

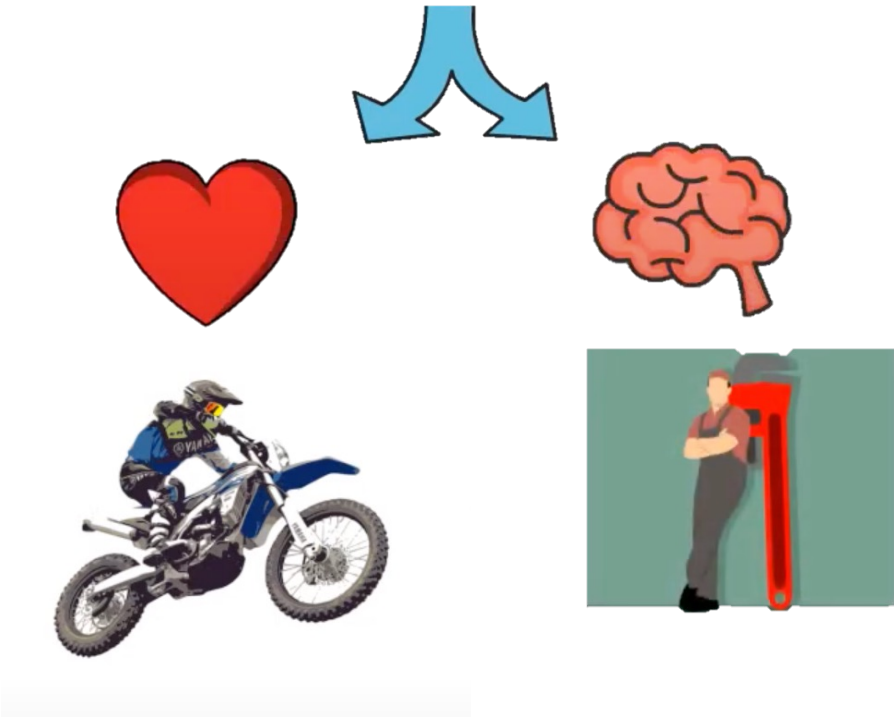
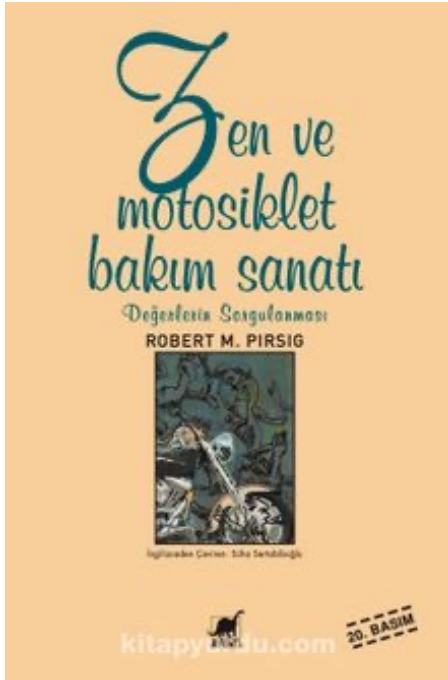
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# Pacemaker Zaman Aralıkları

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Dr. Evrim ŐimŐek

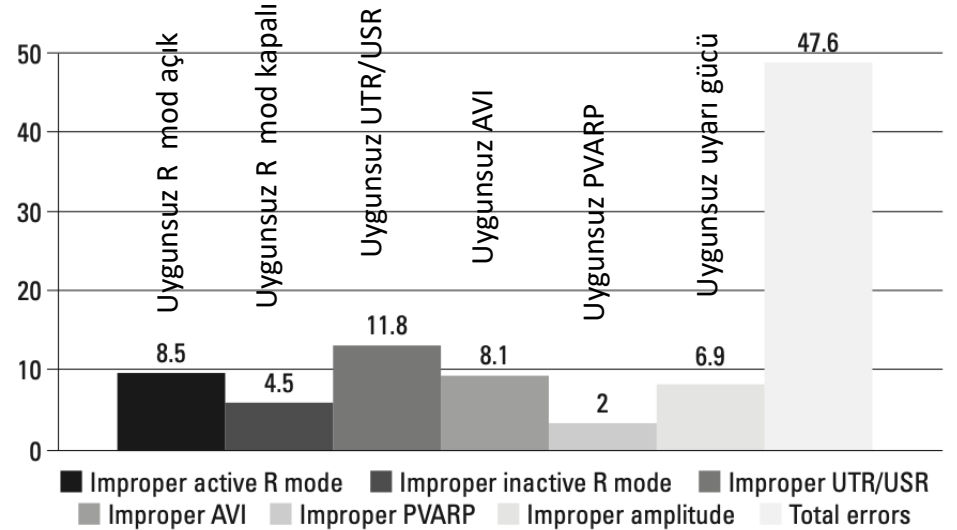
Ege ÜTF Kardiyoloji AD



# Neden Önemli ?

Table 2. Types of erroneous CIED programming

	n	%
<b>Pacemakers</b>	<b>246</b>	
Inconvenient active R mode	21	8.5
Inconvenient inactive R mode	11	4.5
Improper UTR/USR setting	29	11.8
Improper AVI setting*	20	8.1
Inappropriate PVARP setting	14	5.7
Inappropriate RV pacing amplitude	5	2
Improper manual mode switching	17	6.9
<b>Total programming errors among pacemakers</b>	<b>117</b>	<b>47.6</b>
<b>ICDs</b>	<b>117</b>	
Improper base rate setting	23	19.7
Improper VT-VF zone determination	7	6
<b>Total programming errors among ICDs</b>	<b>30</b>	<b>25.6</b>
<b>CRT-Ds</b>	<b>40</b>	
Improper AVI setting leading to biventricular underpacing	3	7.5
Improper LV pacing amplitude	2	5
Inappropriate single RV pacing	1	2.5
<b>Total programming errors among CRT-Ds</b>	<b>6</b>	<b>15</b>
<b>Programming errors among all CIEDs</b>	<b>153/403</b>	<b>38</b>



# Plan

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- Genel konular
- Pacing Modları
- Tek/ çift odacık pacemaker temel zaman aralıkları
- Refrakter periyotlar



# Pacing EKG'si incelerken

---

- Pil hangi modda
  - Ventriküler pace/ sens
  - Atriyal pace/sens
  - AV ilişki
- Sorun var mı? Neden olmuş olabilir?
- Nasıl çözerim?

AS	Atrial Sense - After Refractory and AFR window
AS-Hy	Atrial Sense - In Hysteresis Offset
AS-FI	Atrial Sense - In AFR window
(AS)	Atrial Sense - During TARP
AP	Atrial Pace - Lower Rate
AP ↓	Atrial Pace - Rate Smoothing Down
AP ↑	Atrial Pace - Rate Smoothing Up
AP-FB	Atrial Pace - Fallback (in ATR)
AP-Hy	Atrial Pace - At Hysteresis is Rate
AP-Sr	Atrial Pace - Sensor Rate
AP-→	Atrial Pace - Inserted after AFR
AP-Ns	Atrial Pace - Noise (asynchronous pacing)
AP-Tr	Atrial Pace - Trigger Mode
RVS	Right Vent Sense - After Refractory
[RVS]	Right Vent Sense - During Blanking
RVP	Right Vent Pace - Lower Rate or Atrial Tracked
RVP ↓	Right Vent Pace - Rate Smoothing Down
RVP ↑	Right Vent Pace - Rate Smoothing Up
RVP-FB	Right Vent Pace - Fallback (in ATR)
RVP-Hy	Right Vent Pace - At Hysteresis Rate
RVP-Sr	Right Vent Pace - Sensor Rate
RVP-MT	Right Vent Pace - Atrial Tracked at MTR
RVP-Ns	Right Vent Pace - Atrial Tracked at MTR
RVP-Tr	Right Vent Pace - Trigger Mode
RVP-VRR	Right Vent Pace - Ventricular Rate Regulation
LVS	Left Vent Sense - After Refractory
[LVS]	Left Vent Sense - During Blanking
LVP	Left Vent Pace - Lower Rate or Atrial Tracked
LVP ↓	Left Vent Pace - Rate Smoothing Down
LVP ↑	Left Vent Pace - Rate Smoothing Up
LVP-Hy	Left Vent Pace - At Hysteresis Rate
LVP-Sr	Left Vent Pace - Sensor Rate
LVP-MT	Left Vent Pace - Atrial Tracked at MTR
LVP-Ns	Left Vent Pace - Noise (asynchronous pacing)
LVP-Tr	Left Vent Pace - Trigger Mode
LVP-VRR	Left Vent Pace - Ventricular Rate Regulation
Inh-LVP	Left Vent Pace - Inhibited Due to LVPP
PVC	PVC after Refractory

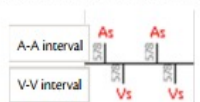
Biotronik

As/AP	Atrial sensing/pacing
Vs/Vp	Ventricular sensing/pacing
Lvp/LVs	Left ventricular pacing/sensing
Rvp/RVs	Right ventricular pacing/sensing
Ars	Atrial refractory sensing
Ars (FFP)	Ars in far-field protection window
Vrs	Ventricular refractory sensing
Aflut	Atrial flutter detected
Afib	Atrial fibrillation detected
Msw,DDI	Modeswitch to DDI
Det. VF	VF detected
Rdt.	Redetection criteria are fulfilled
1:1	1:1 A:V ratio
Term.	Charging of the capacitors Tachycardia episode has terminated

VT-1	VT-1 Zone Sense
VT	VT Zone Sense
VF	VF Zone Sense
AN	Atrial Rate Noise
RVN	Right Ventricular Rate Noise
LVN	Left Ventricular Rate Noise
ATR ↓	Atrial Tachycardia Sense - Count Down
ATR ↑	Atrial Tachycardia Sense - Count Up
ATR-Dur	ATR Duration Started
ATR-FB	ATR Fallback Started
ATR-End	ATR Fallback Ended
FB	ATR in Progress
RID-TU	Rhythm ID Template Update
RID+	Rhythm ID Correlated
RID-	Rhythm ID Uncorrelated
C--	RhythmMatch™ Correlated without percentage
U--	RhythmMatch™ Uncorrelated without percentage
PVP-→	PVARP after PVC
PMT-B	PMT Termination
AF-Rhythm	AFib Rhythm
V-Epsd	Ventricular Tachy Start Episode
V-EpsdEnd	Ventricular Tachy End Episode
V>A	Ventricular Rate Faster than Atrial Rate
AFibV	V AFib Criteria Met
V-Dur	Duration Met
Stb	Stable
Unstb	Unstable
Sudden	Sudden Onset
Gradl	Gradual Onset
V-Detect	Ventricular Detection Met
Chrg	Start/End Charge
Dvrt	Therapy Diverted
Shock	Shock Delivered
SRD	Sustained Rate Duration Expired

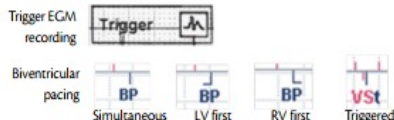
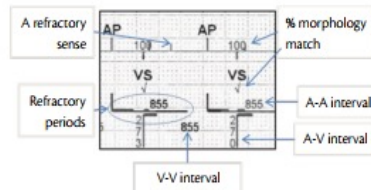
Medtronic

AS/AP	Atrial sensing/pacing
AR	Atrial refractory sense
Ab	Atrial event in blanking period
VS/Vp	Ventricular sensing/pacing
BV	Biventricular pace
VR	Ventricular refractory sense
TS	Sense in (slow) VT zone
T-F	Sense in fast VT zone via VT
TF-	Sense in fast VT zone via VF
FS	Sense in VF zone
TDI	VT detected
TFI	FVT detected
FDI	VF detected
TP	Tachy pace (ATP)
CE	Charee end



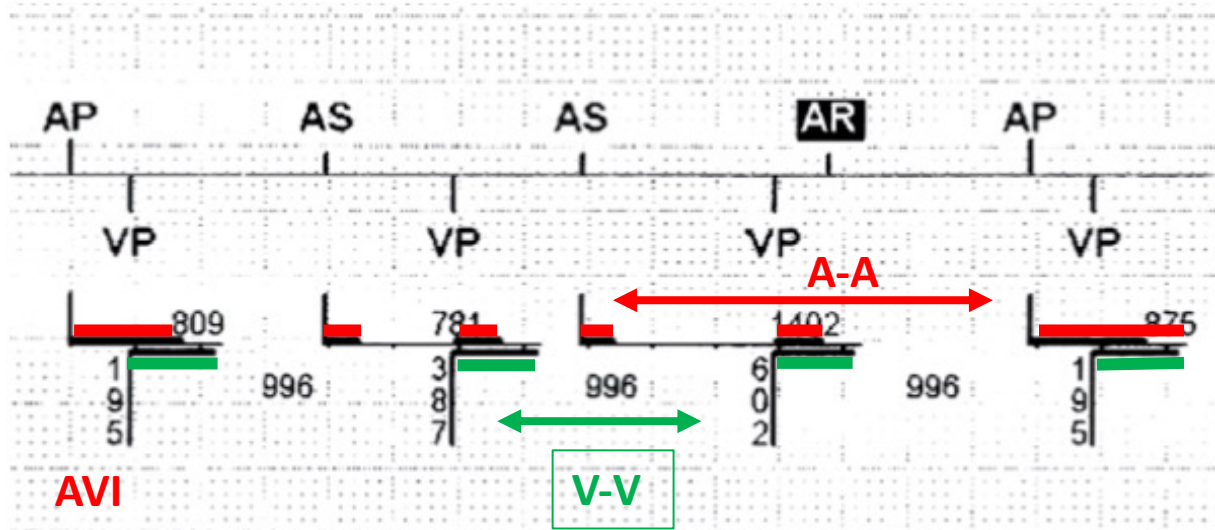
Ap/A	Atrial pacing
As/P	Atrial sensing
Ar	Atrial refractory sensing
Vs/R	Ventricular sensing
Vp	Ventricular pacing
Vr	Ventricular refractory sensing
bV	Biventricular pacing

St-Jude Medical



A/MS	Modeswitch
LOC	Loss of capture
VPP	Ventricular backup pacing
-	Interval that is not binned
VS	Binning of interval in Sinus zone
T1	Binning of interval in VT1 zone
T2	Binning of interval in VT2 zone
F	Binning of VF interval
E	Reconfirmation of VF

- VS: Sens
- VP: Pace
- VB: Blanking
- VR: Refrakter
- AS: Sens
- AP: Pace
- AB: Blanking
- AR: Refrakter



Atrial refrakter dönem

Ventriküler refrakter dönem

$$60.000 / \dots \text{ms} = \dots \text{vuru/dk}$$

$$60.000 / \dots \text{vuru/dk} : \dots \text{ms}$$

# NBG (NASPE/BPEG) kodlama

Uyarı / Pace	Algılama / Sens	Algılama yanıtı	Hız yanıtı	Multiside Pace
A:Atriyum	A:Atriyum	I: İnhibe	-	A:Atriyum
V:Ventrikül	V:Ventrikül	T:Tetikleme <ul style="list-style-type: none"><li>Ventrikül sens alırsa uyarı verme</li><li>Atriyal sens algılsa AV gecikme tetikleme</li></ul>	R: Hız yanıtı	V:Ventrikül
D: Dual	D: Dual	D: Dual		D: Dual
O: Yok	O: Yok	O: Yok		O: Yok

# Temel zaman aralıkları-I

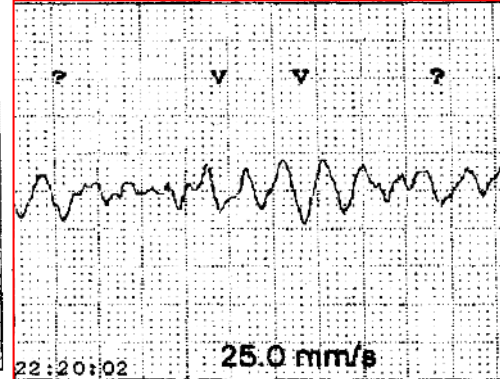
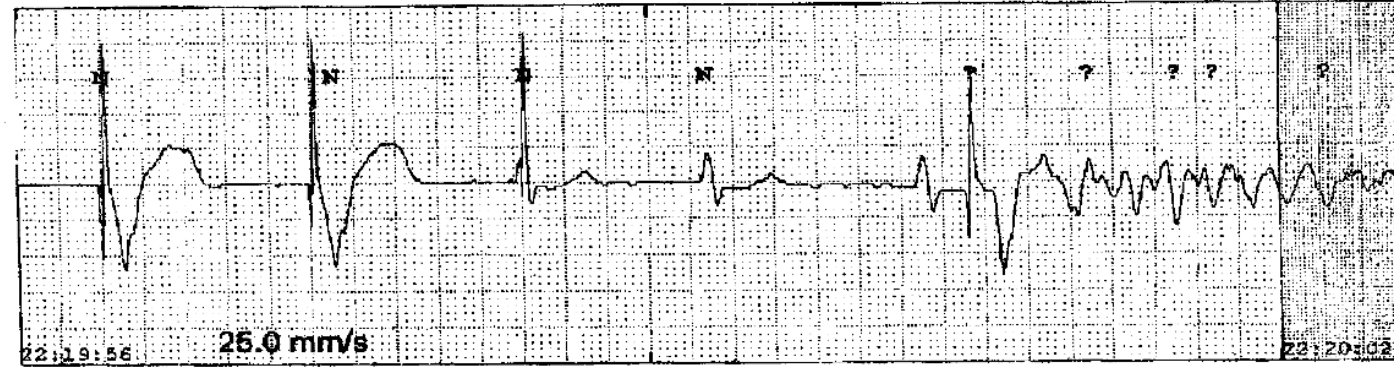
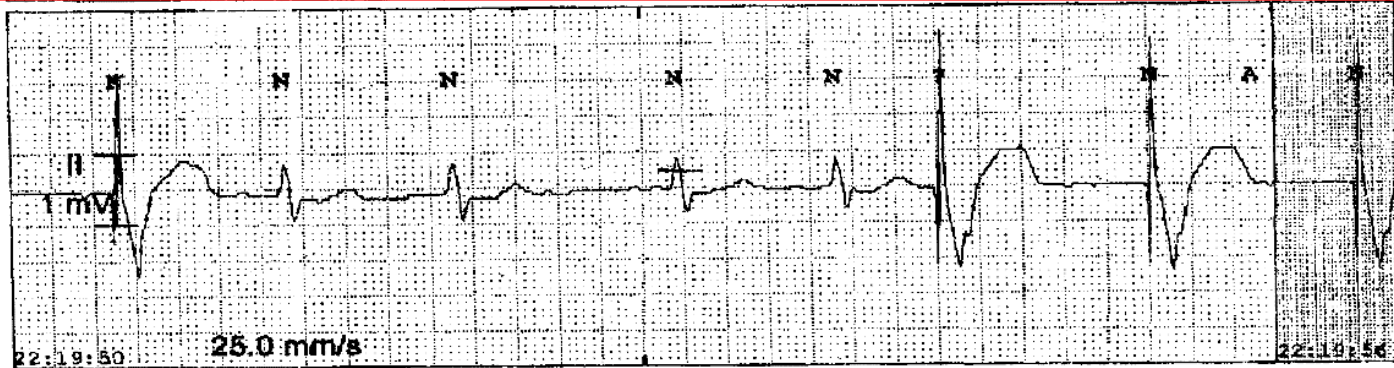
---

- Tek odacıklı kalp pilleri
  - Alt hız aralığı ( Lower rate interval- LRI)
- Çift odacıklı kalp pilleri
  - Alt hız aralığı ( Lower rate interval- LRI)
  - Atriyo ventriküler aralık ( Atrioventricular interval- AVI)

# VOO Pacing

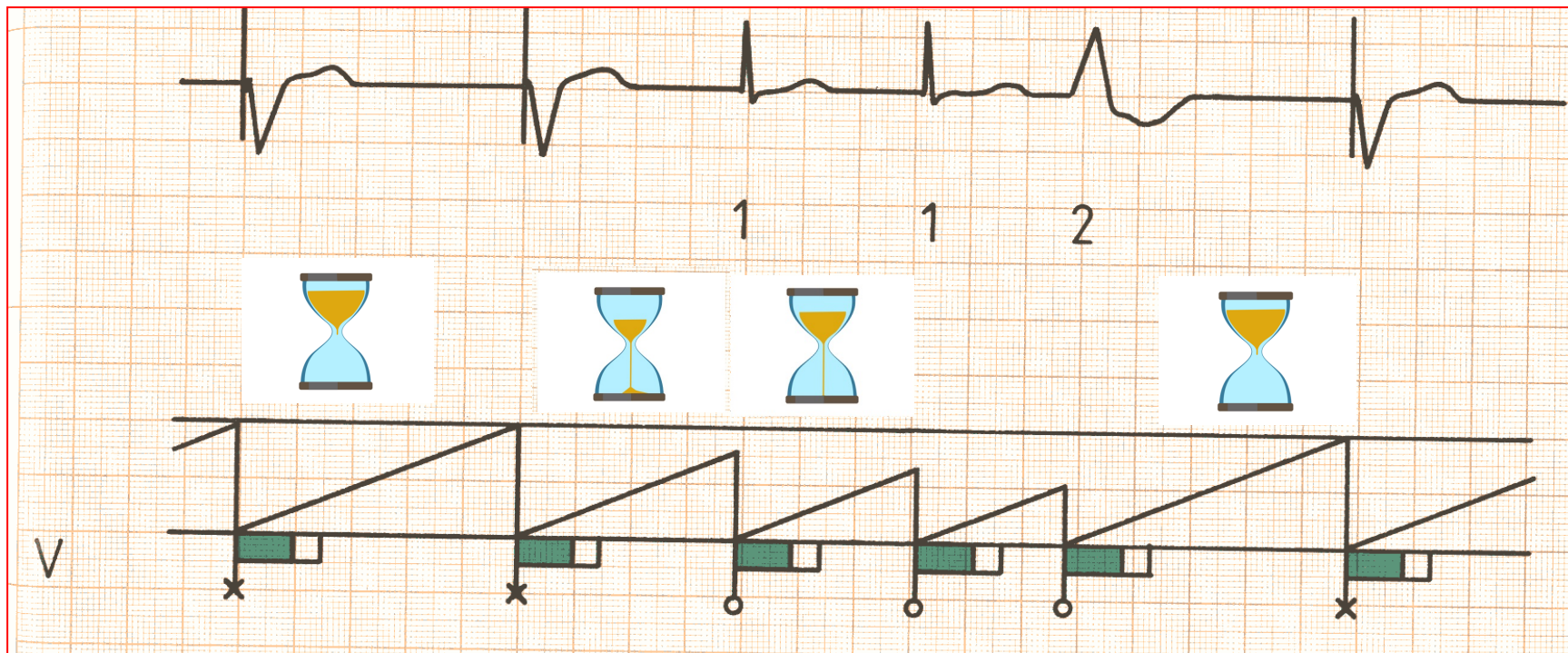


# VOO Pacing- Magnet modu



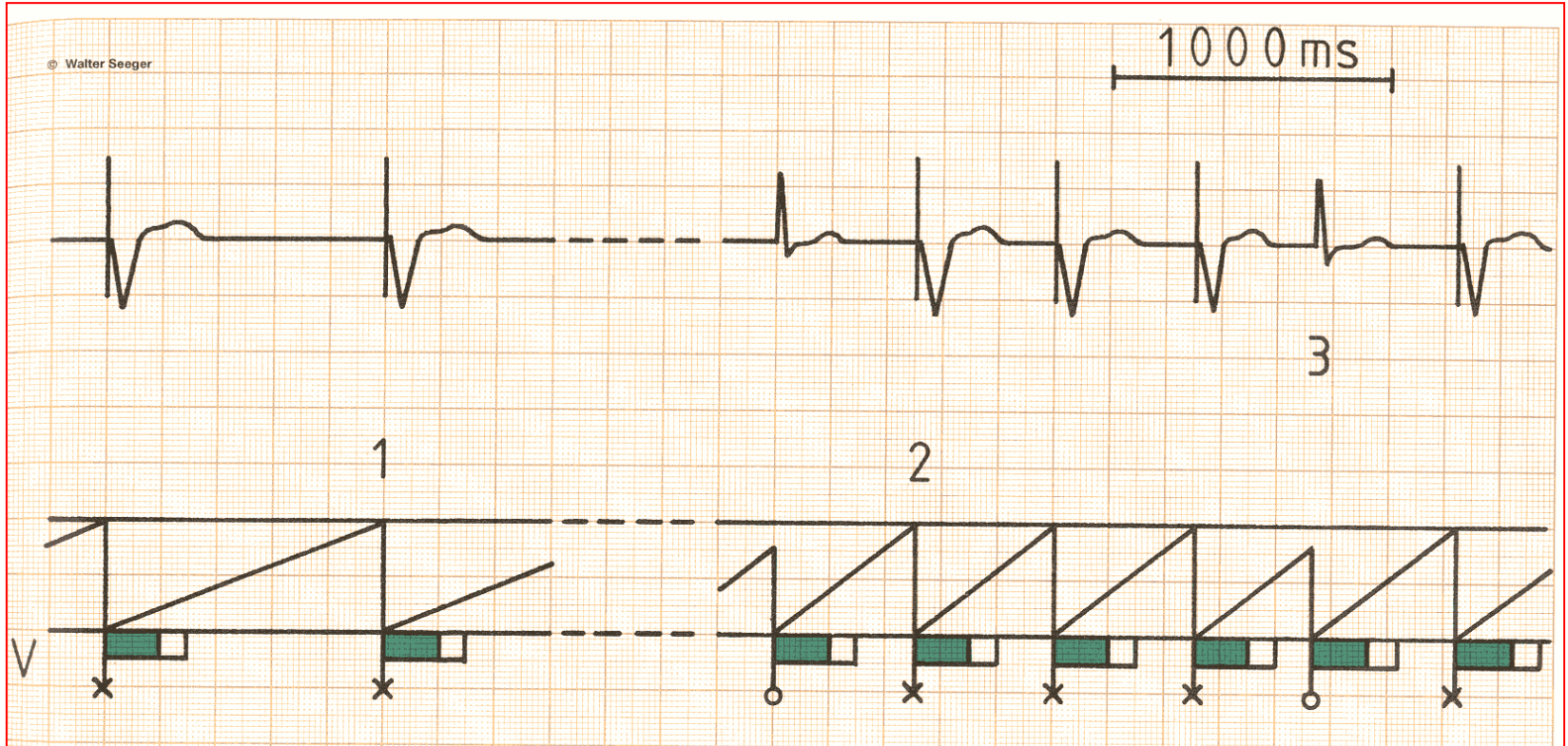


# VVI Pacing





# VVIR Pacing



### Rate Response

— Programmed — Pending

Rate (bpm)

180  
160  
140  
120  
100  
80  
60  
40

4 3 USR  
ADL  
LR

Increasing patient activity --->

#### Rates

Lower Rate	60 ppm
ADL Rate	110 ppm
Upper Sensor Rate	130 ppm

Rate Profile Optimization

#### Adjust Rate Response

ADL Response

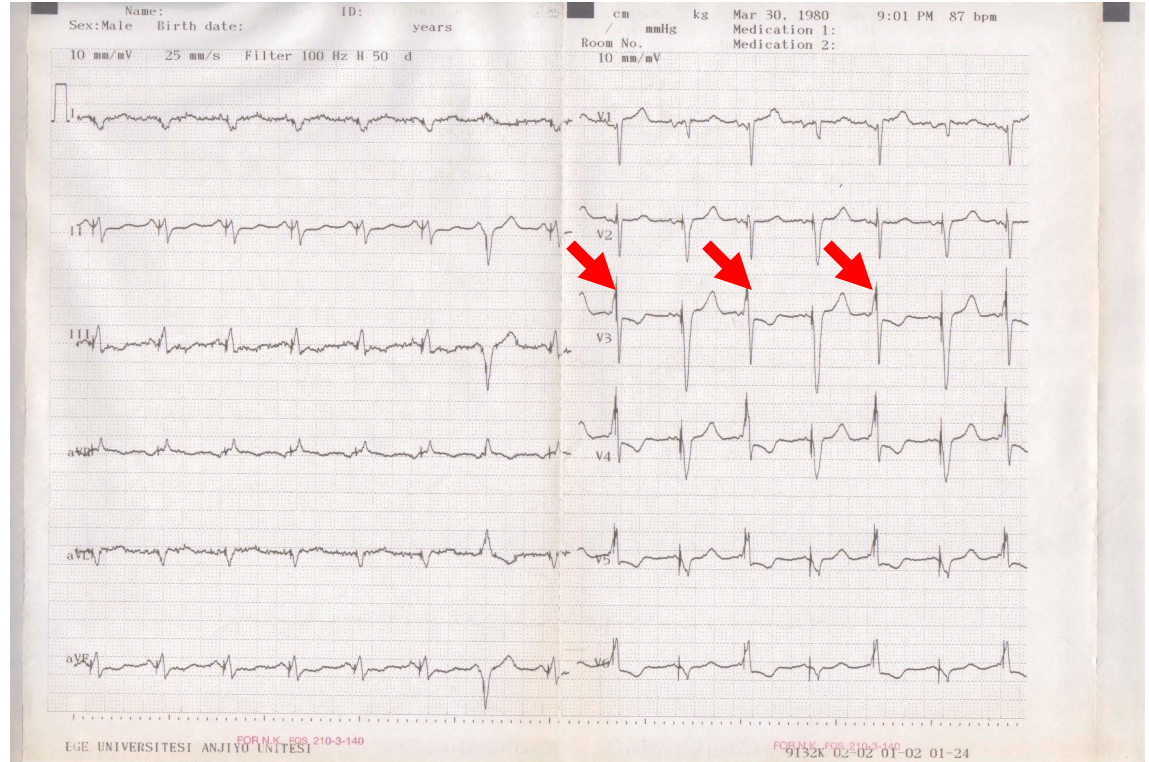
Exertion Response

Additional Parameters...

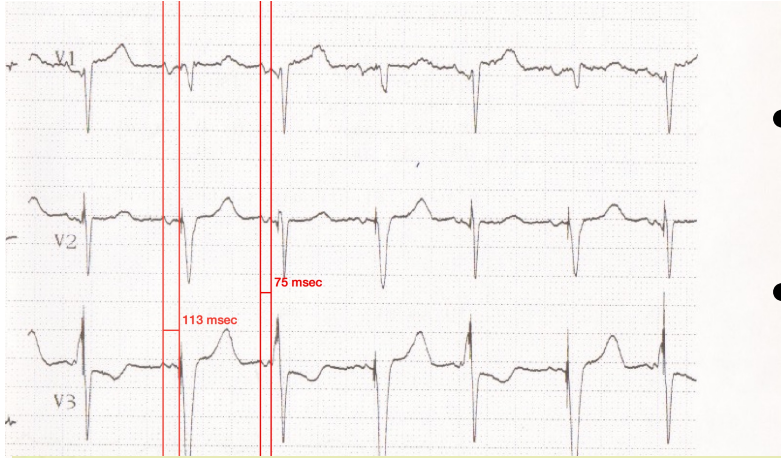
# VVT Pacing



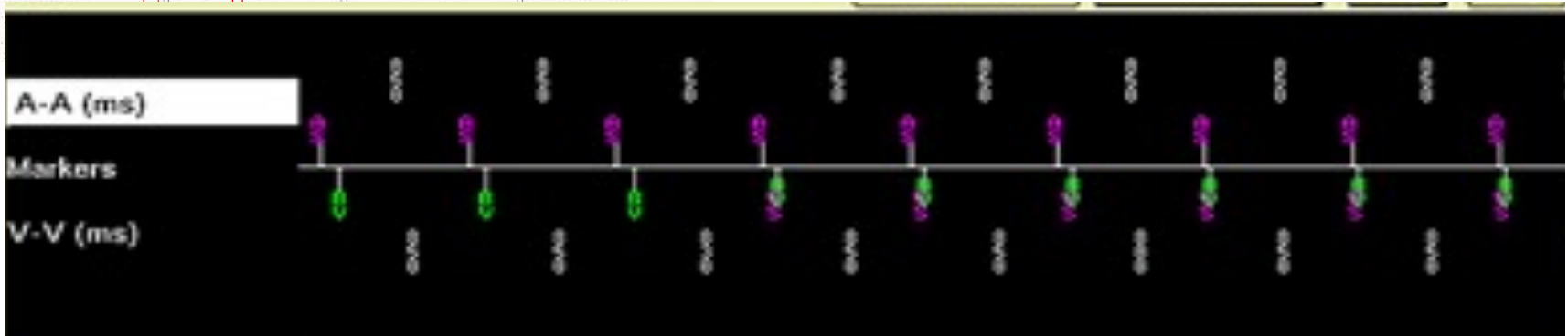
- KRT-D hastası



# VVT Pacing

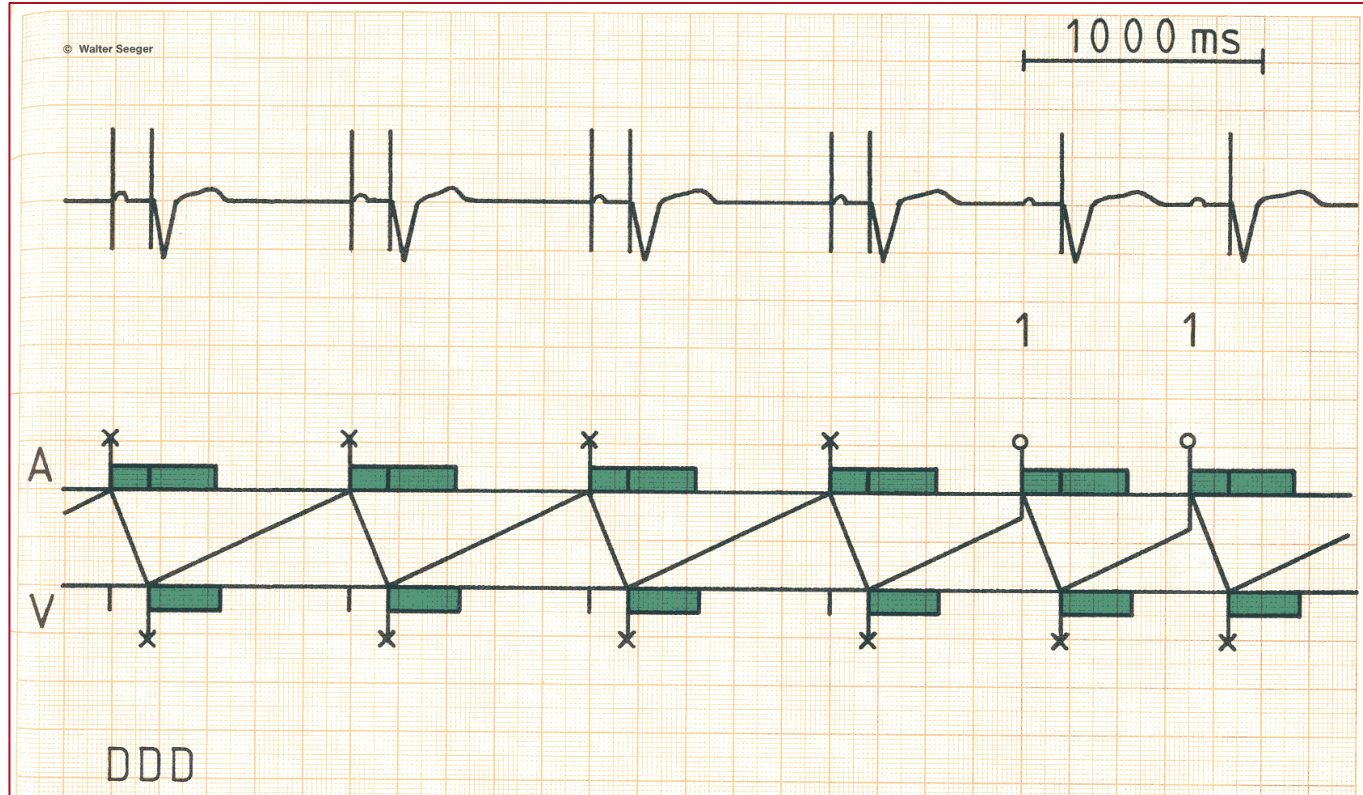
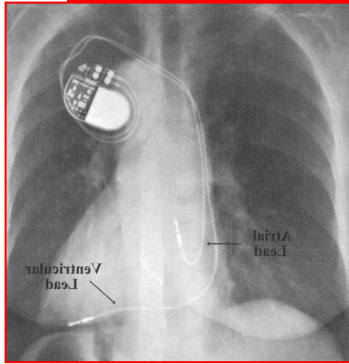


- Ventriküler sens yanıtı V pace tetiklemiş
- VVT modu

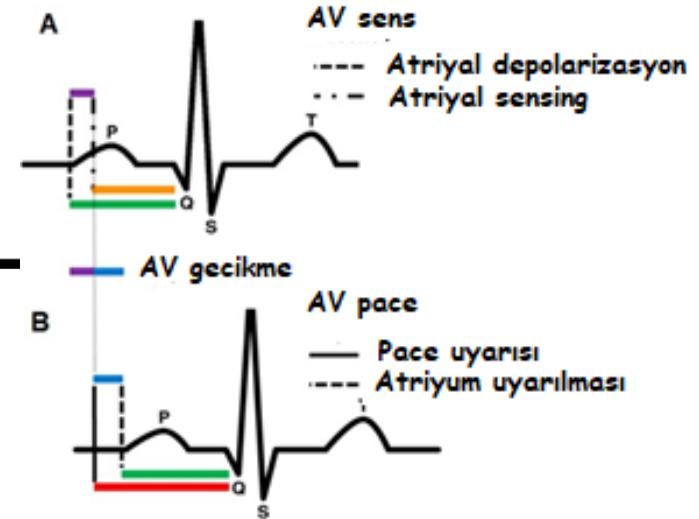
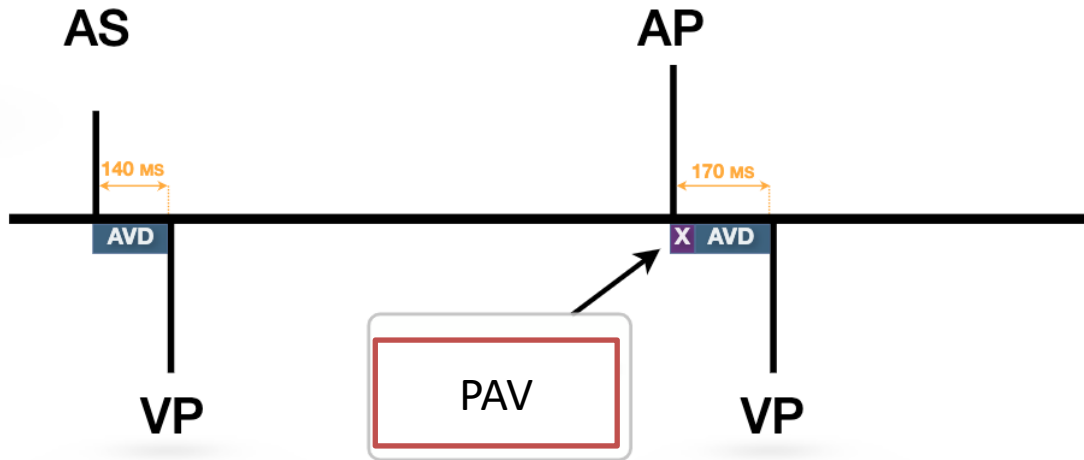


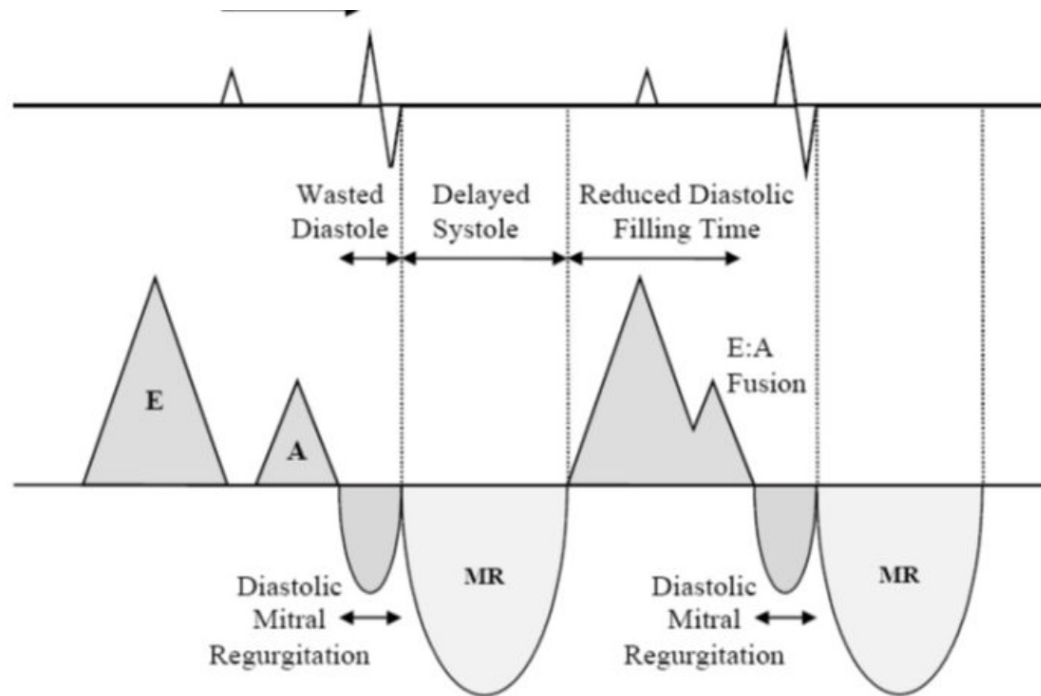


# DDD Pacing

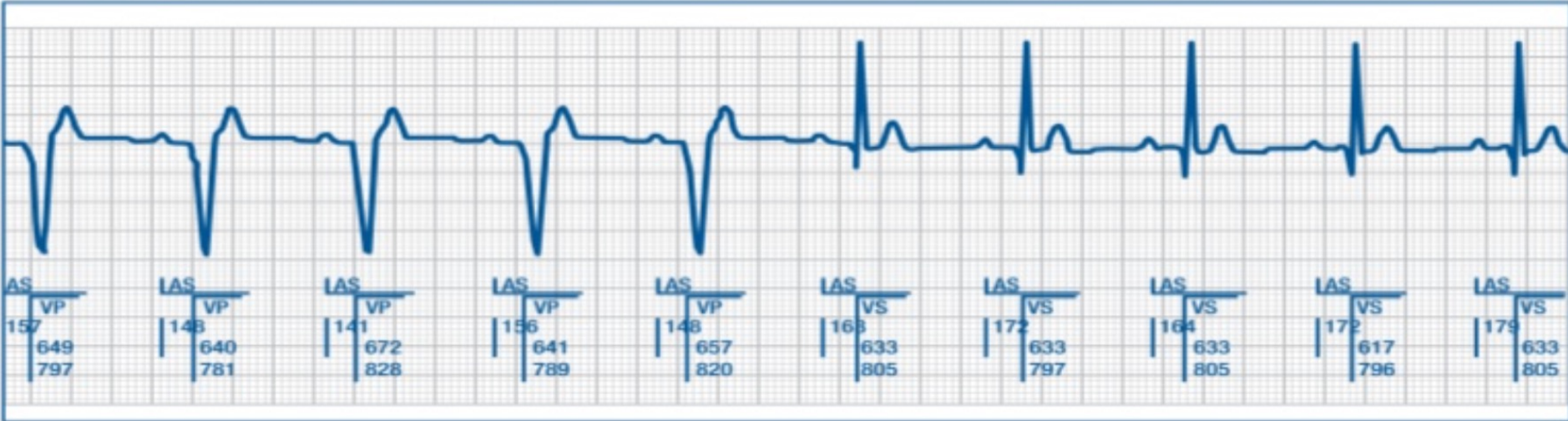


# DDD pacing AV gecikme





# AVI Histerezis



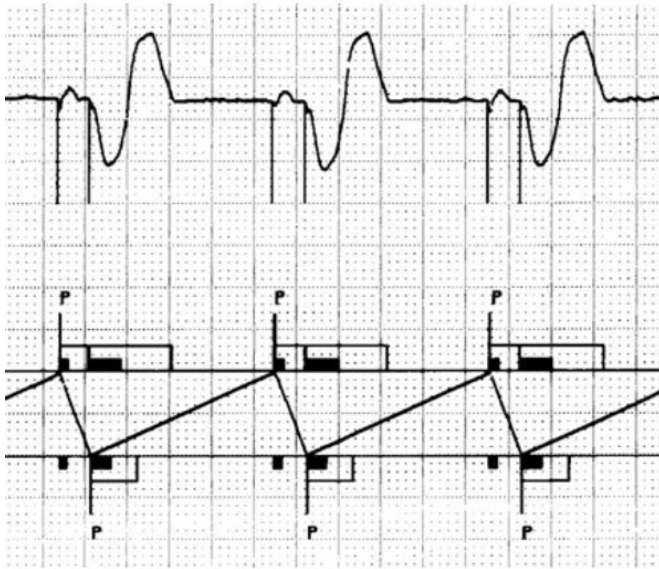
Sensed AVI:150ms

Paced AVI:160ms

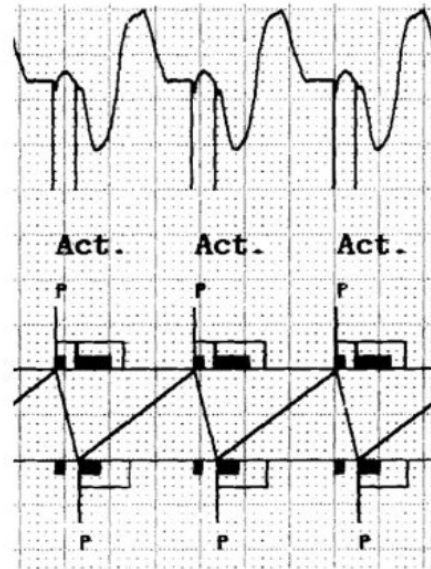
Histerezis: 50ms



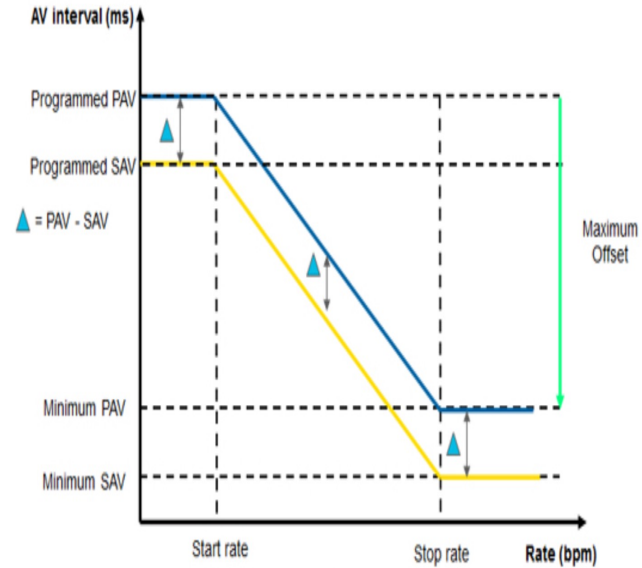
# Hıza bağlı değişen AV delay



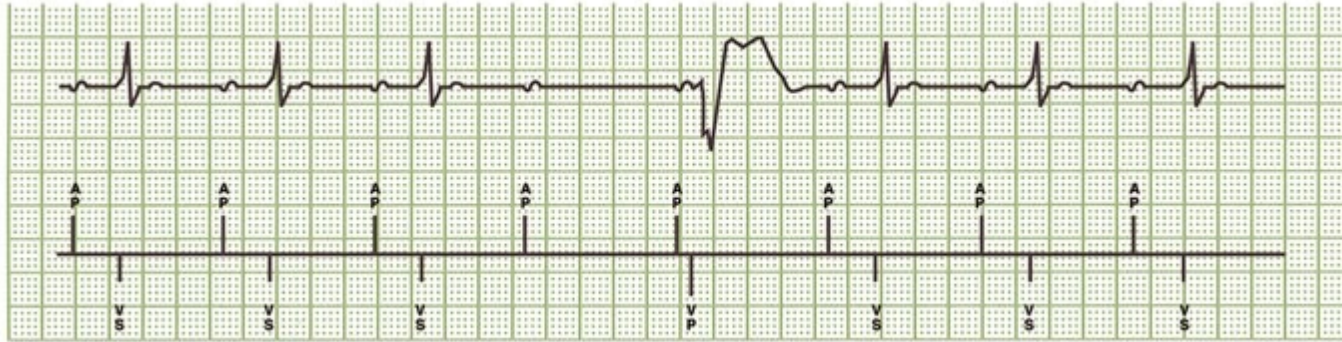
PAV ( ) : 150 ms



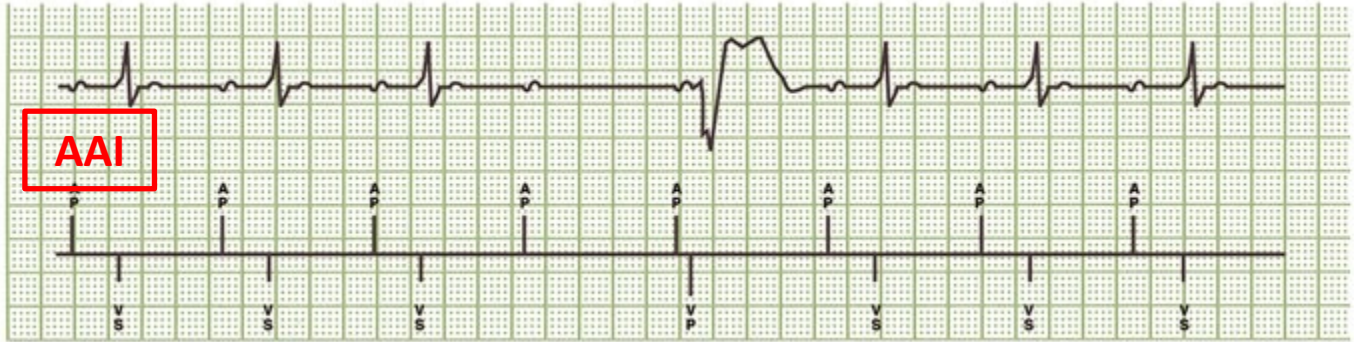
PAV ( ) : 120 ms



# Hocam pilim çalışmıyormuş



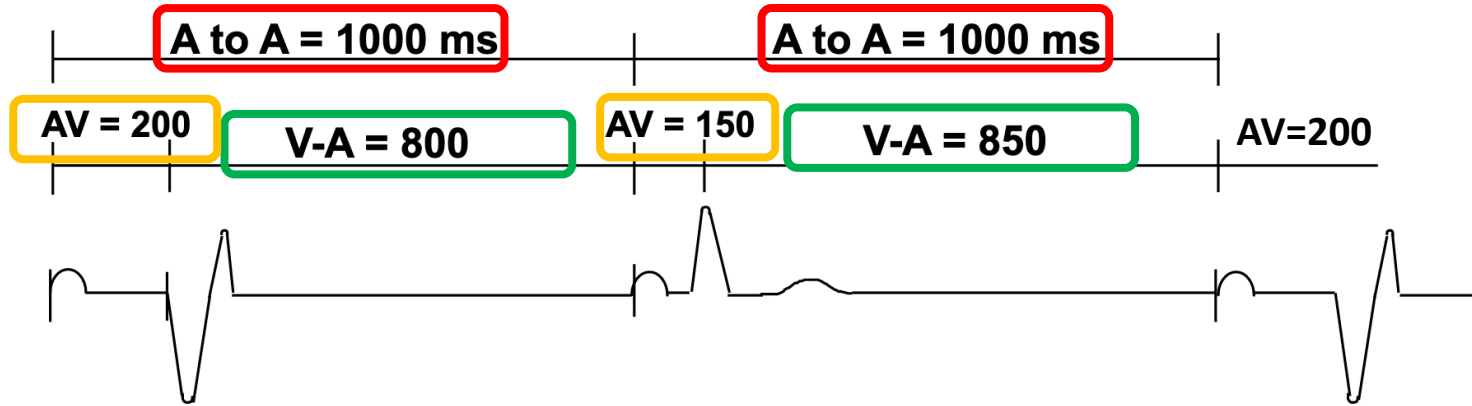
# AAI ↔ DDD: MVP<sup>®</sup> /SafeR<sup>®</sup>



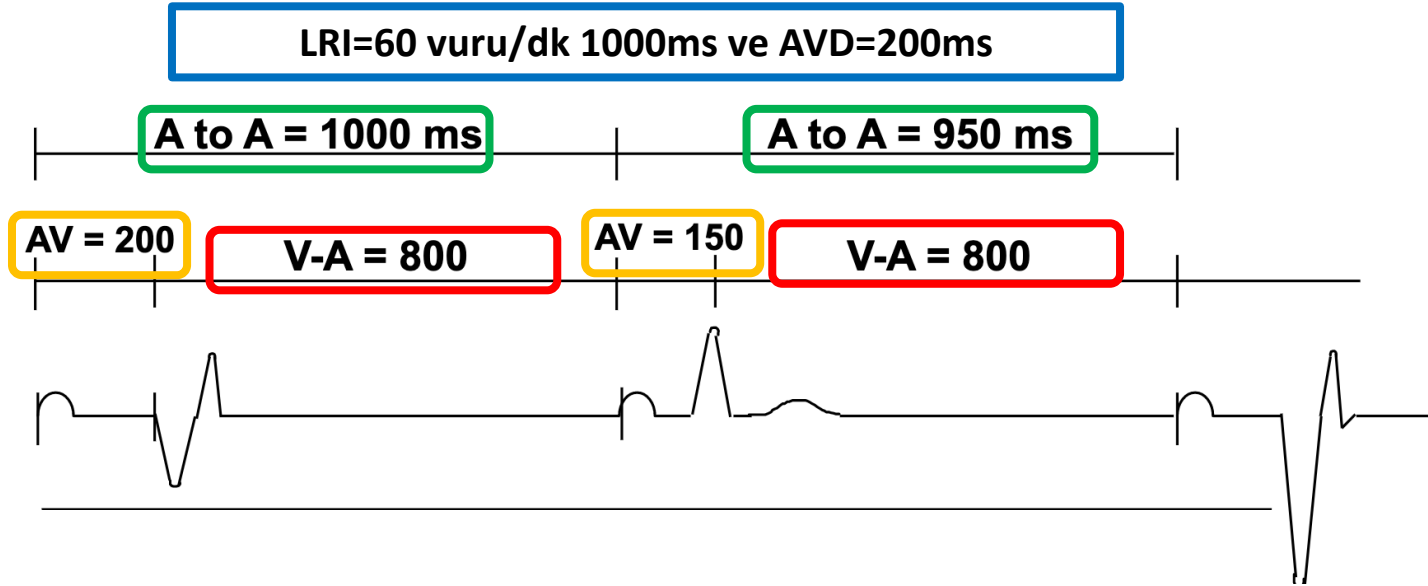
# Atrialy temelli zamanlama



LRI=60 vuru/dk 1000ms



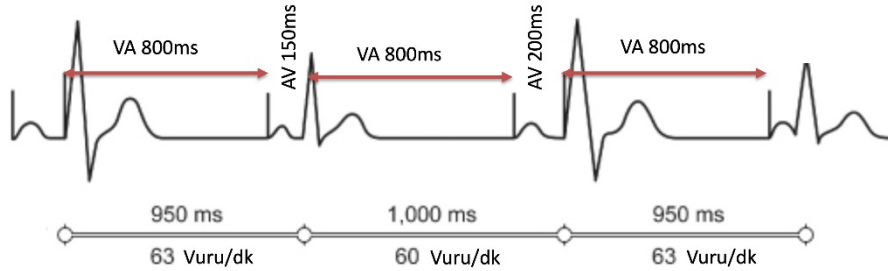
# Ventriküler temelli zamanlama





## Ventrikül temelli zamanlama

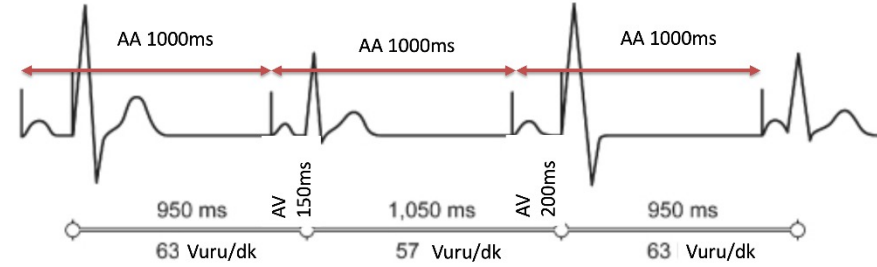
VA sabittir (LR-AV gecikme)



Alt hız:60 Vuru/dk (1000ms)  
Paced AV:200 ms (Hız deęişken AV)

## Atrial temelli zamanlama

AA sabittir



Alt hız:60 Vuru/dk (1000ms)  
Paced AV:200 ms (Hız deęişken AV)

# Temel zaman aralıkları-II

---

- Tek odacıklı kalp pilleri
  - Alt hız aralığı ( Lower rate interval- LRI)
  - **Ventriküler blanking period**
  - **Ventriküler rölatif refrakter period**
- Çift odacıklı kalp pilleri
  - Alt hız aralığı ( Lower rate interval- LRI)
  - Atriyo ventriküler aralık ( Atrioventricular interval- AVI)

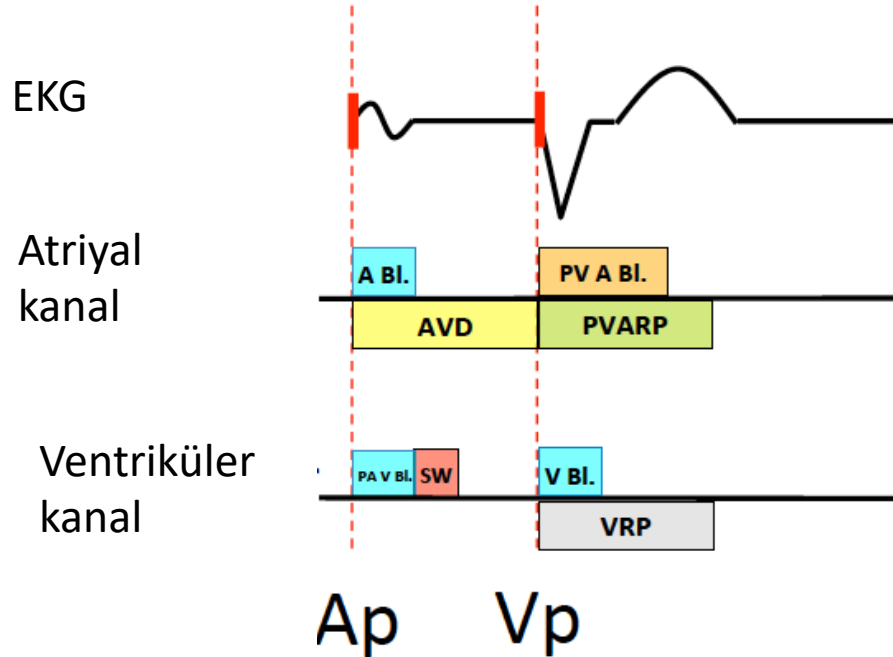
# Temel zaman aralıkları-II

---

- Tek odacıklı kalp pilleri
- Çift odacıklı kalp pilleri
  - Alt hız aralığı ( Lower rate interval- LRI)
  - Atriyo ventriküler aralık ( Atrioventricular interval- AVI)
  - **Atriyal/Ventriküler blanking period**
  - **Atriyal/Ventriküler rölatif refrakter period**
  - **Post atriyal ventriküler blanking period**
  - **Post ventriküler atriyal blanking/rölatif refrakter period**



# Temel zaman aralıkları-II



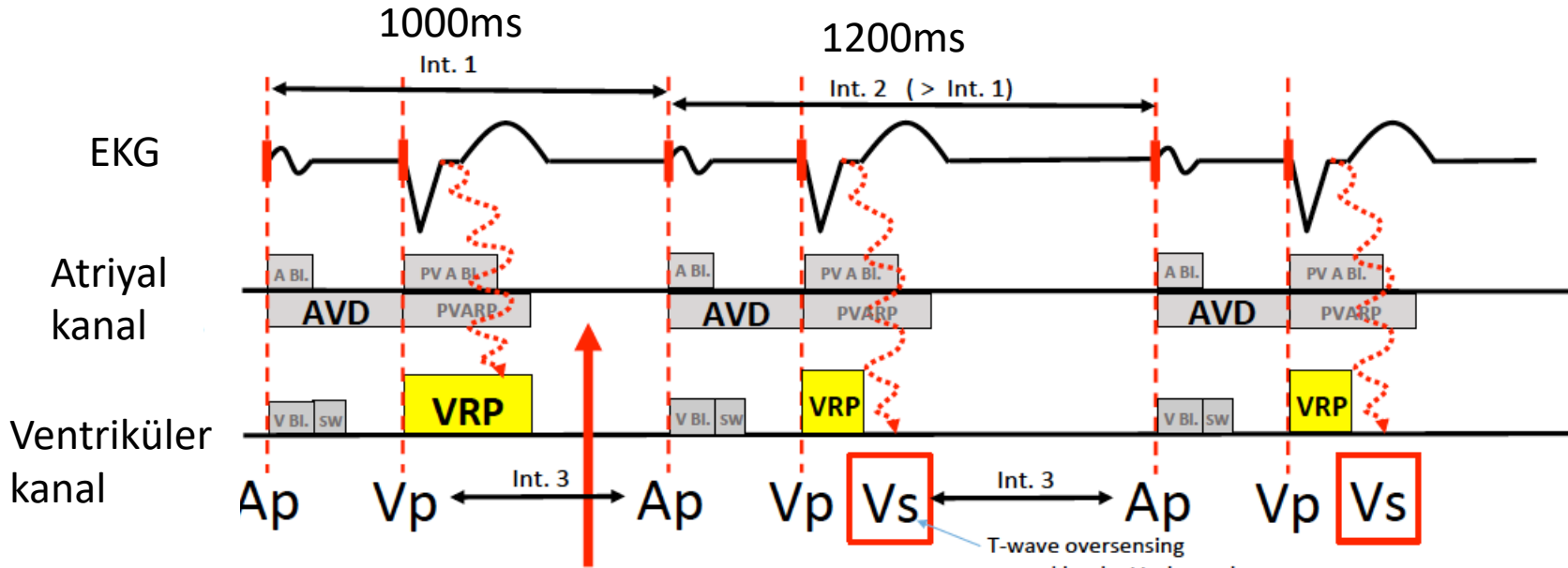
Blanking vs. rölatif refrakter dönem ?

# Neden var ?

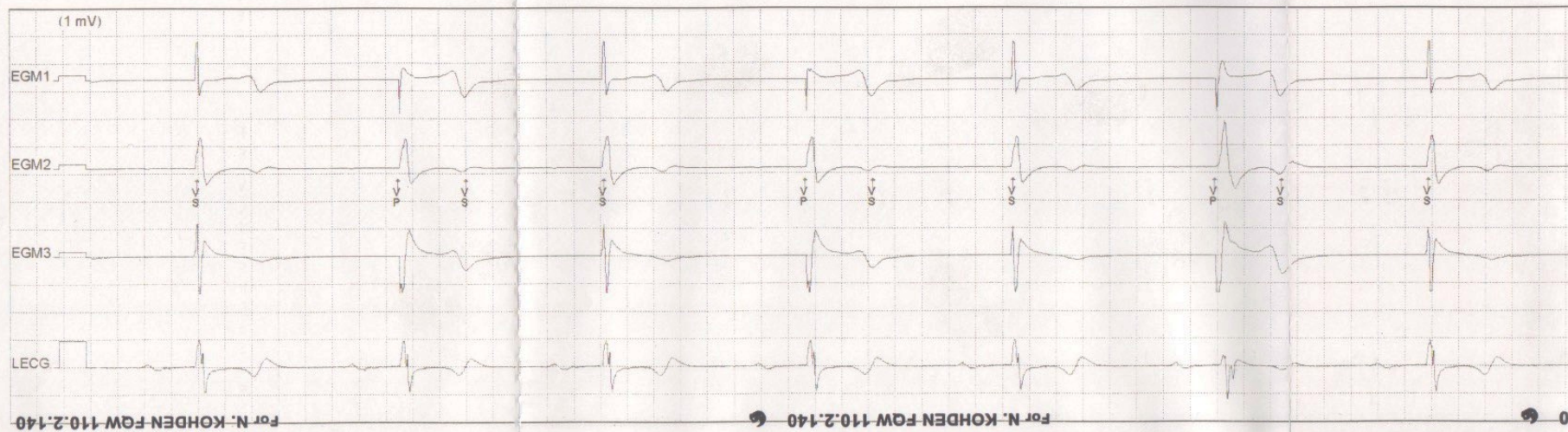
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- Yanlış algılamaları önlemek
- Uygun hızda pace etmek
- Crosstalk önlemek
- Pacemaker mediated / endless loop taşikardilerini (ELT) önlemek

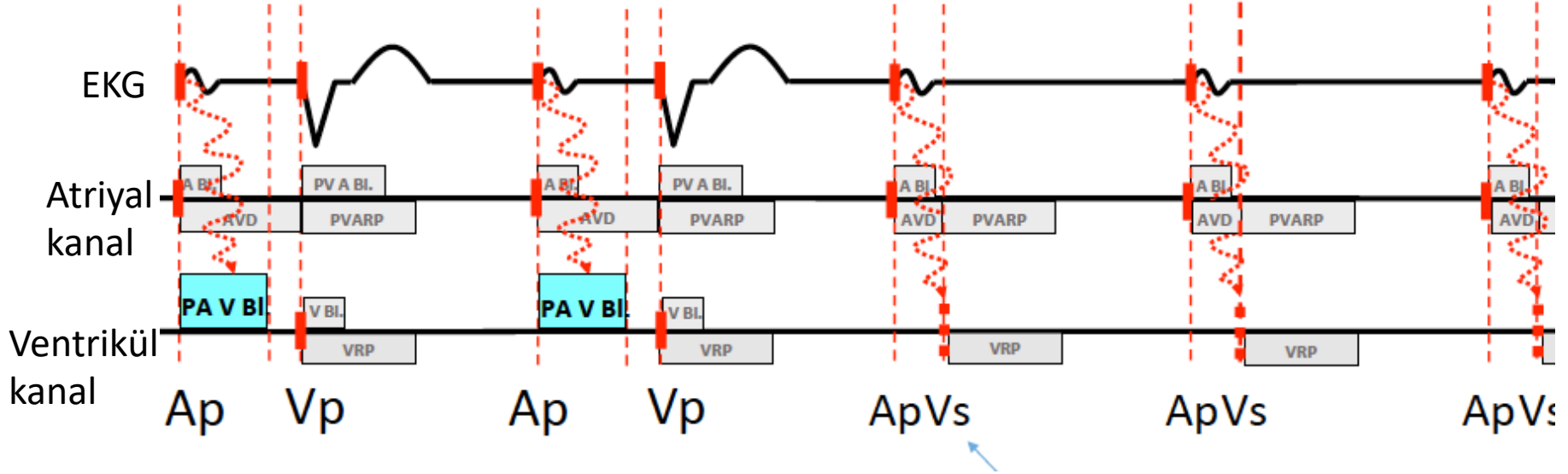
# T dalgası oversensing (TWOS)



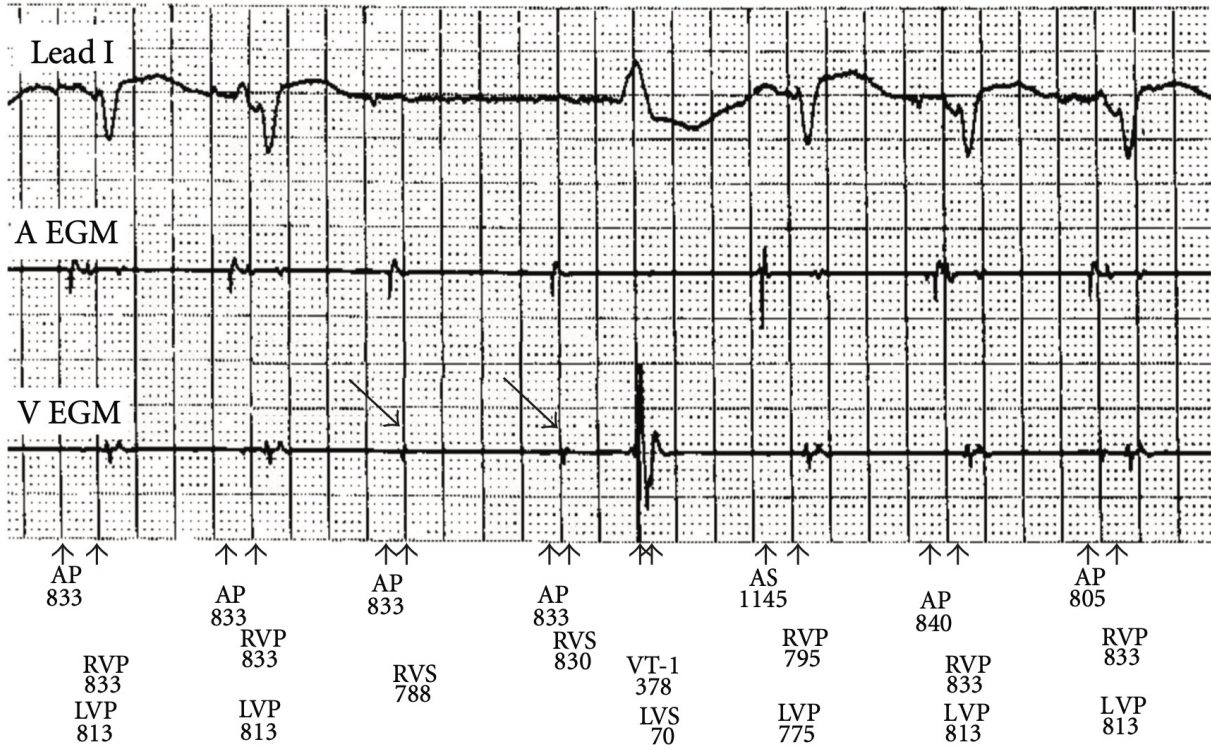
# TWOS



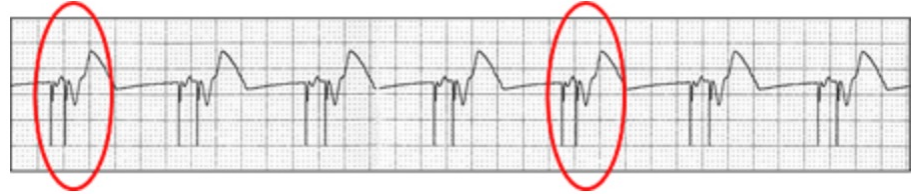
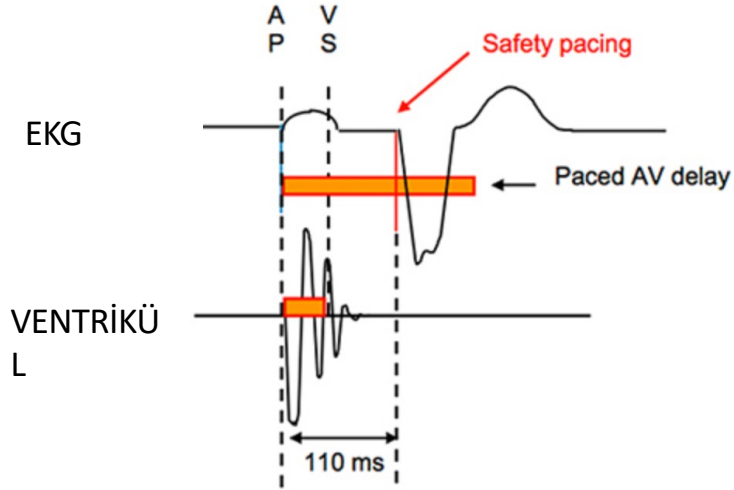
# Crosstalk



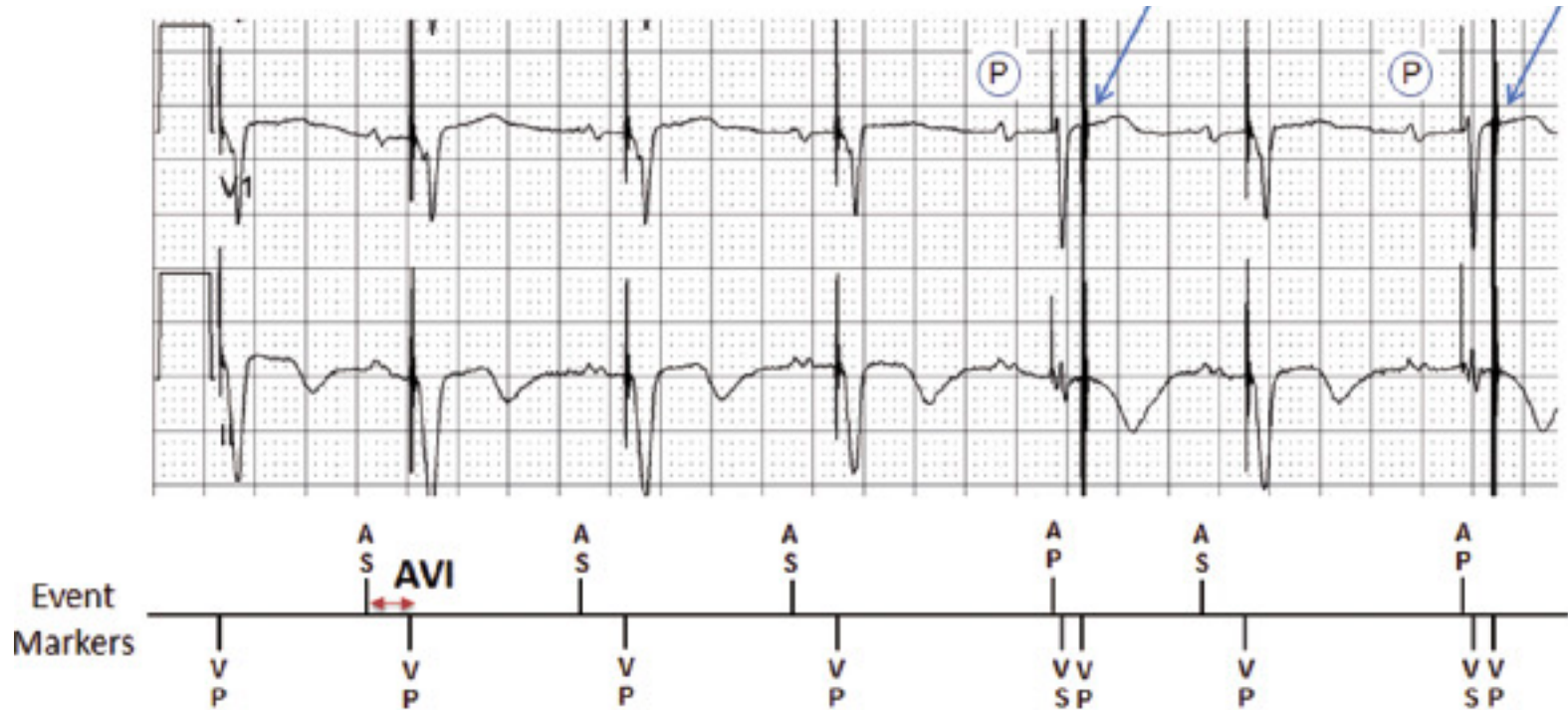
right v



# VVT Pacing



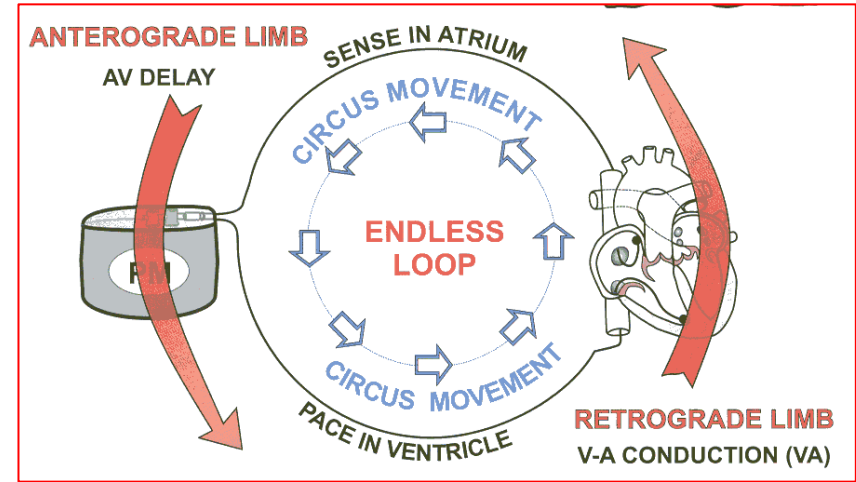




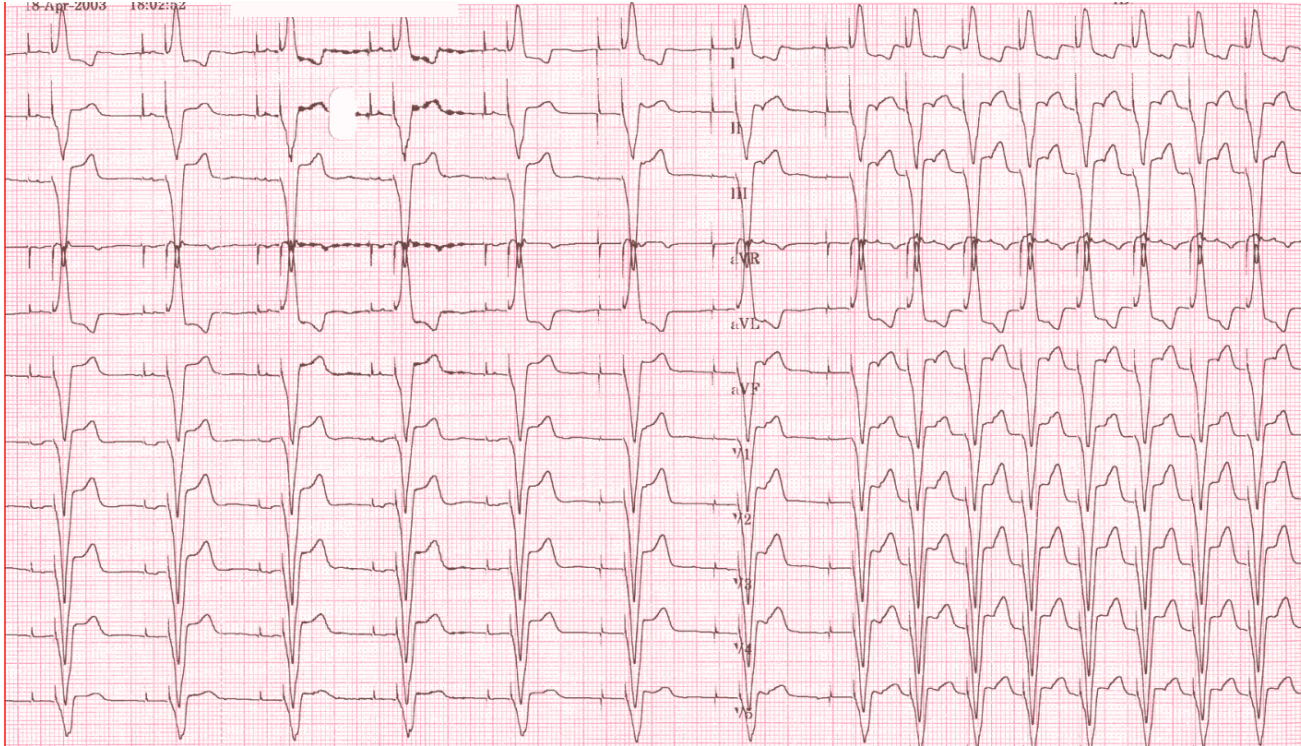




# PMT

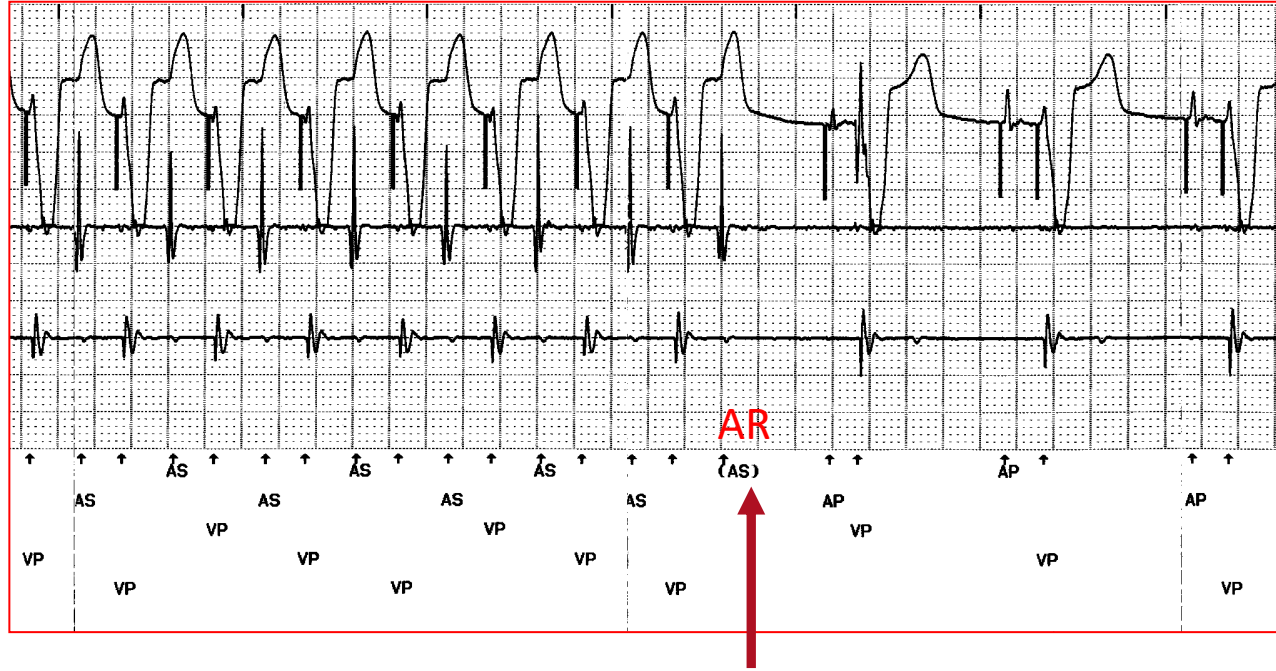


# PMT



- AS ile başlar
- UTR geçmez
- Magnet ile sonlanır

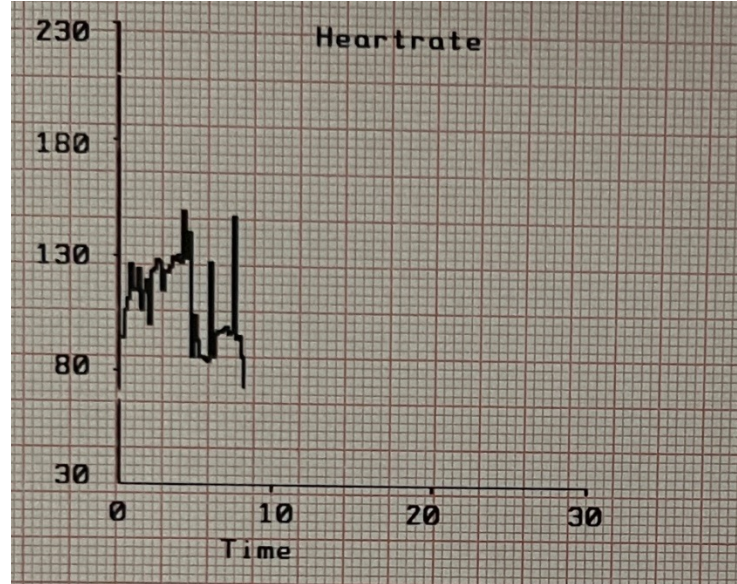
# PMT müdahalesi



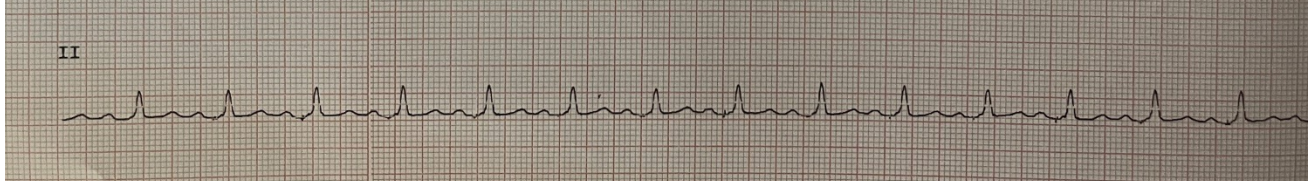
X sayıda “VP-AS” algılanmasının ardından PVARP otomatik uzatılıyor  
⇒ (tek) P dalgası iletilmediğinde ⇒ taşikardi sonlanıyor

# Üst Hız Yanıtı

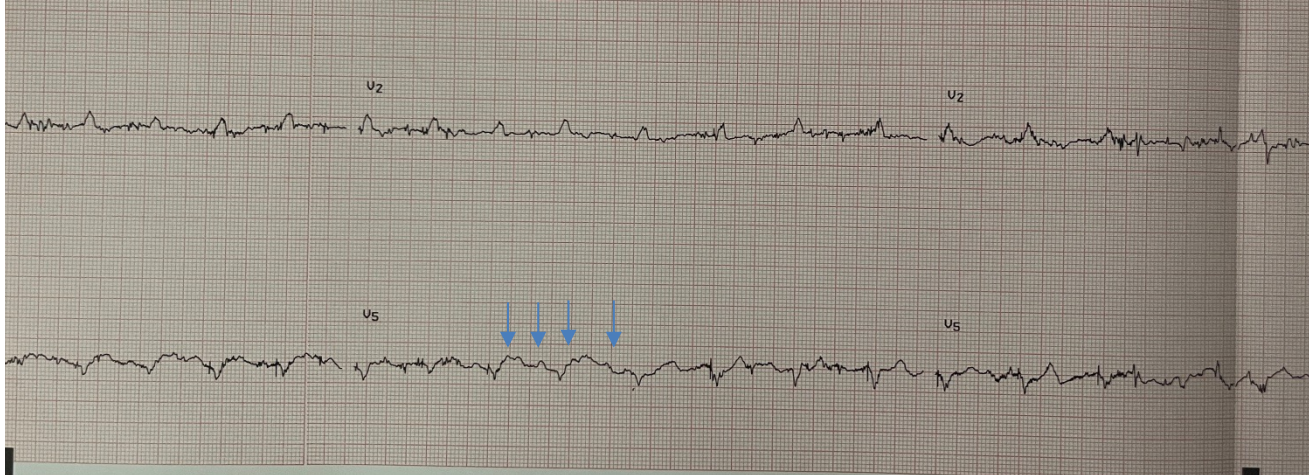
- 23 y. Kadın hasta
- VDD KPM
- Efor dispnesi







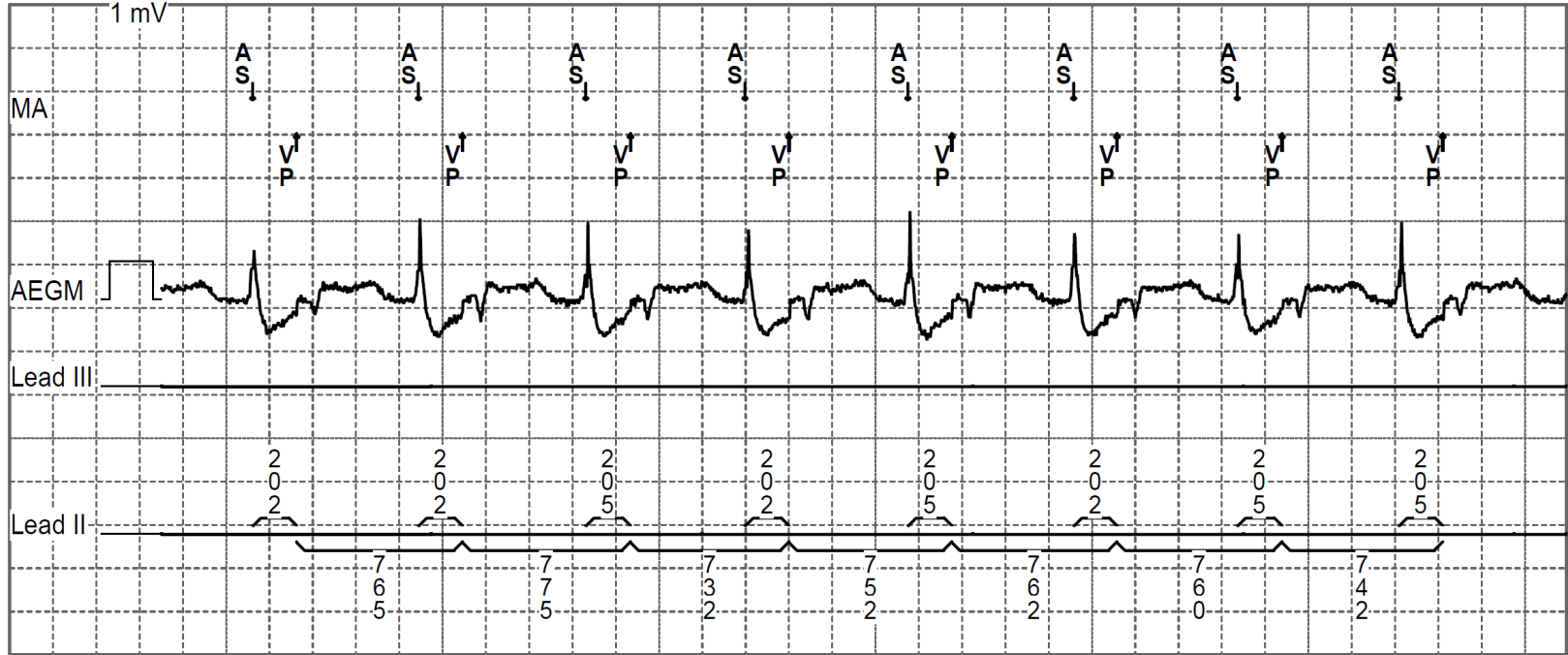
Efor başlangıç



10 mets  
Stage 3 Bruce Prot.

Collected: 01/22/20 11:23:15 AM

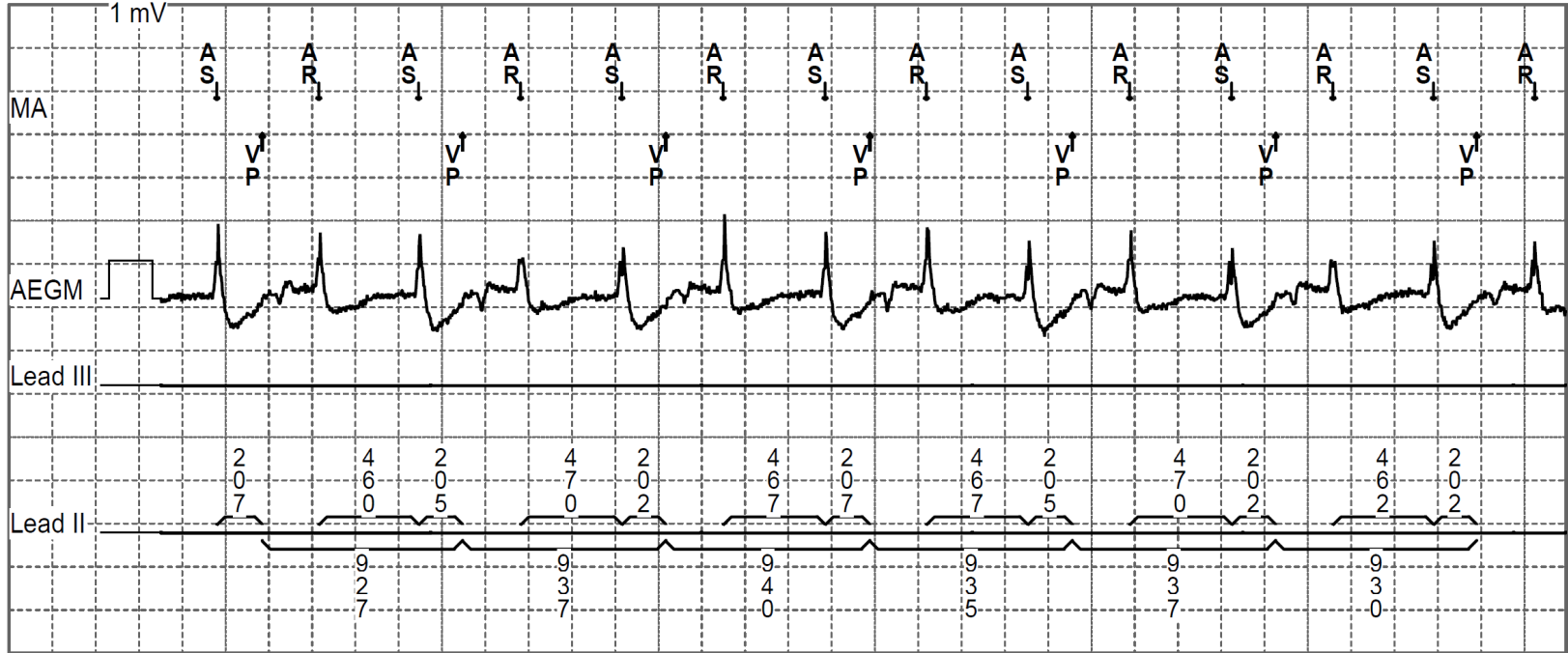
25.0 mm/sec



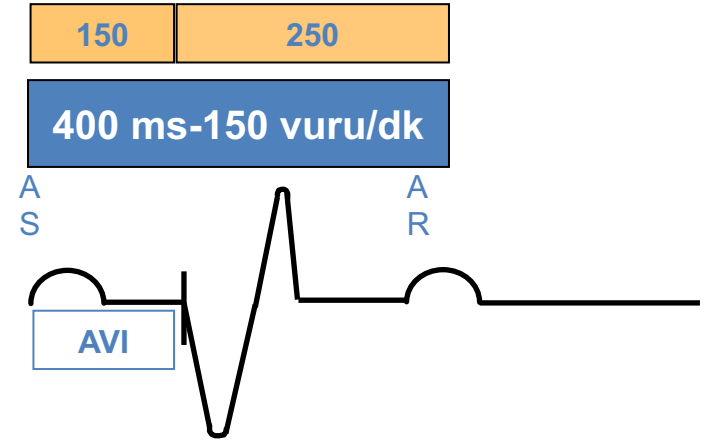
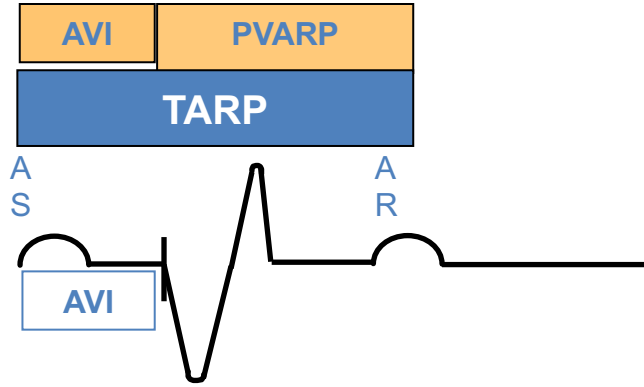


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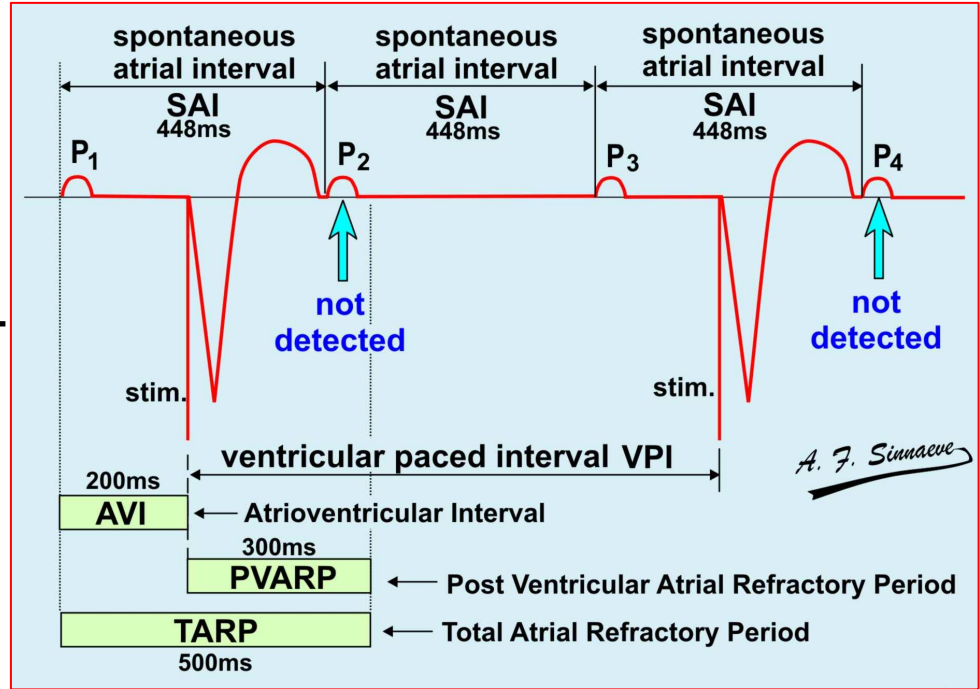
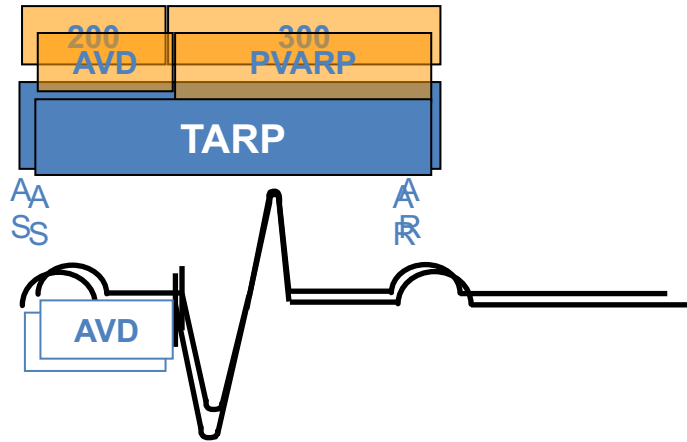
25.0 mm/sec



# Üst Hız Yanıtı: TARP

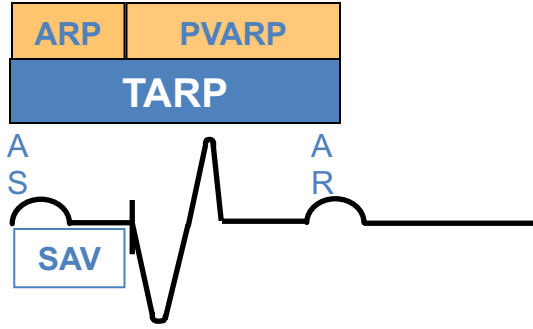


# Üst hız yanıtı - I :TARP-Problemi

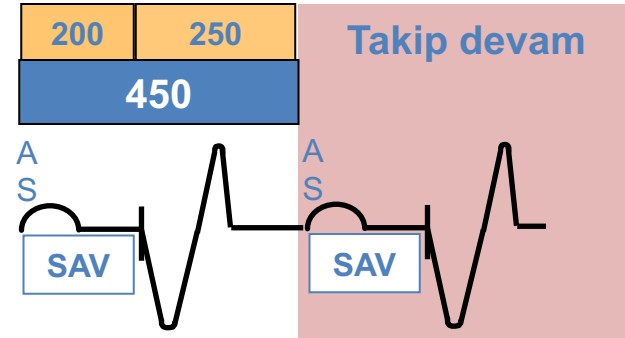
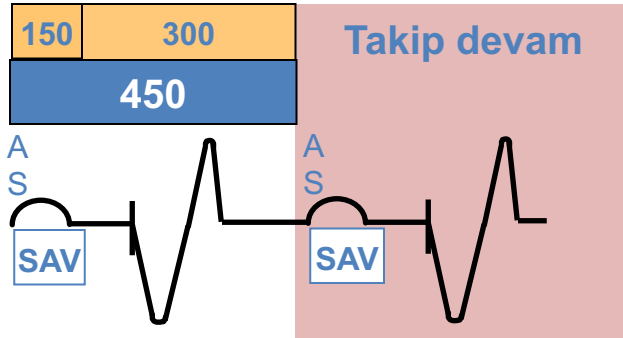
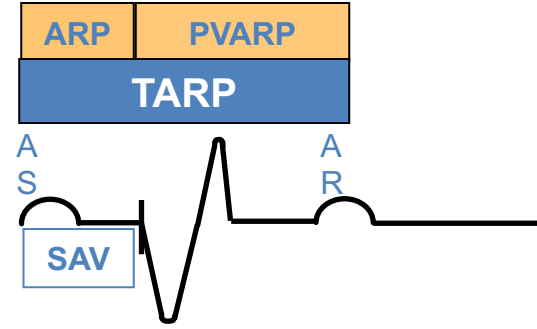


# Üst hız yanıtı - I :TARP-Problemi

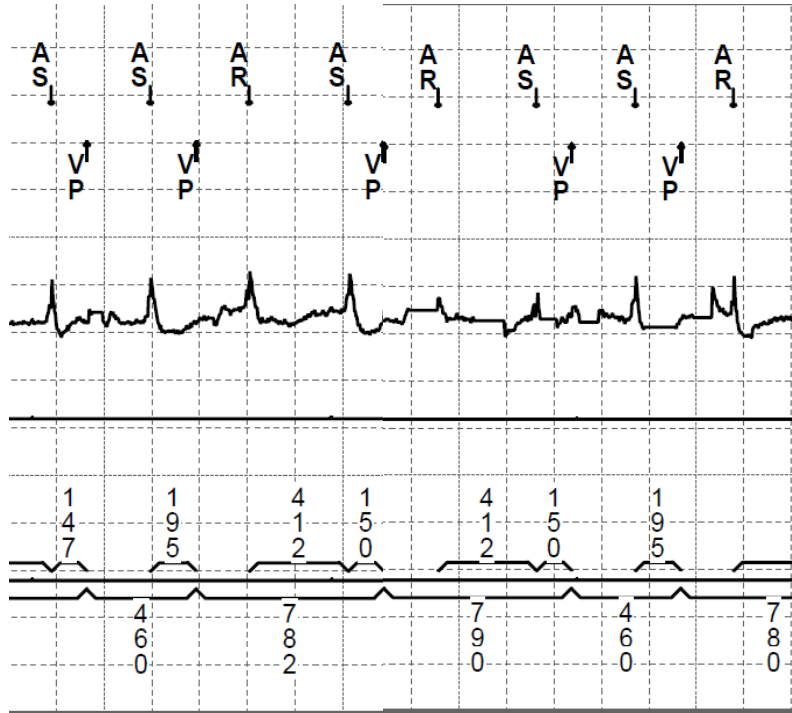
AV gecikme kısaltılabilir



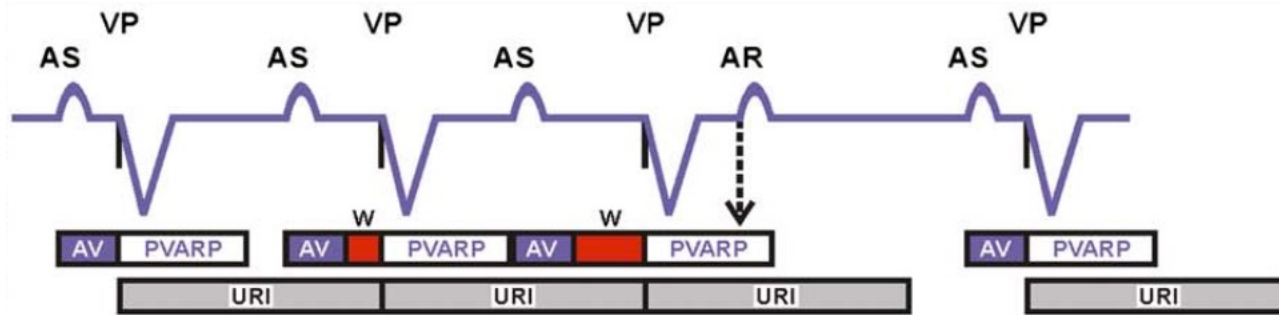
PVARP kısaltılabilir

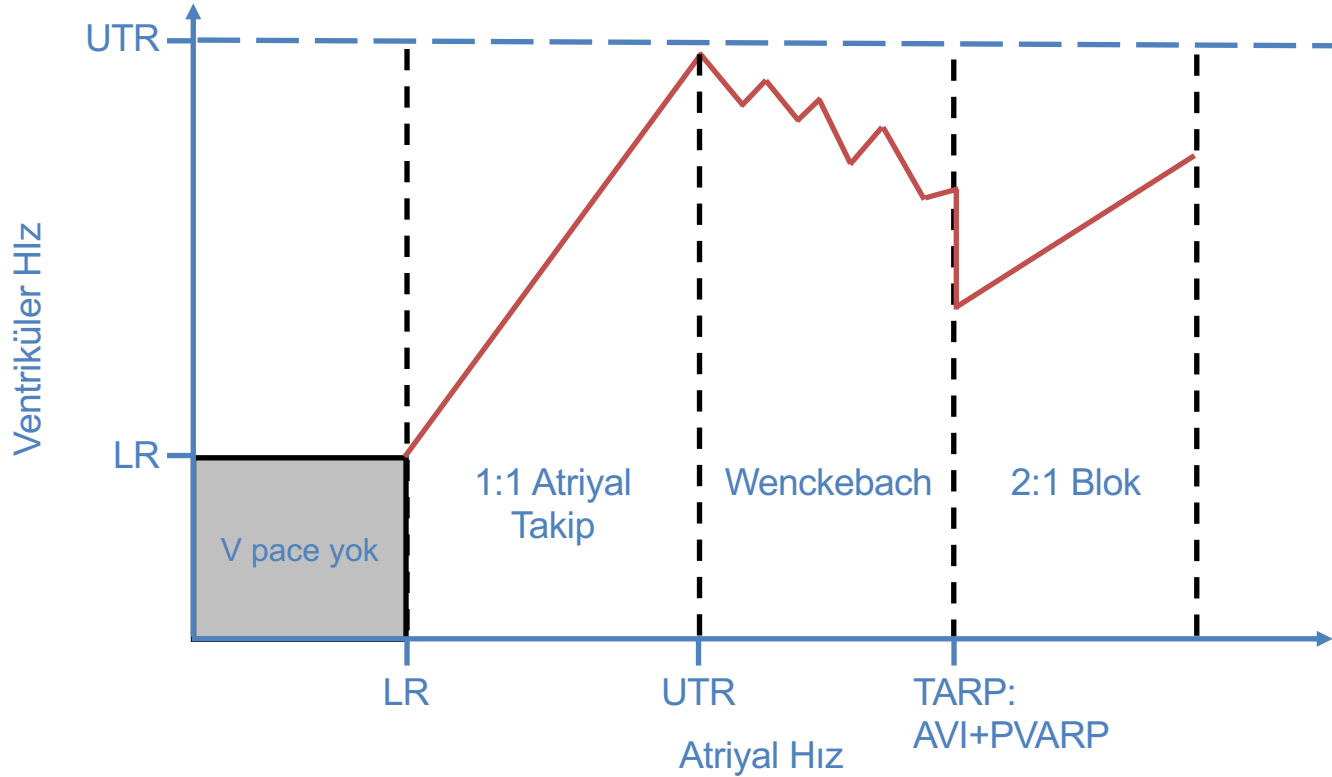


# Üst hız yanıtı -II :Upper tracking rate



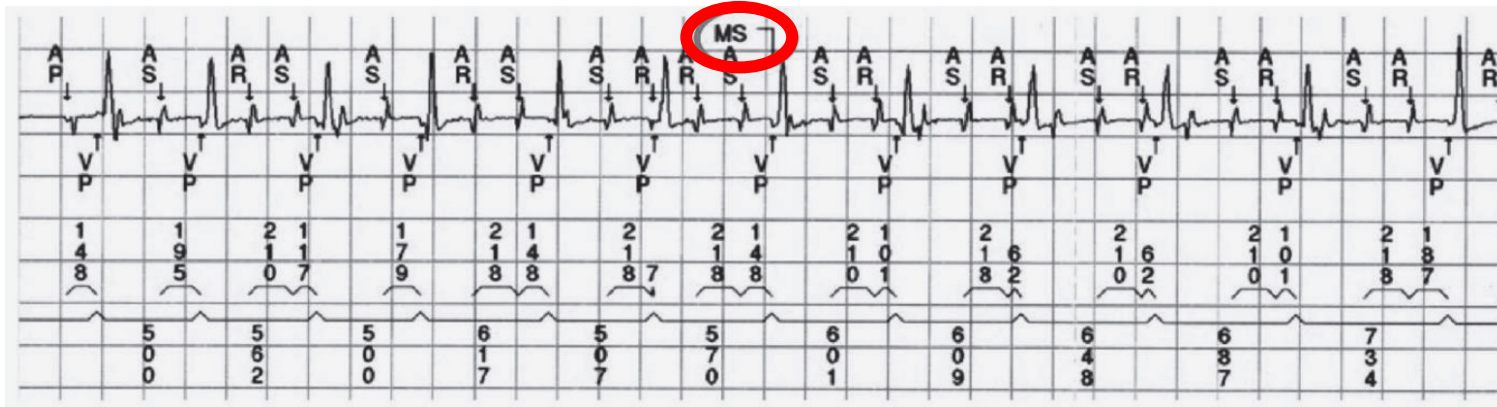
# Üst hız yanıtı -II :Upper tracking rate





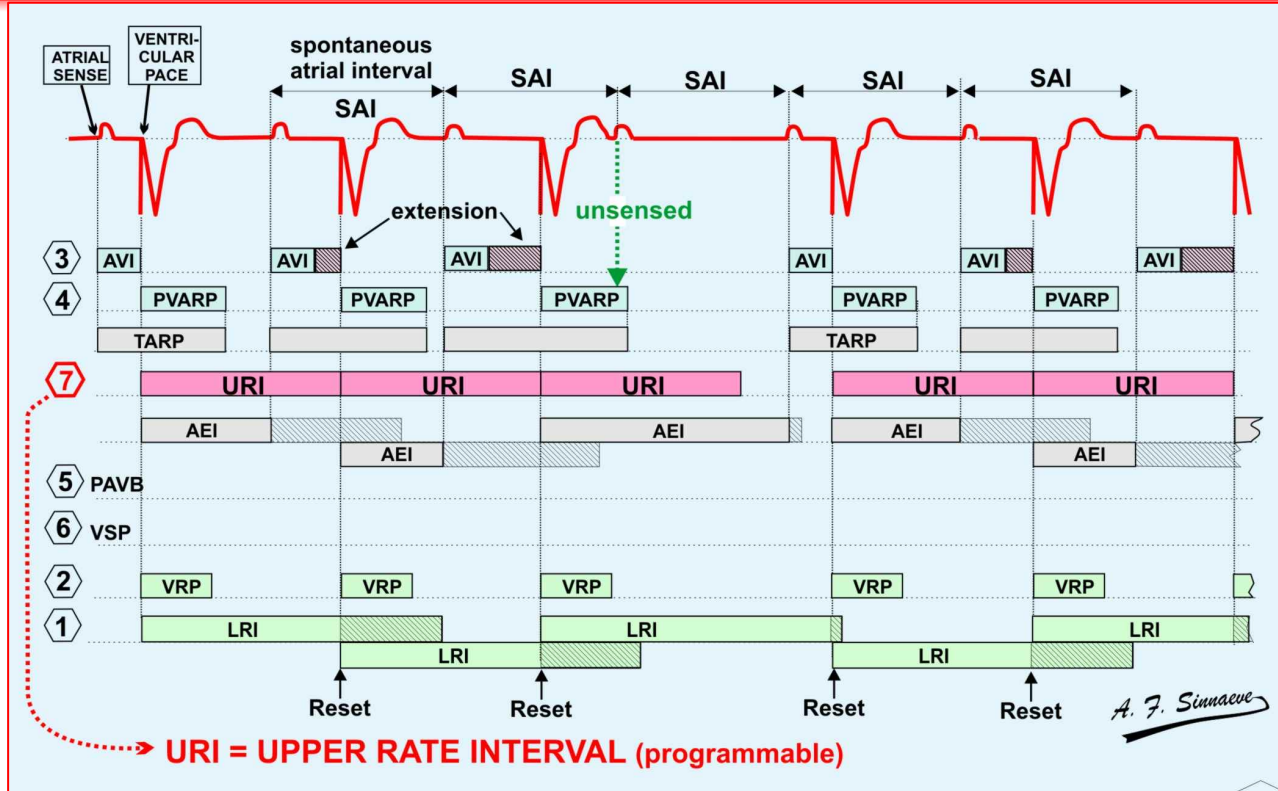


# Otomatik Mod Değişimi (AMS)



- 7 vurudan 4 tanesi AS-AR, AR-AS ya da AR-AR ise
- DDD/R → DDI/R

# DDD Pilde 7 Temel Zaman Aralığı





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Teşekkürler...