

# Pacing for AF Prevention



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# Atrial Pacing for AT Prevention: Electrophysiological Concepts

1. Prevention of AT in context with bradycardia, rate decrease, and pauses
  - “vagally induced“ AT and sinus node disease
  - conventional and rate adaptive pacing, dedicated pacing algorithms
2. Treatment of intra-/interatrial conduction delay
  - patients  $\pm$  conventional pacing indication
  - dedicated/multiple atrial pacing sites
3. Prevention of short-long sequences after APBs with post-extra-systolic pause
  - patients  $\pm$  conventional pacing indication
  - dedicated pacing algorithms
4. Overdrive suppression of ectopic activity
  - patients  $\pm$  conventional pacing indication
  - dedicated pacing algorithms



# Conventional Pacing in Patients with Bradycardia

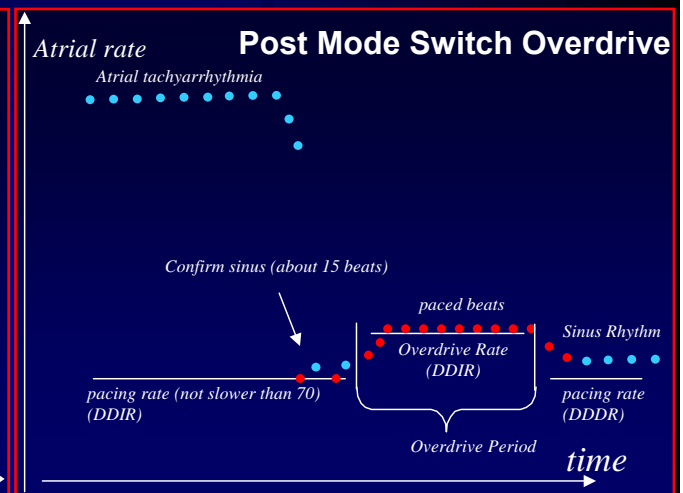
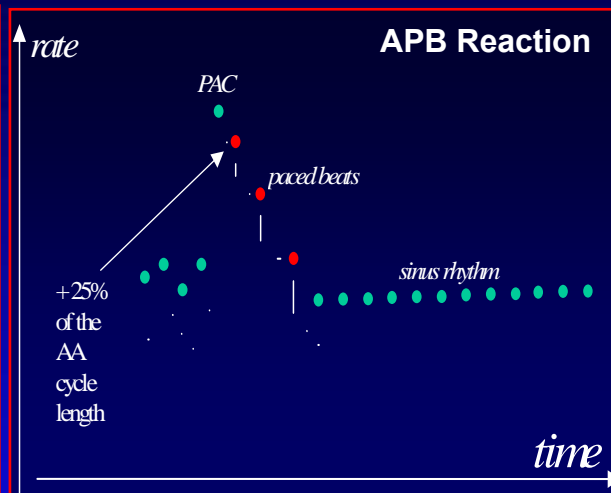
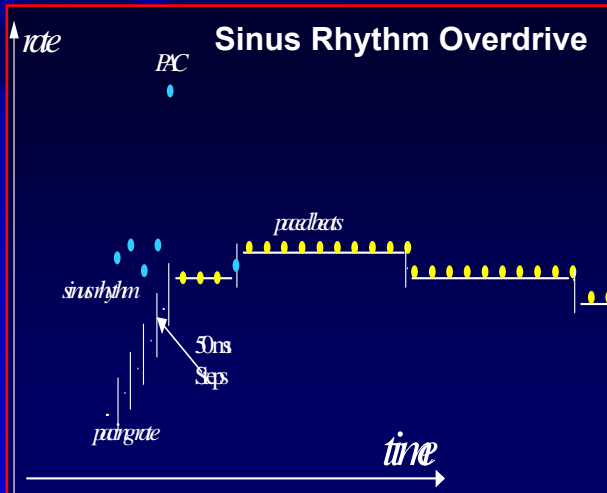
	<b>Patients</b>	<b>LRL</b>	<b>FU</b>	<b>Outcome</b>
Garrigue 1998	22	75*	1 mo	65% free of AT
Bellocci 1999	78	70-80	3 mo	60% free of AT
Schrepf 2000	94	70	6 mo	76% free of AT
Delfaut 1998	30	80-90	9 mo	SR <30→143 days
Lewalter 1998	20	75	6 we	5.6 episodes/day
Ricci 1999	69	70	3 mo	0.9 episodes/day
Funck 2000	25	80*	3 mo	AT Burden -48%
Ward 1999	18	90	2 mo	AT Burden 1.8%

FU: follow-up duration, LRL: lower rate limit, SR: sinus rhythm

\*: 10 bpm above mean atrial rate (pacemaker memory)



# Preventive Atrial Pacing Algorithms

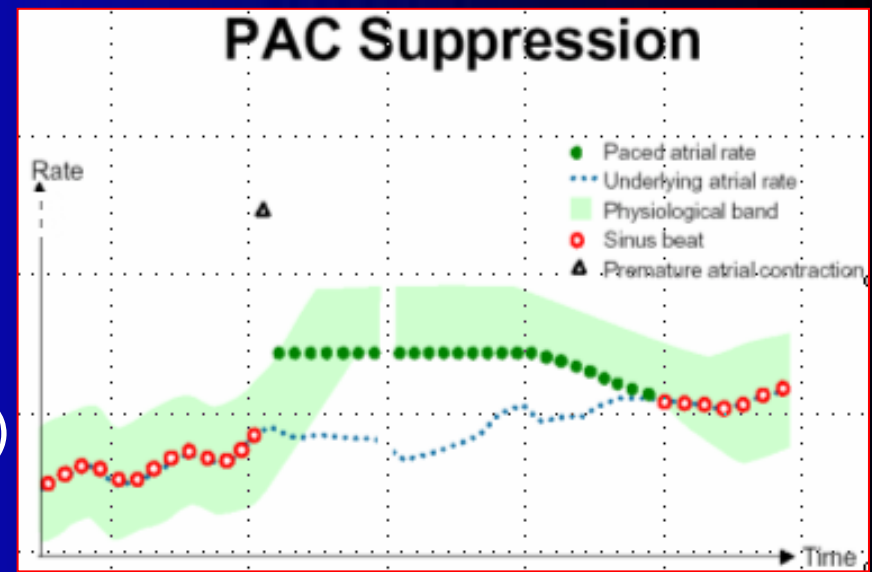


## Continuously active algorithms

- sinus rhythm overdrive

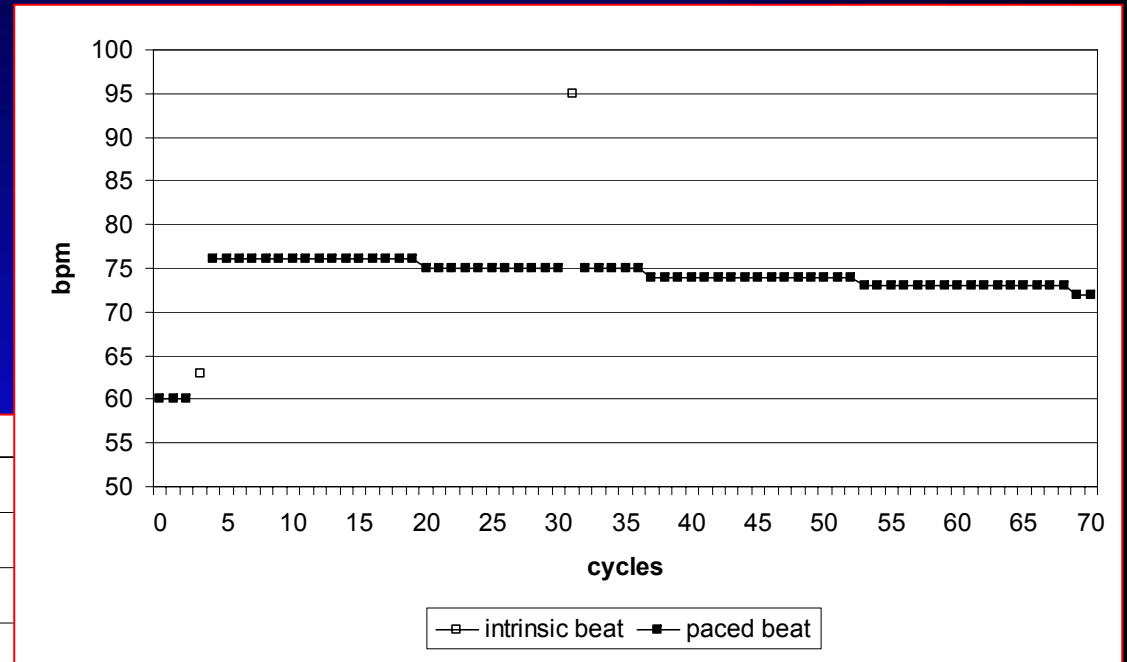
## Triggered Algorithms

- APB reaction (pause prevention)
- APB suppression (focus suppression)
- Post mode switching overdrive

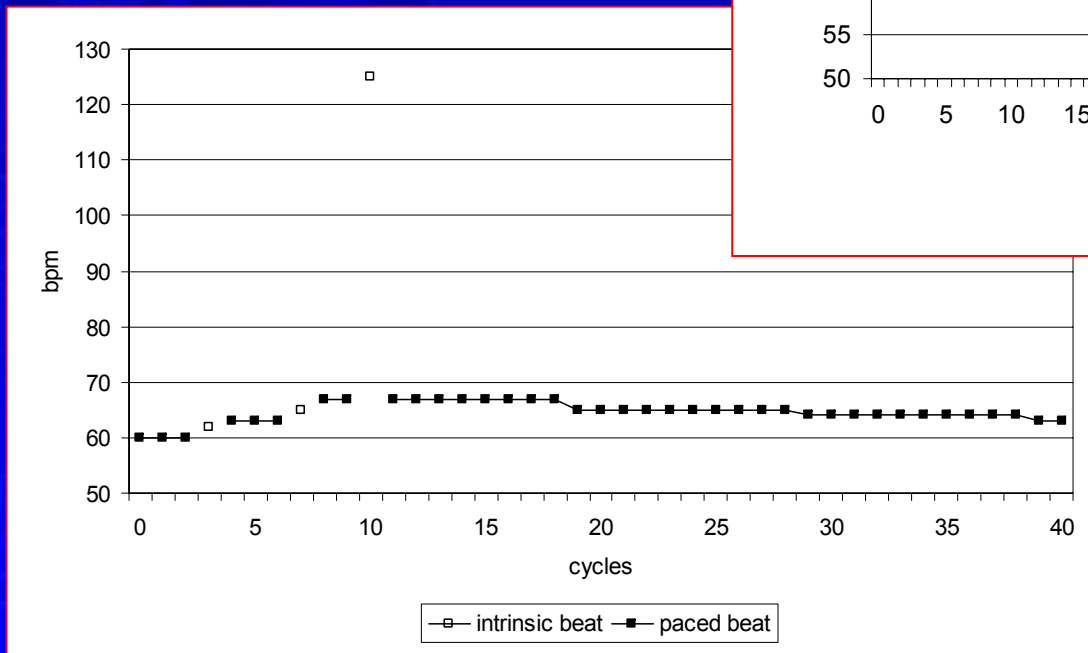




# Dynamic Sinus Rhythm Overdrive Pacing Algorithms



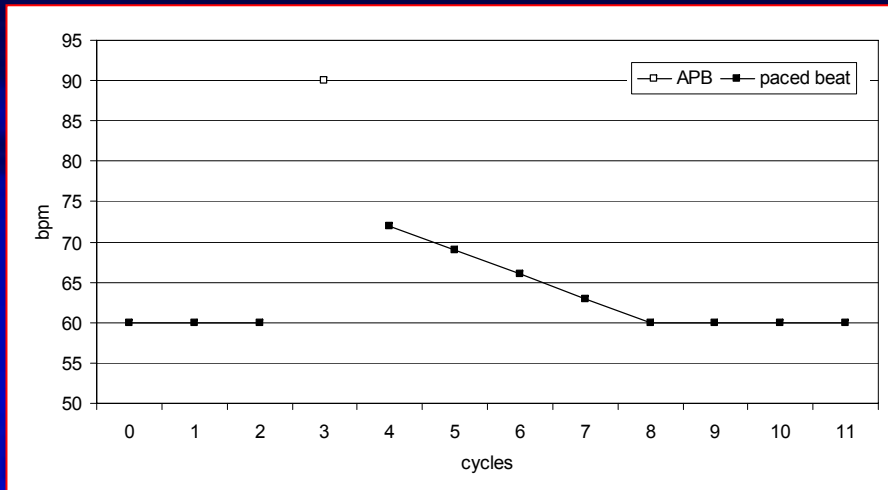
Pace Conditioning™  
(Vitatron)



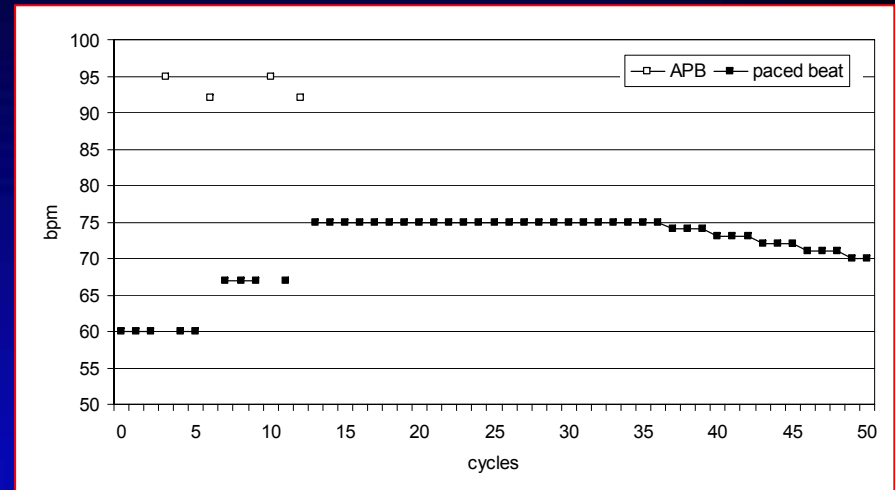
Atrial Preference Pacing™  
(Medtronic)



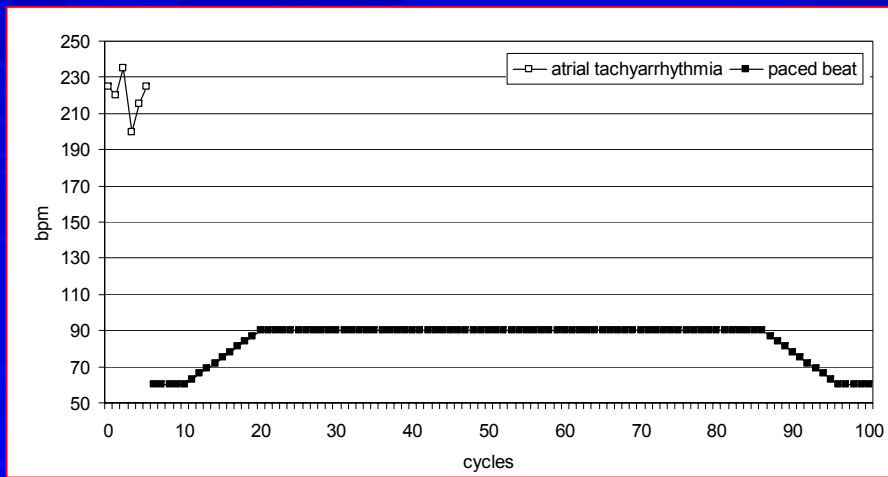
# Triggered Pacing Algorithms



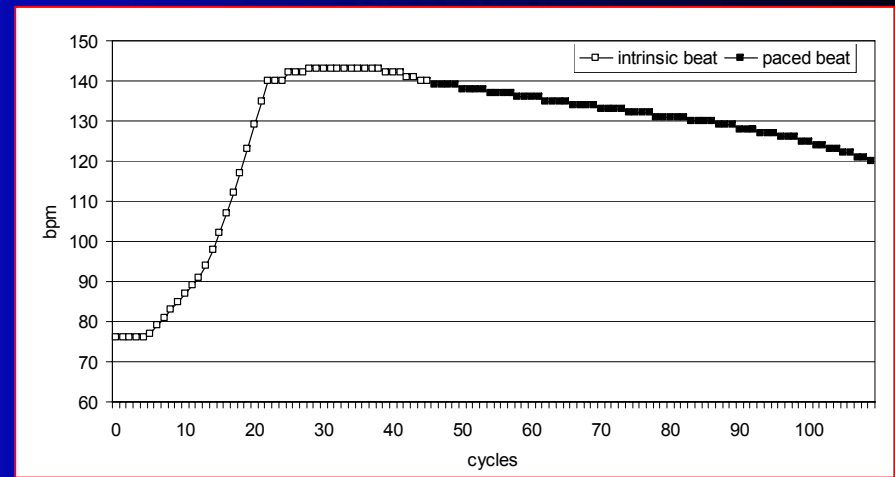
Post extrasystolic pause suppression™



Acceleration on premature atrial complex™



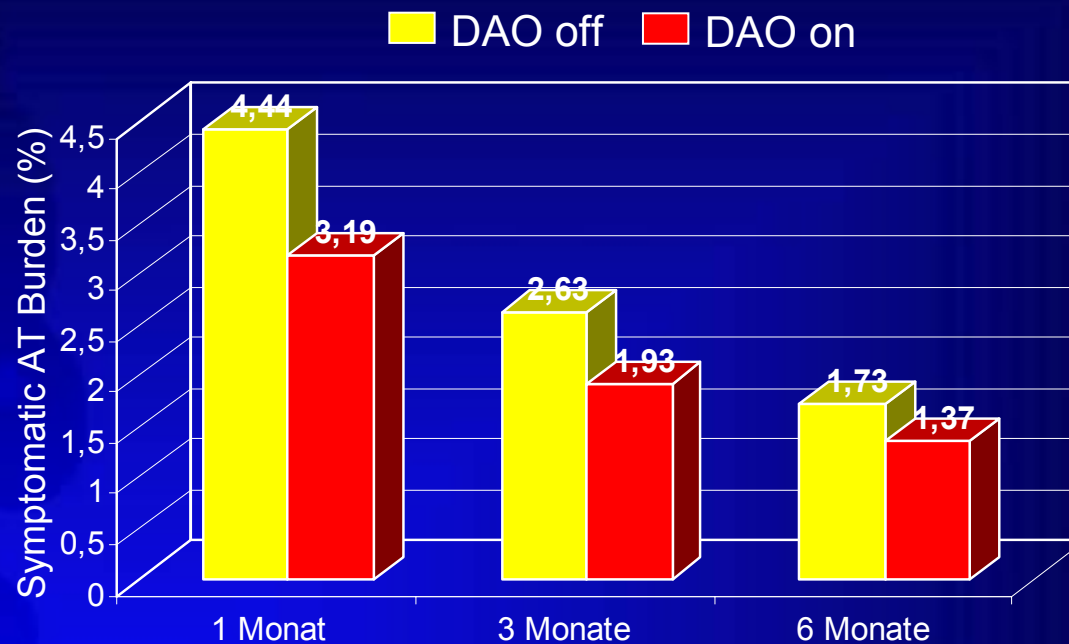
Post mode switching overdrive pacing™



Post exercise response™



# Prevention of AT in Sinus Node Disease: ADOPT-A



n = 288 (sinus node disease + sympt. AT)

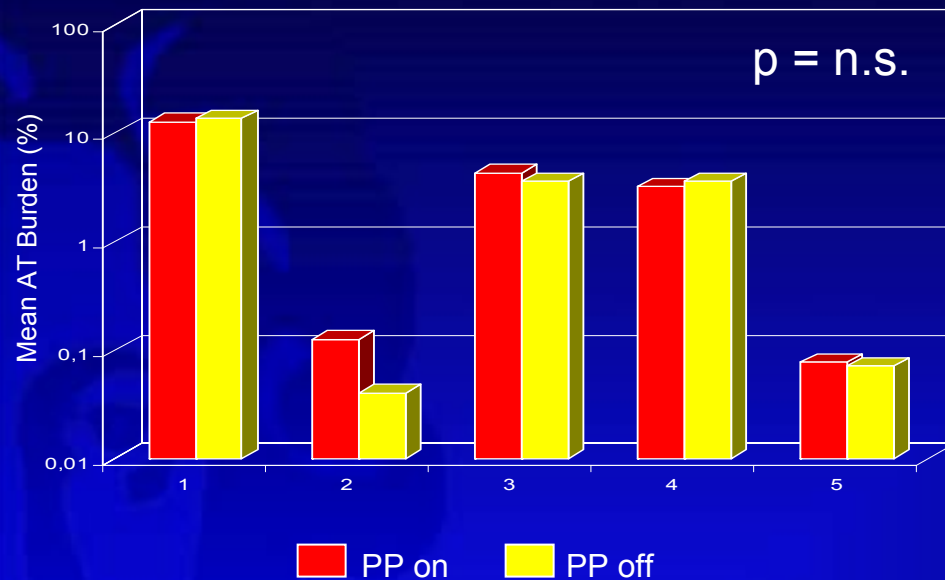
Preventive pacing with the  
“Dynamic Atrial Overdrive“ (DAO) algorithm



# AT500™ and PIPAF Studies

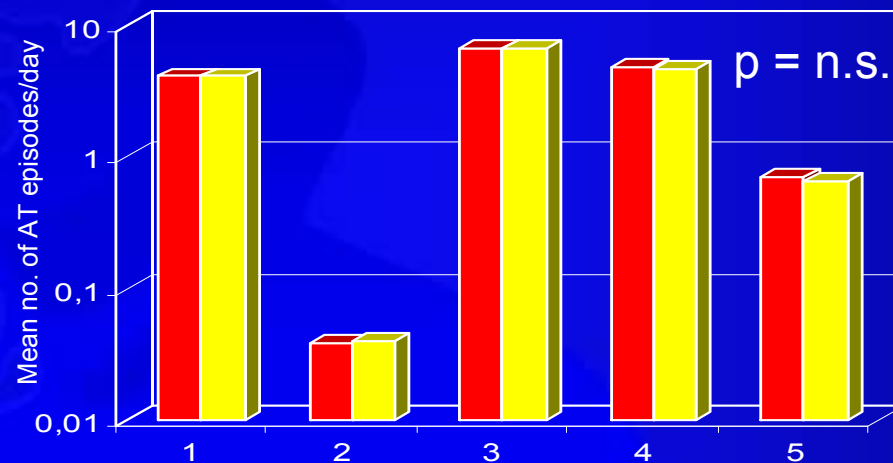
## AT Burden

- 1: AT500 Verification Study (n=325)<sup>1</sup>
- 2: ATTEST (n=370)<sup>2</sup>
- 3: ASPECT septal (n=71)<sup>3</sup>
- 4: ASPECT non-septal (n=84)<sup>3</sup>
- 5: PIPAF (n=44)<sup>4</sup>



## No. of AT Episodes

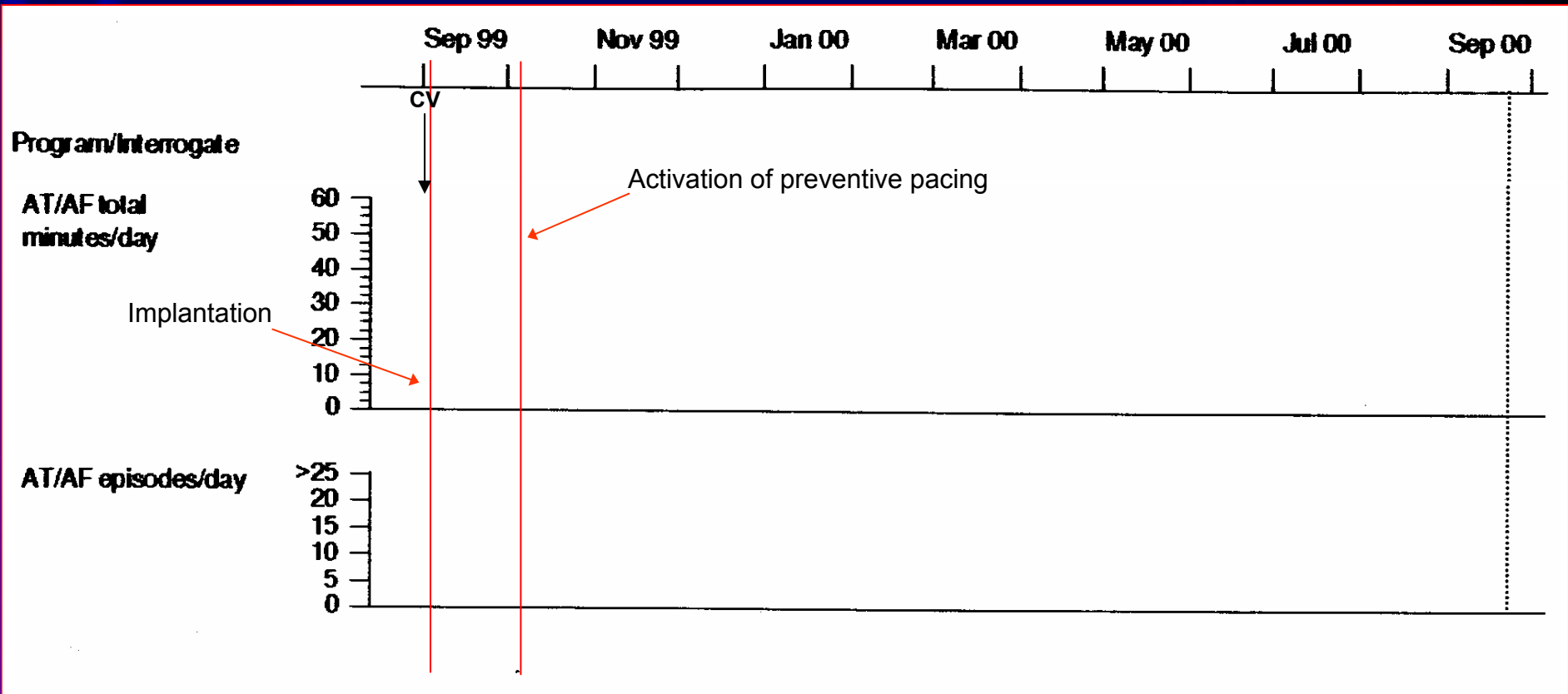
→ no significant impact on no. of AT episodes or AT burden



<sup>1</sup>Israel JCE 2001, <sup>2</sup>Lee JACC 2003, <sup>3</sup>Padeletti JCE 2004, <sup>4</sup>Blanc Europace 2004



# Is this a Non-Responder to Pacing for AT Prevention?

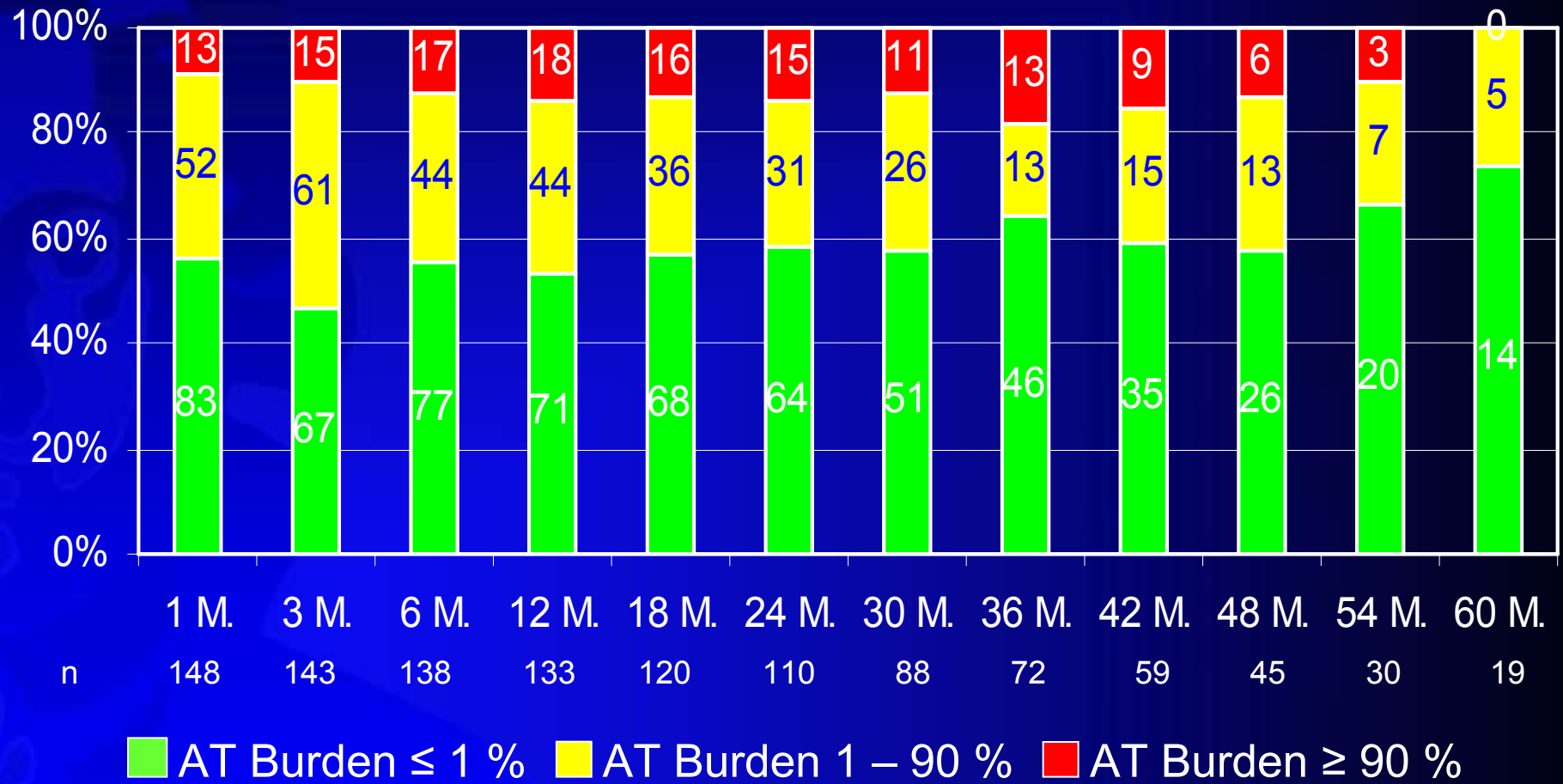


→ continuously sinus rhythm already with DDDR, 60 bpm  
(preventive pacing: no improvement → “non-responder”)



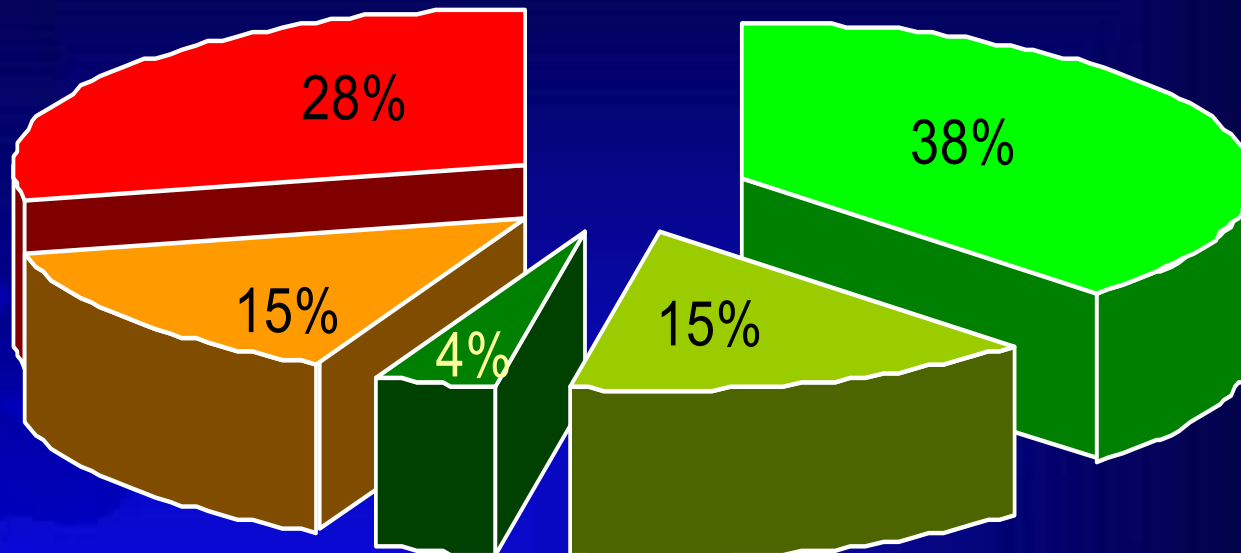
# Long-Term Effect of Preventive Atrial Pacing

Patients (% , numbers in columns: no. of patients)





# Impact of Preventive Pacing Algorithms

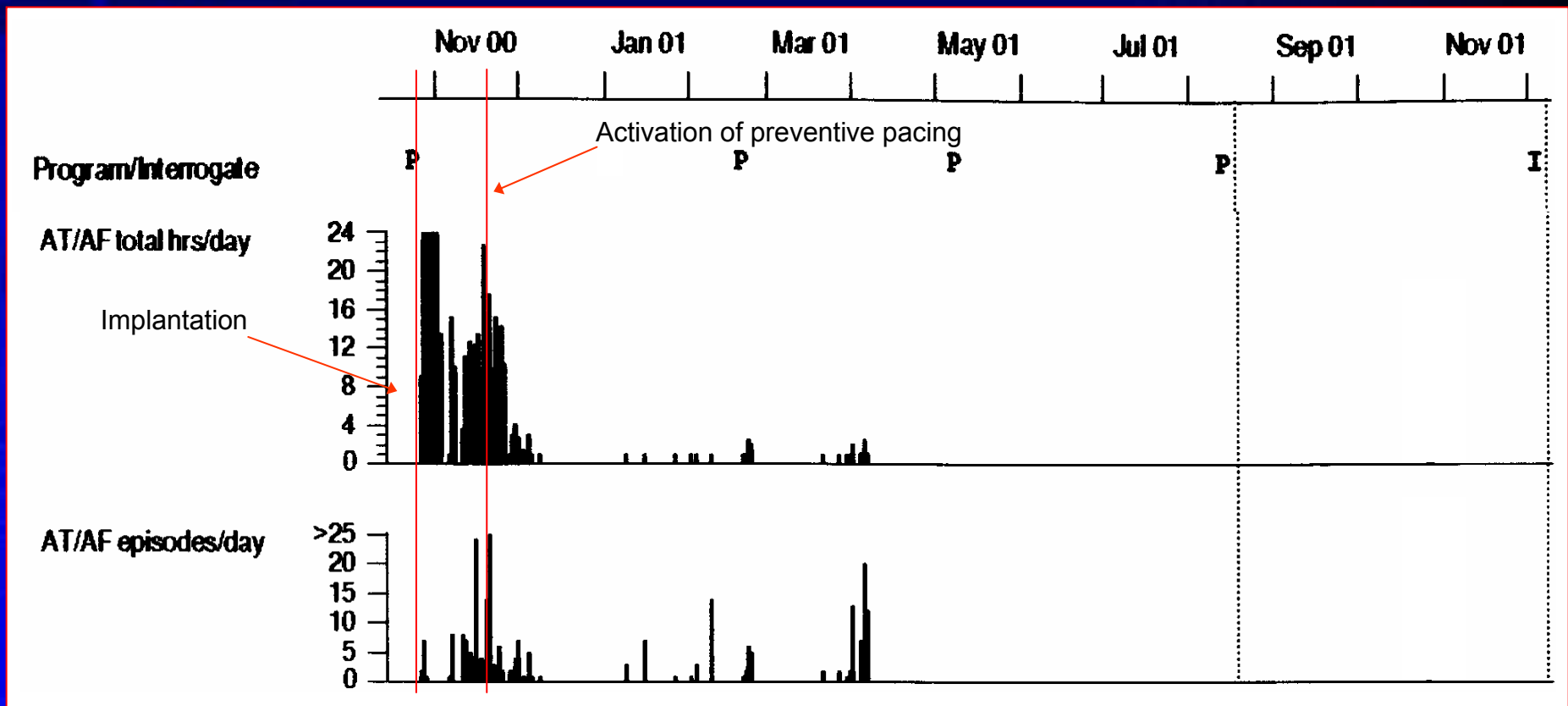


- Progression
- no change
- “reverse remodeling”
- AT free only with preventive algorithms
- AT free with DDD, 60 bpm

**AT-Burden**  
**1 month (DDD, 60 bpm)**  
**versus**  
**3 month (APP active)**



# Delayed Response to Preventive Pacing (Reverse Remodeling?)

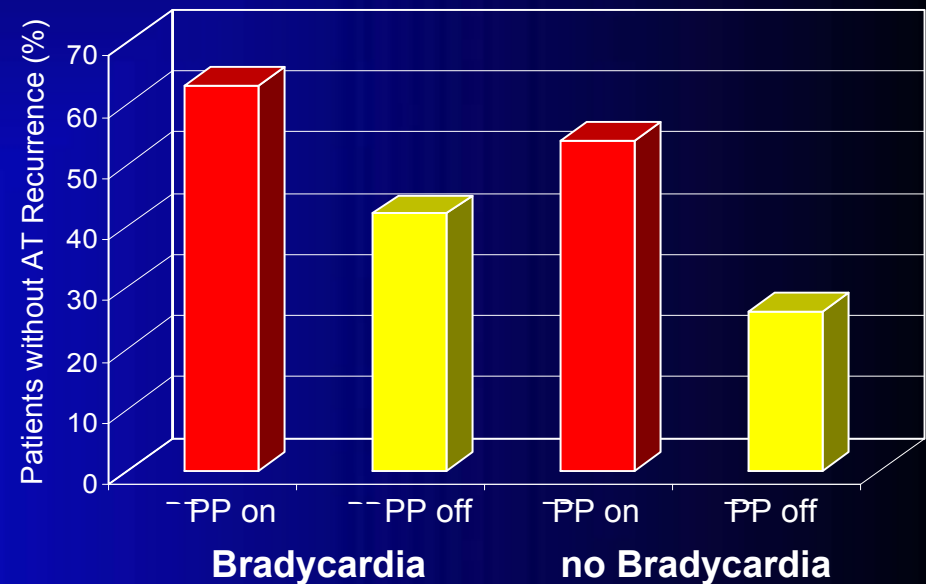
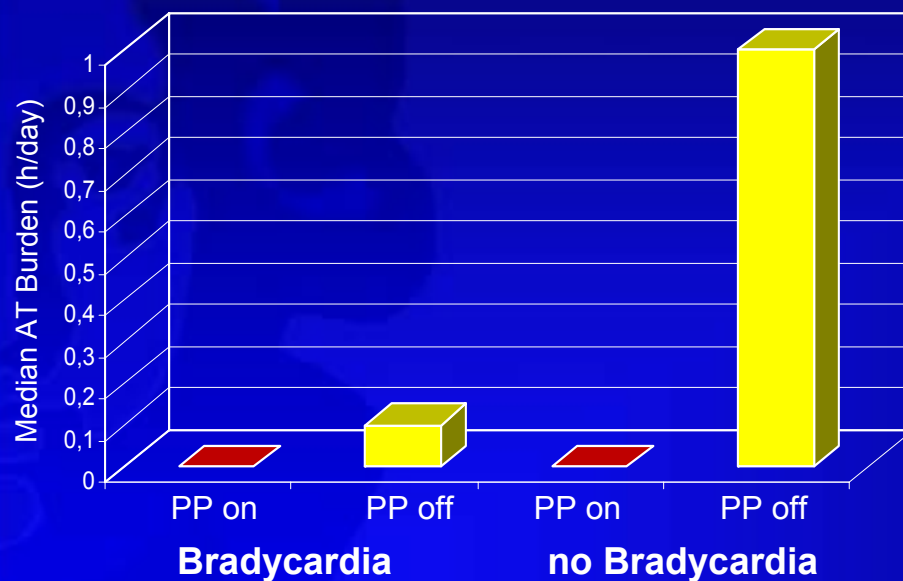


→ in the first 6 months after activation of preventive pacing still AT recurrences which then fade out (PA<sup>3</sup>: Non-Responder)



## Effect of Preventive Pacing in Patients without Bradycardia

- AFT study (DDDR, 70 bpm  $\pm$  4 preventive pacing algorithms)
- 89% of patients (n = 97) with class I/III antiarrhythmic drugs



→ in patients without bradycardia, the effect of DDDR 70 bpm alone is smaller, the “on-top” effect of preventive pacing algorithms more prominent



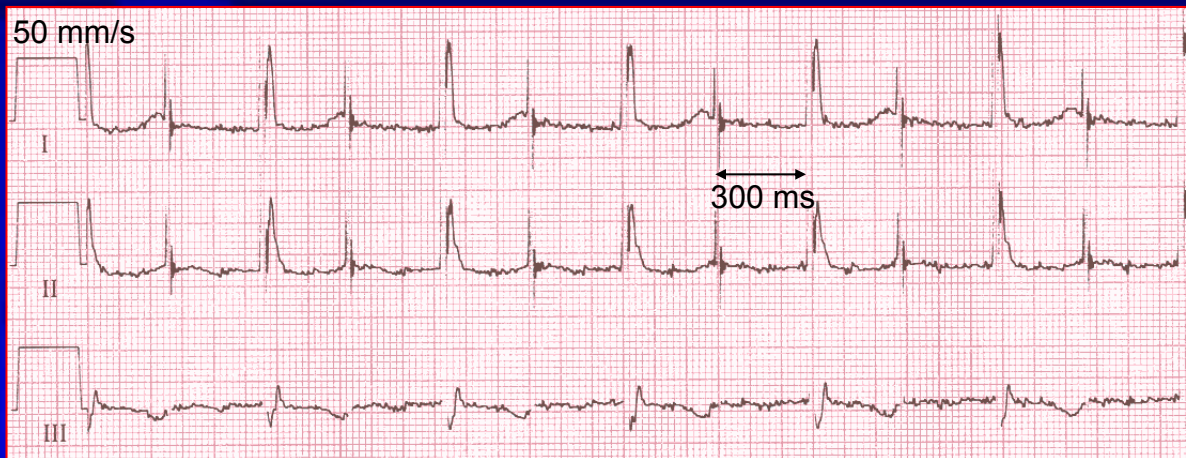
## Effect of Preventive Pacing in Patients without Bradycardia

	1 Mo AFB	3 Mo AFB	6 Mo AFB	12 Mo AFB	18 Mo AFB	24 Mo AFB	36 Mo AFB	48 Mo AFB	60 Mo AFB
<b>&gt;40% VP</b>	24 %	22 %	21 %	25 %	25 %	26 %	32 %	28 %	30 %
<b>&lt;40% VP</b>	8 %	8 %	13 %	7 %	6 %	6 %	6 %	6 %	6 %
<b>p</b>	0.001	0.001	0.158	0.001	<0.001	<0.001	<0.001	0.008	0.015

AT Burden (in % of the time) over a 5 year period in 158 patients with preventive pacing stratified according to the percentage of ventricular pacing (% VP) into > and < 40 %



# Forced Ventricular Pacing Due to Too Aggressively Programmed Overdrive

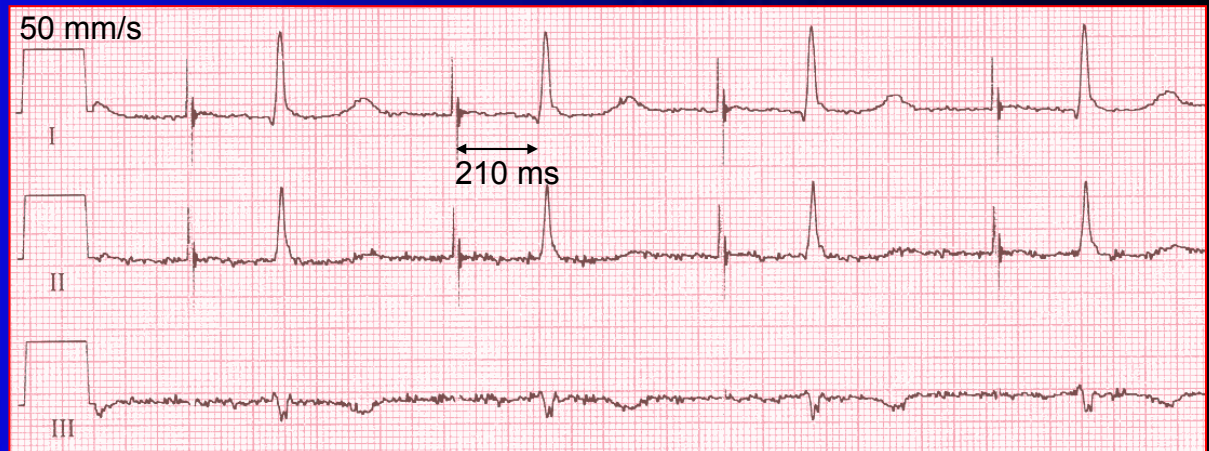


Too aggressively programmed preventive pacing

- atrial pacing > 100 bpm in reaction to intrinsic beats
- excessively long AV delay
- ventricular (pseudo-) fusion

After reprogramming

- atrial pacing near 60 bpm
- normalization of the AV delay
- no ventricular pacing

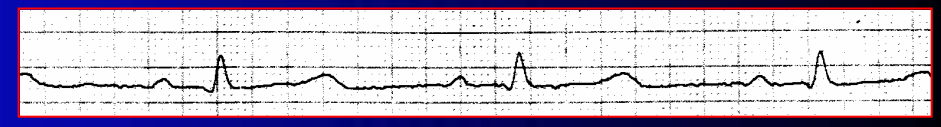
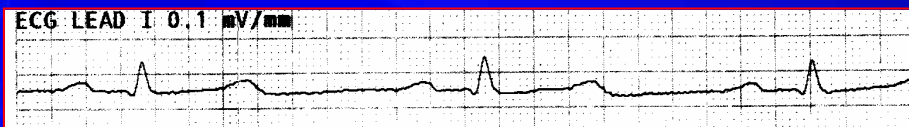
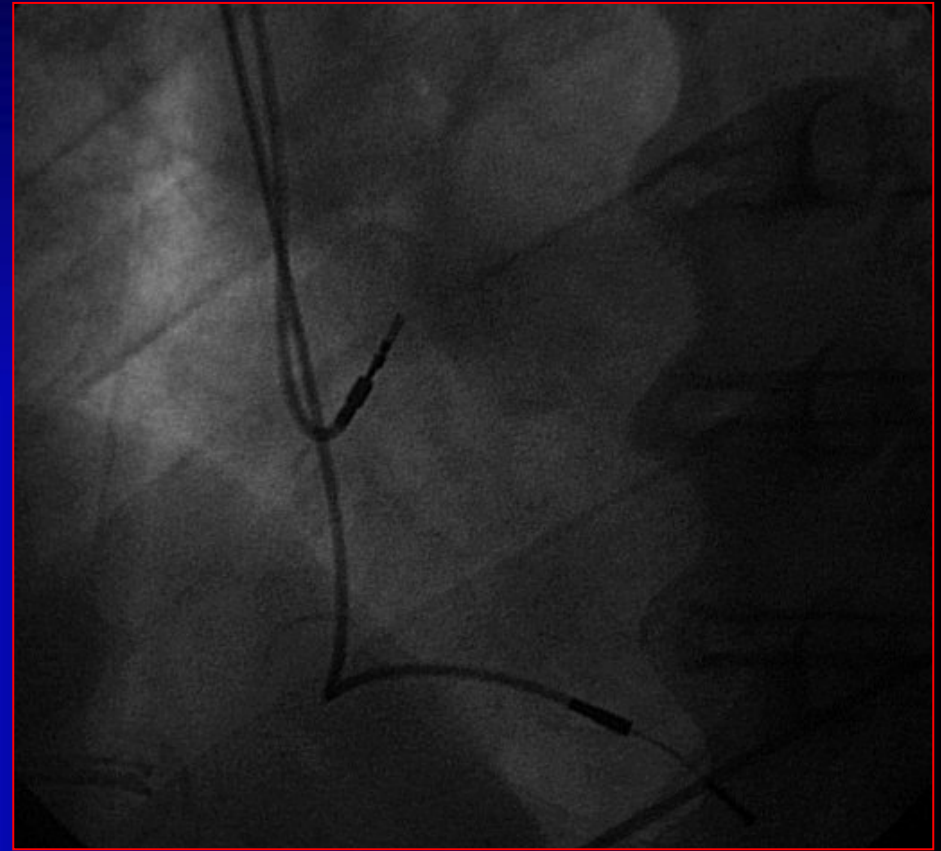
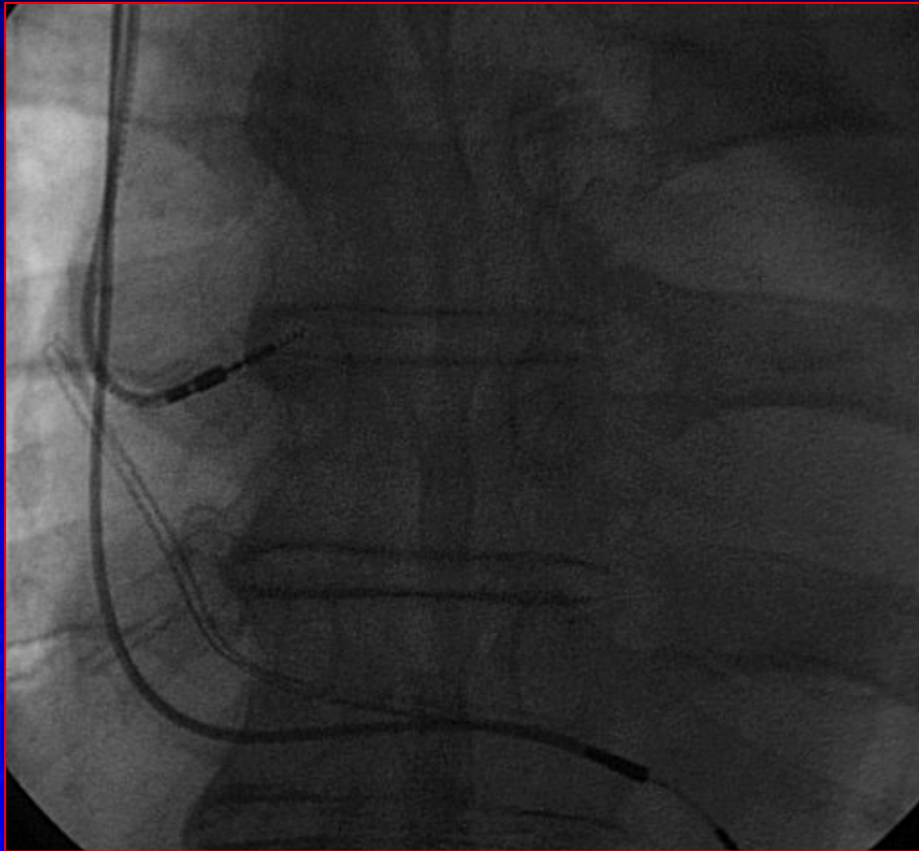




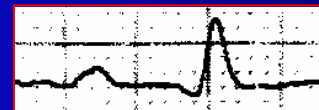
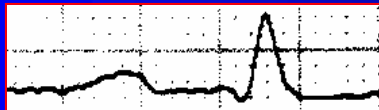
# Atrial (High) Septal Lead Position: Bachmann Bundle Pacing

AP

LAO 40°



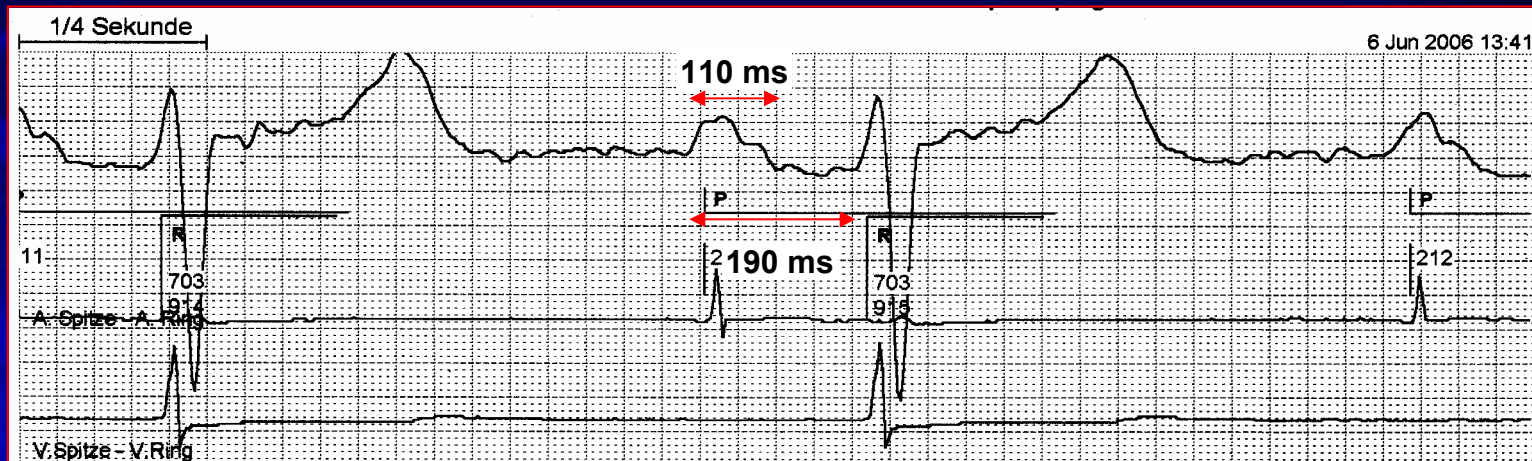
intrinsic P Wave (120 ms)



paced P Wave (80 ms)

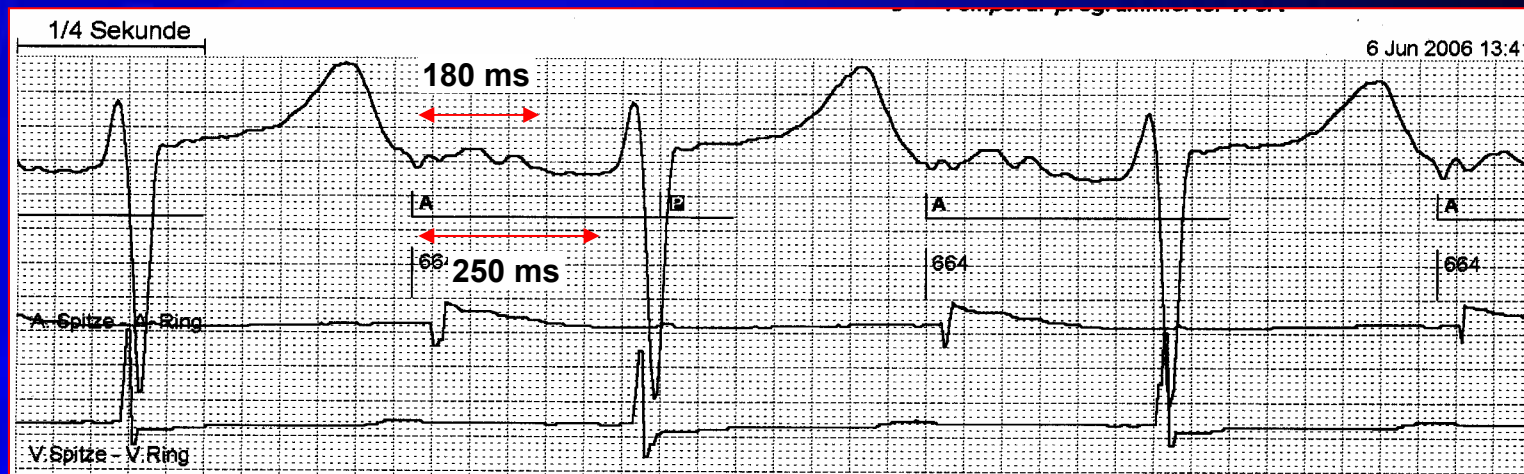


# Atrial/AV-Desynchronization by Pacing



Intrinsic P wave

100 mm/s



Paced P wave

100 mm/s



## Indications for Atrial Preventive Pacing

- Context with a conventional indication for pacing or ICD therapy (sinus node disease, AV block, primary or secondary prevention of sudden cardiac death)
- Bradycardia (particularly sinus node disease) due to antiarrhythmic drug treatment of ATs
- Planned AV node ablation (first implantation of a dual-chamber device, after 1-3 months reassessment if AV node ablation is still required (symptoms, device memory on AT recurrence and ventricular rate))