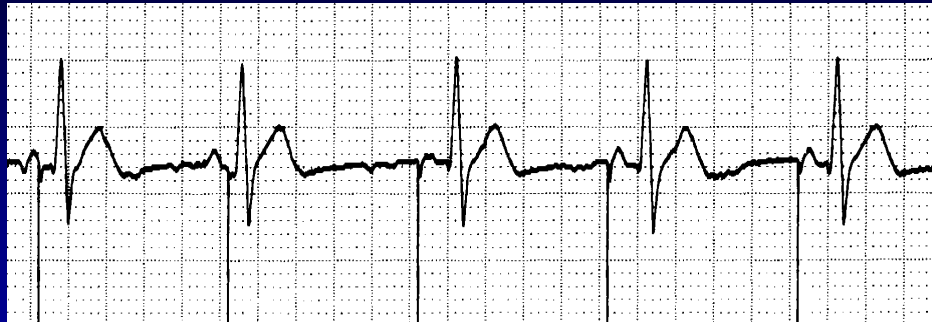
# VVI



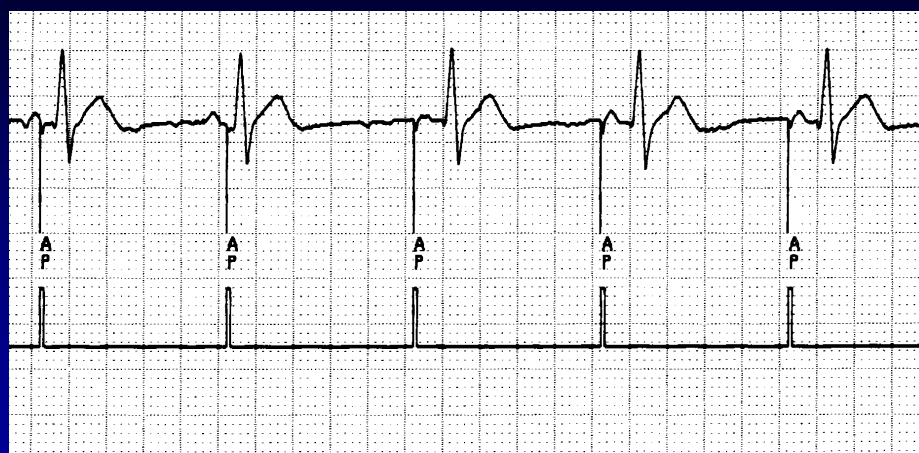
# VVI: Défaut de capture



# AAI



# AAI: Undersensing



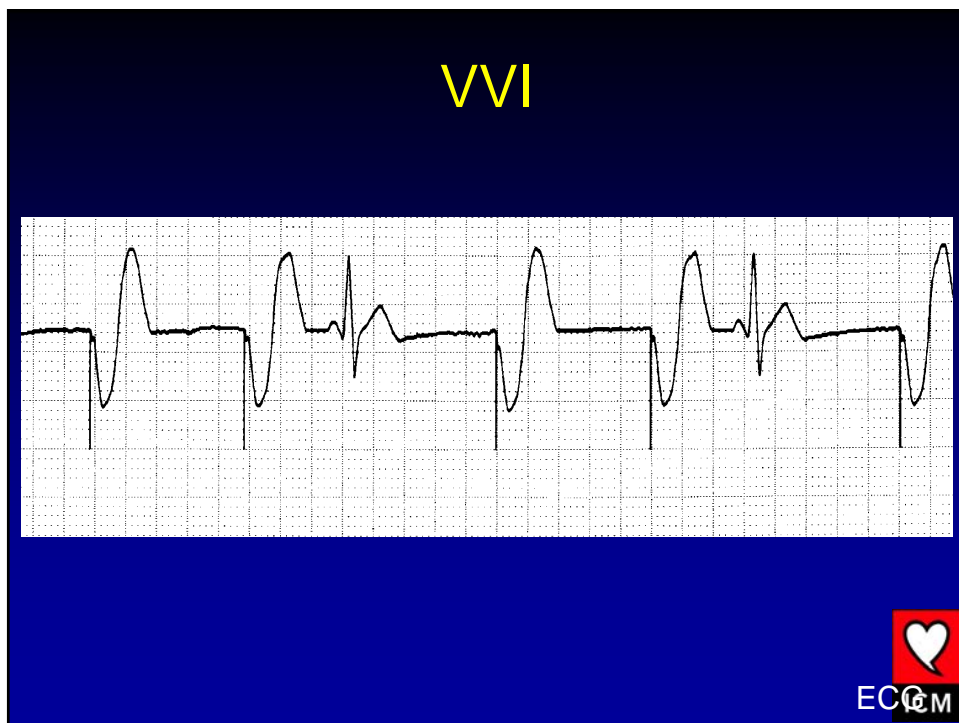
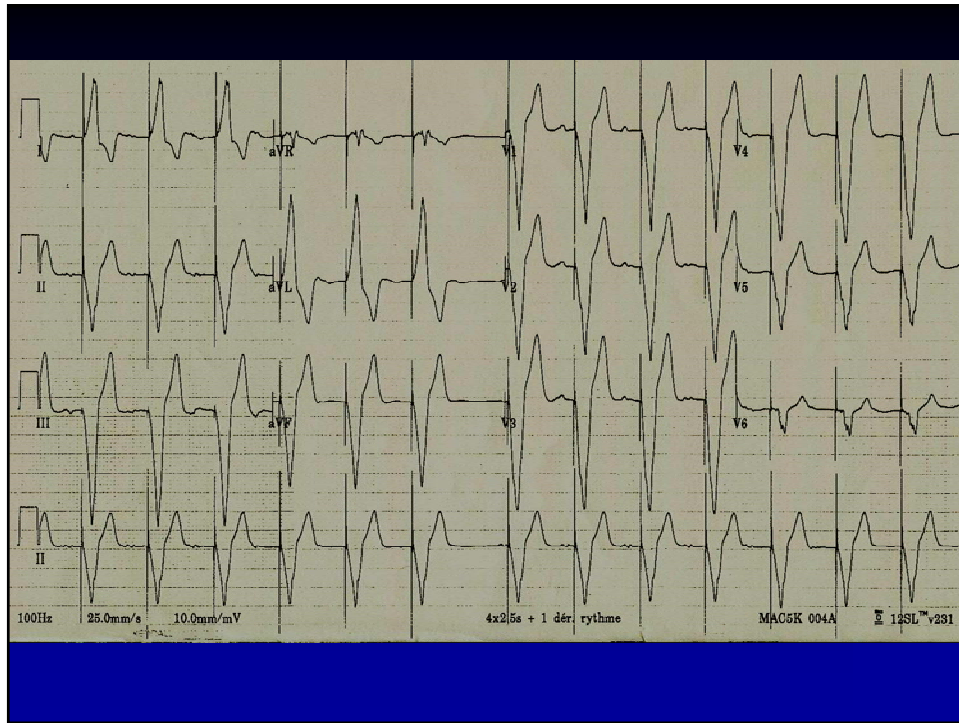


## VVI



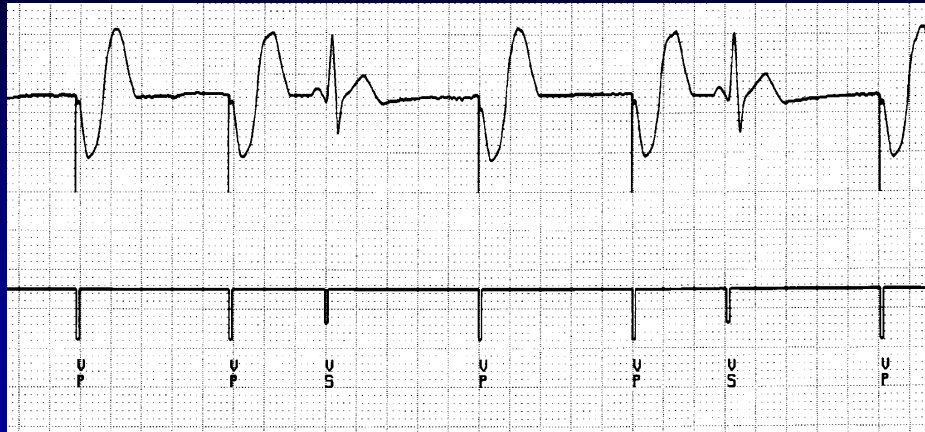
## VVI Oversensing







## VVI: Sensing et Pacing Ok



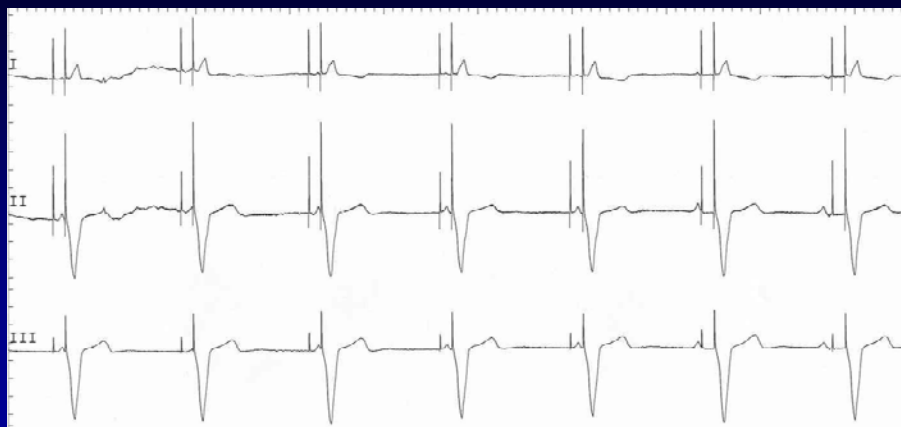
## VVI



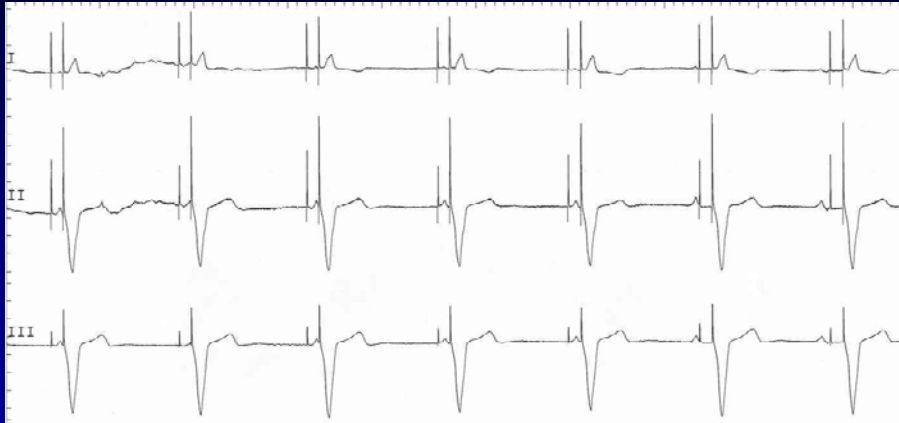
## Ventricular Undersensing



## DDD



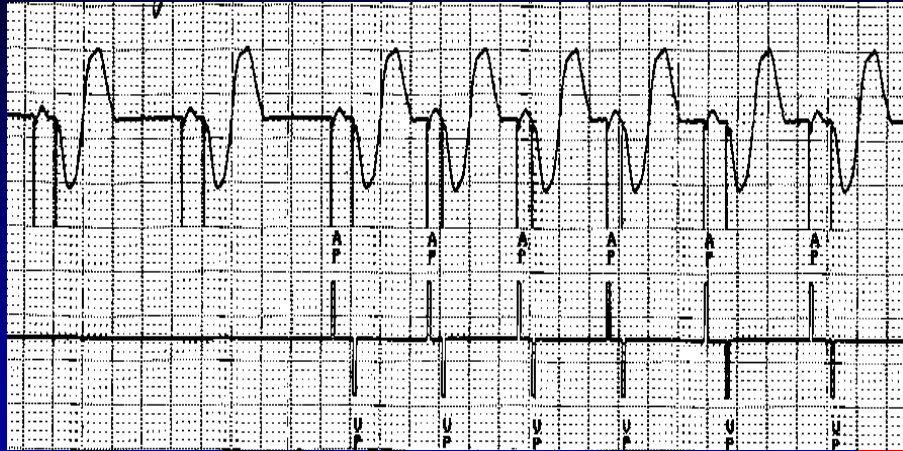
## Undersensing Atrial



## DDD



# Magnet Operation



ECG M