

ICD Case Study

tracing your own images

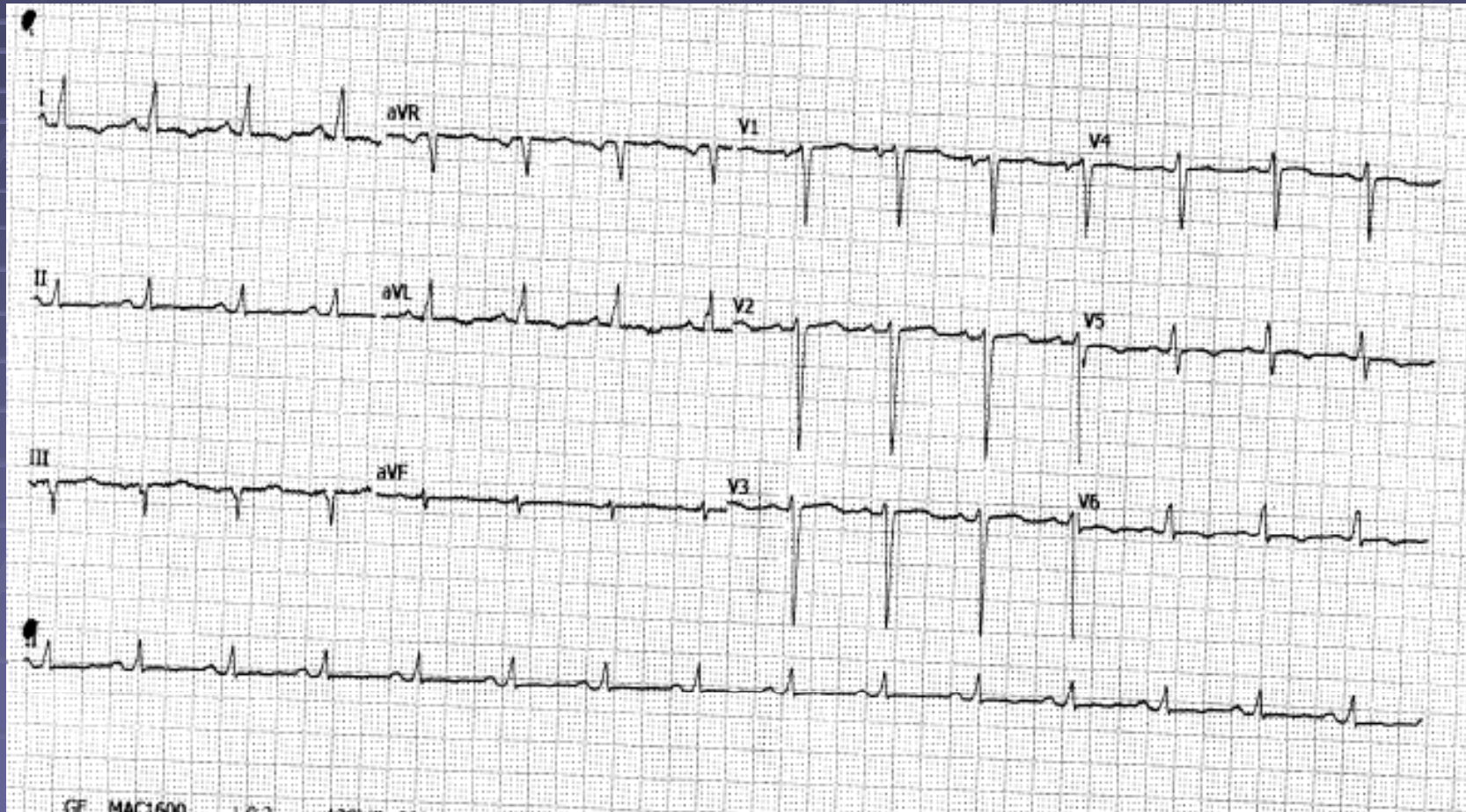


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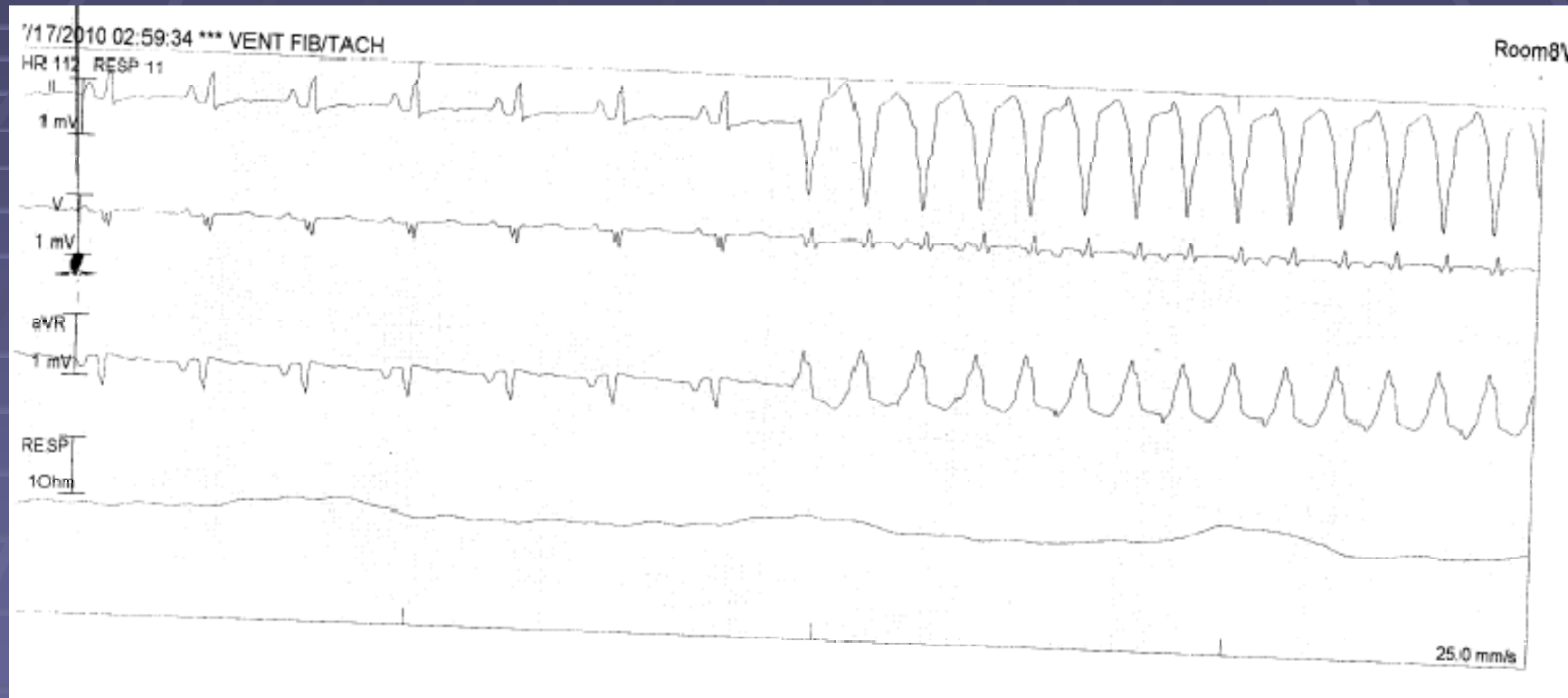
Case Description

- A 25 years old male served in a combat unit for 3 years (GOLANY)
- Implantation of Dual chamber ICD in 7/2010 due to Severe Non ischemic Dilated Cardiomyopathy.
- One month prior to implant the patient felt fatigue and shortness of breath (PND) treated with diuretics.
- NSVT in Holter without symptoms
- EF=10%
- NSR, QRS = 100ms

Baseline ECG



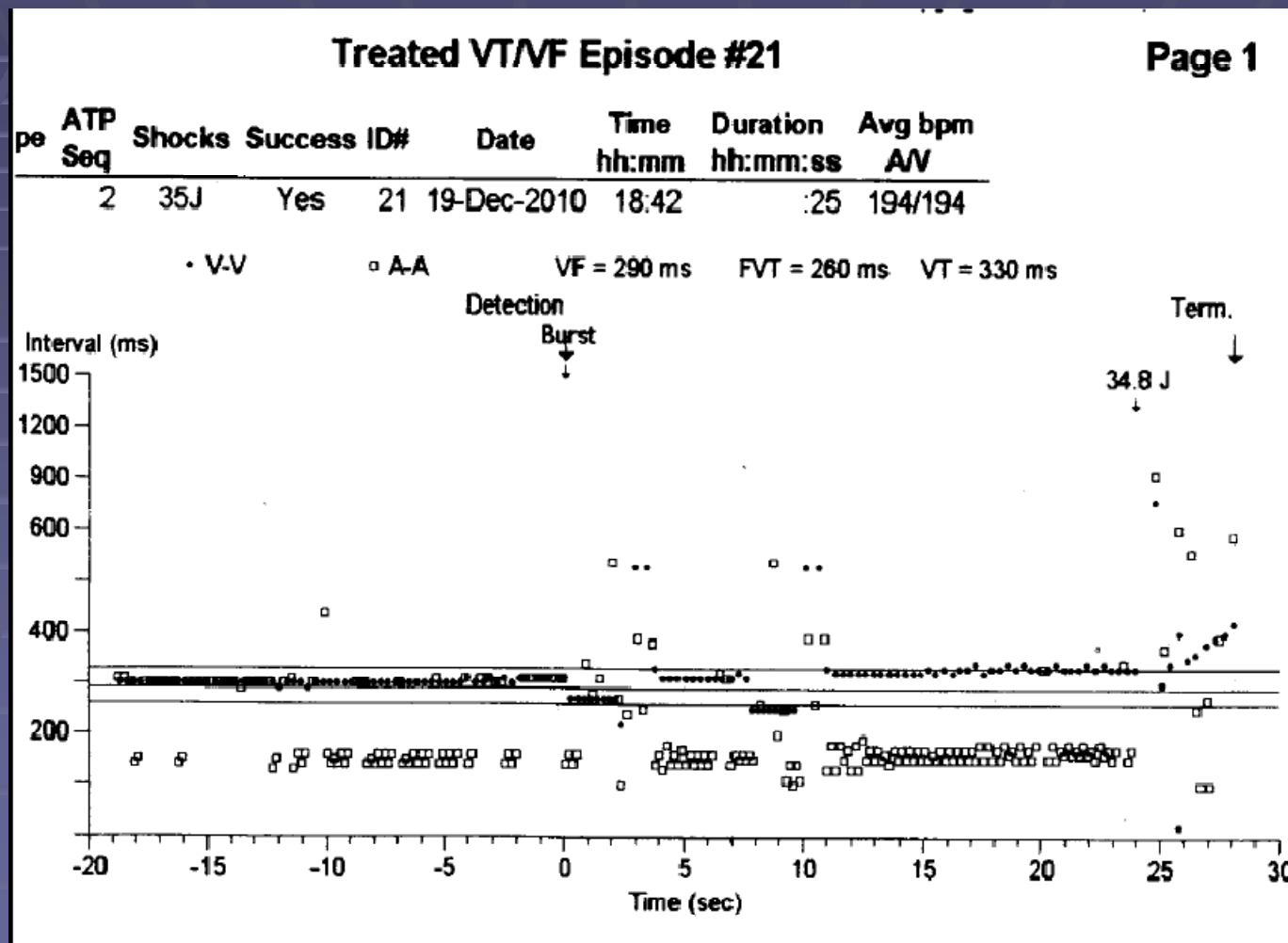
Holter findings



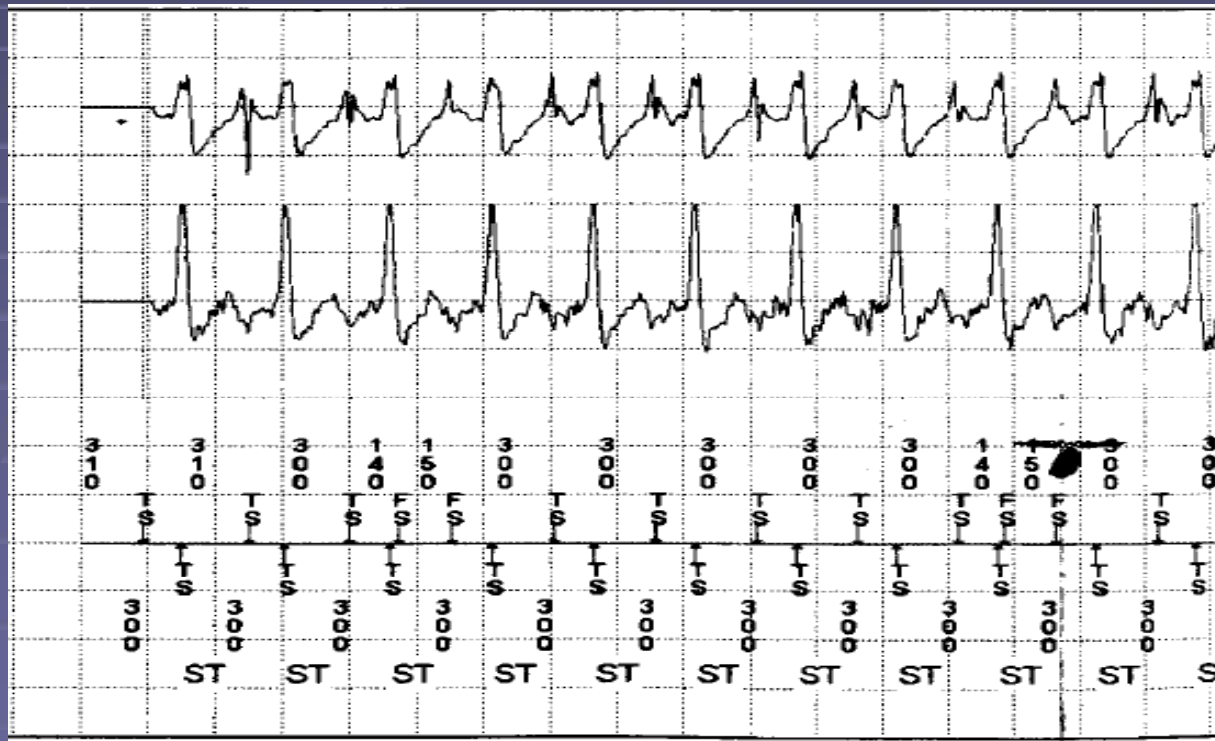
Echo Results Prior To Implant

Findings			
LV cavity size: Moderately dilated		Aortic valve structure: Thickened	
LV systolic function: Severely reduced		Mitral regurgitation: Mild-to-moderate (I-II)	
Visually-estimated LVEF: 10 %		Tricuspid regurgitation: Mild-to-moderate (I-II)	
RV systolic function: Moderately reduced		Pulmonary regurgitation: Mild (I)	
LA cavity size: Mildly dilated		Estimated systolic PA pressure: Mildly increased	
RA cavity size: Dilated			
Pericardial effusion: Small			
Cardiac Chambers			
Left ventricle			
End-diastolic diameter:	6.3 cm	End-systolic diameter:	5.7 cm
Interventricular septum thickness:	1.0 cm	Posterior wall thickness:	0.9 cm
Estimated LV mass:	251 g	Estimated LV mass index:	142 g/m ²
Right ventricle			
Diastolic dimension:	4.5 cm		
Left atrium			
A-P diameter:	5.4 cm	End-systolic area:	26.5 cm ²
Aorta			
Aortic root / sinuses:	2.4 cm		
Proximal ascending aorta:	2.3 cm		
Mid-aortic arch:	2.2 cm		
Vena cava			
IVC inspirium	1.4 cm	IVC expirium	2.5 cm
Hemodynamics			
Pulmonary artery / RA pressure			
TR sys pressure gradient:	32 mmHg	Estimated mean RA pressure:	10 mmHg
Estimated sys PA pressure:	42 mmHg		
LV filling			
Mitral inflow			
Peak E-wave:	73 cm/s	Peak A-wave:	43 cm/s
E/A ratio:	1.7	Deceleration time:	120 msec
Tissue Doppler			
S' velocity (septal):	4 cm/s	S' velocity (lateral):	4 cm/s
E' velocity (septal):	7 cm/s	E' velocity (lateral):	8 cm/s
E/e' ratio (septal):	10.43	E/e' ratio (lateral):	9.12
Summary			סיכום
חדר שמאלי מורחב בינונית, דפנותיו בעובי תקין, תפקודו הגלובלי מופחת במידה קשה מאוד. תבנית מילוי רסטורטיבית.			
חדר ימין בגבול עליון, תפקודו הגלובלי מופחת בינונית.			

19.12.11 the patient had 1 shock



The beginning of the episode



Continuation



ATP treatment



Episode Text

Treated VT/VF Episode #21

Page 1

Treated VT/VF Episode #21

Episode #21: 19-Dec-2010 18:42:39

Episode Summary

Type VT (spontaneous)
 Detect Duration 32 sec
 Duration 25 sec
 Max Rate 375 bpm/194 bpm
 Median 194 bpm (310 ms)
 Stability 0 ms - 10 ms
 Sensitivity at onset Active, Sensor = 118 bpm
 Therapy VT Rx2: CV, Successful
 Device was in Mode Switch prior to detection.

Initial VT/VF Detection

Withheld By
 Sinus Tach
 AFib/AFlutter

Therapies	Delivered	Charge	Ohms	Energy
x 1 Burst	Seq 1 to Seq 2			
x 2 CV	34.8 J	8.49 sec	47 ohms	0.0 - 35 J
Termination				

Parameter Settings	Initial	Redetect	V. Interval (Rate)
VF On	24/32	12/16	290 ms (207 bpm)
FVT via VF			260 ms (231 bpm)
VT On	20	12	330 ms (182 bpm)
Monitor Monitor	28		400 ms (150 bpm)

PR Logic

AF/AFI On
 Sinus Tach On
 Other 1:1 SVTs Off
 SVT V. Limit 290 ms

Other Enhancements

Stability Off
 Onset Off
 High Rate Timeout Off

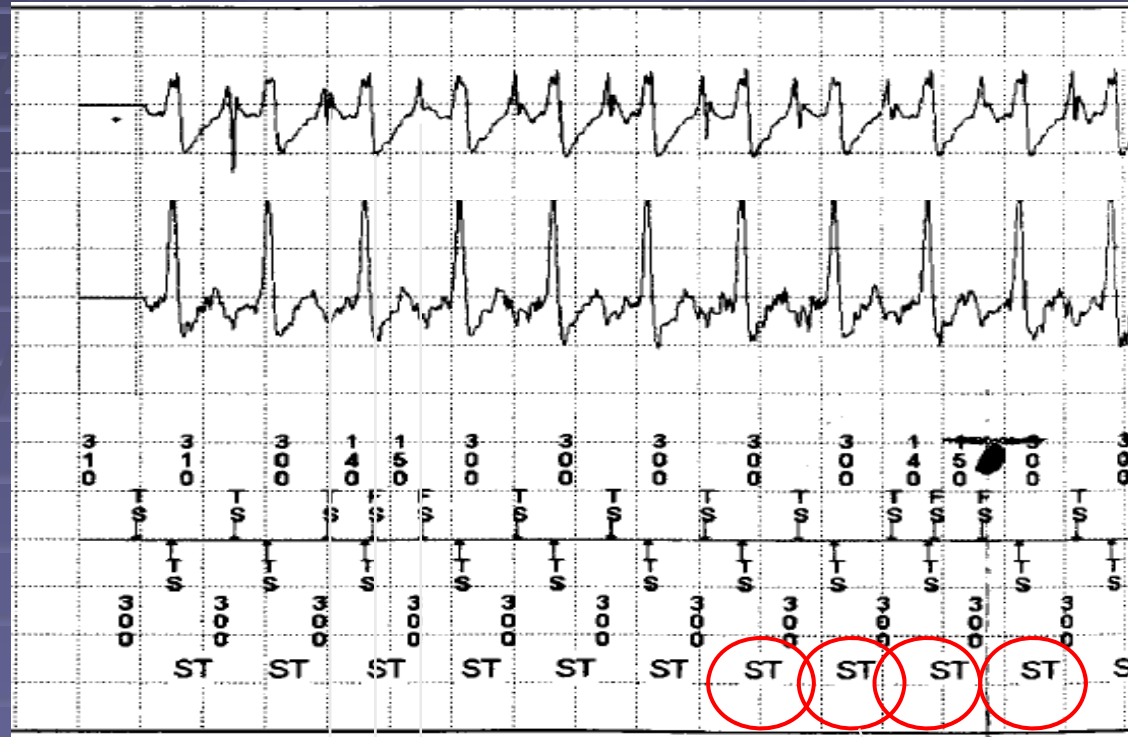
EGM	Source	Range	Sensitivity
EGM1	Atip to Aring	+/- 4 mV	Atrial 0.3 mV
EGM2	Can to RVcoil	+/- 8 mV	RV 0.3 mV

Take a look and ask yourself:

- Was the shock appropriate?
- What was the rhythm?
- Any recommendations regarding programming?



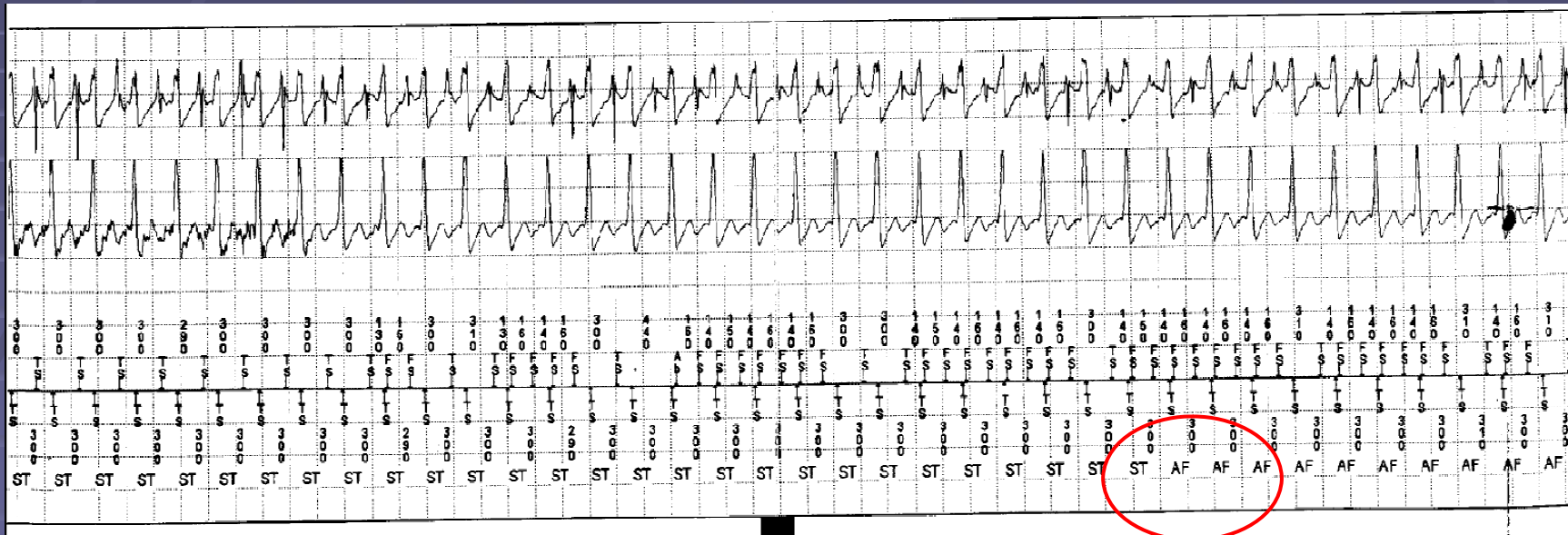
So...What was the rhythm?



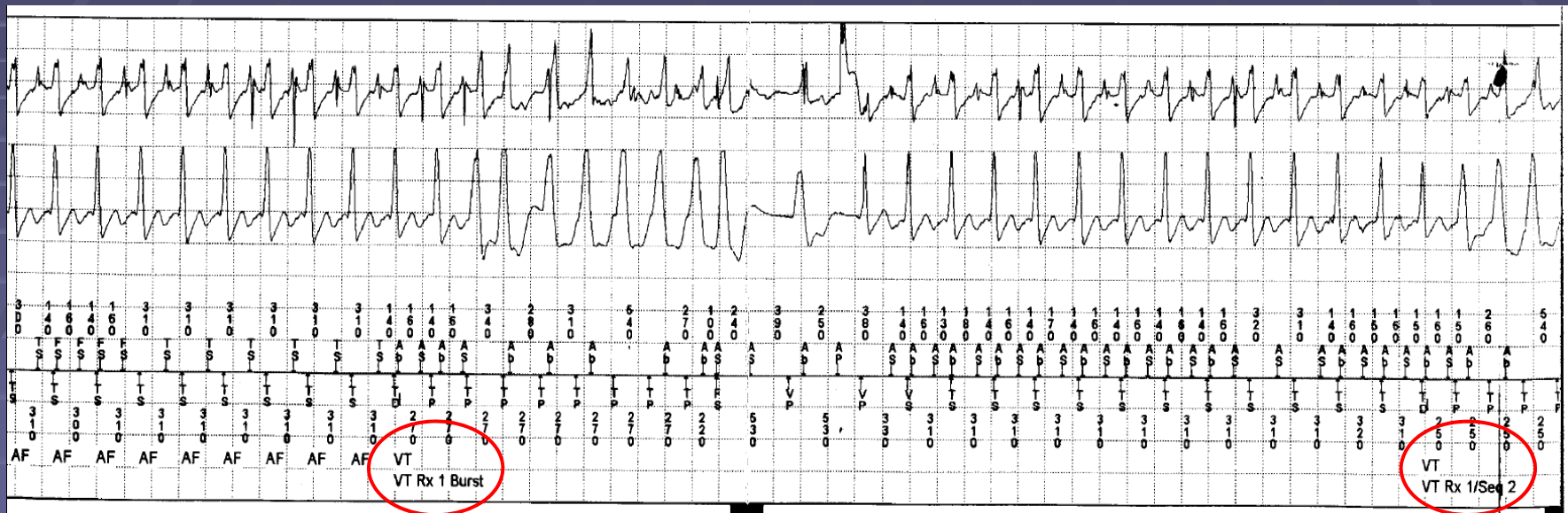
Atirum
FFRW
Vent

The device
Classified as Sinus Tach

Sinus Tach continues, but due to atrial oversensing, the device
classifies as AF
A>V and the rate is in the SVT limit



If it's Sinus Tach, why treat?



Dual Tachycardia Detection Rule

6.14 Detecting double tachycardias

To ensure proper detection and therapy during double tachycardia episodes (VT, FVT, or VF in the presence of SVT), the device provides double tachycardia detection whenever PR Logic criteria are enabled. The device detects double tachycardia episodes using both rate and PR Logic pattern and rate analysis information.

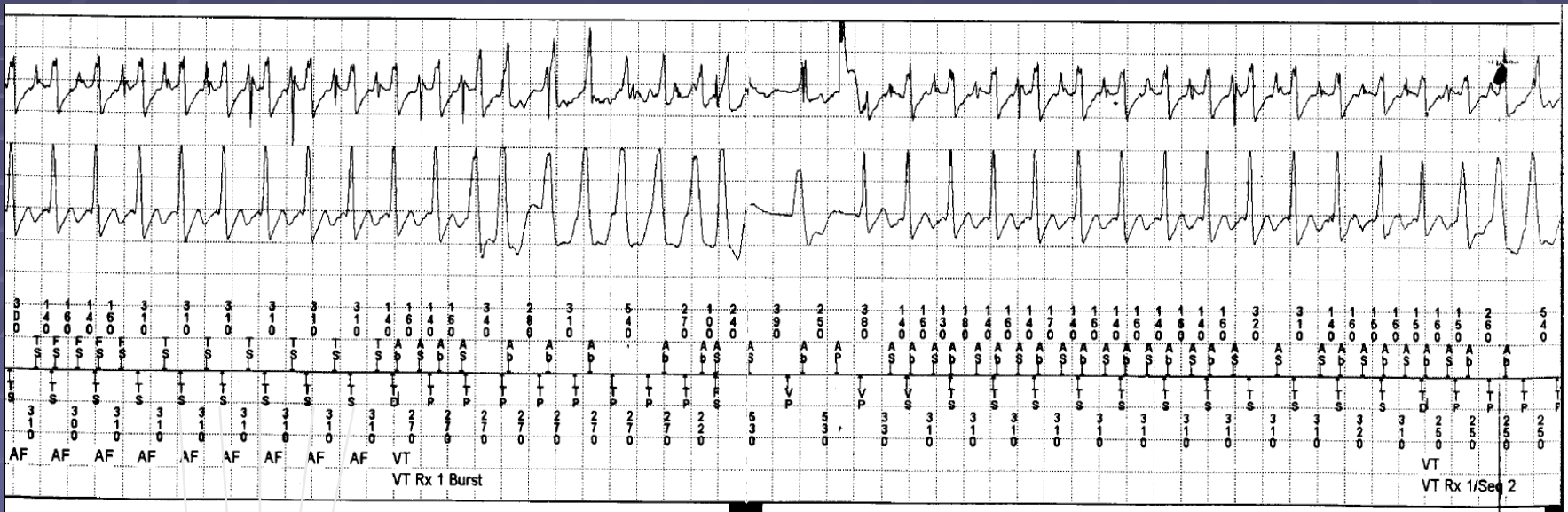
6.14.1 Details about double tachycardia detection

The device detects VF or FVT via VF in the presence of SVT if all of the following conditions occur (Figure 6-1, page 86):

- The AF evidence counter indicates atrial fibrillation.
- Fewer than 10 of the most recent 12 ventricular intervals include a far-field R-wave.
- Ventricular detection occurs using the interval or combined count criterion.
- The V-V median interval is greater than or equal to the SVT V. Limit.
- The rhythm is A:V dissociated.

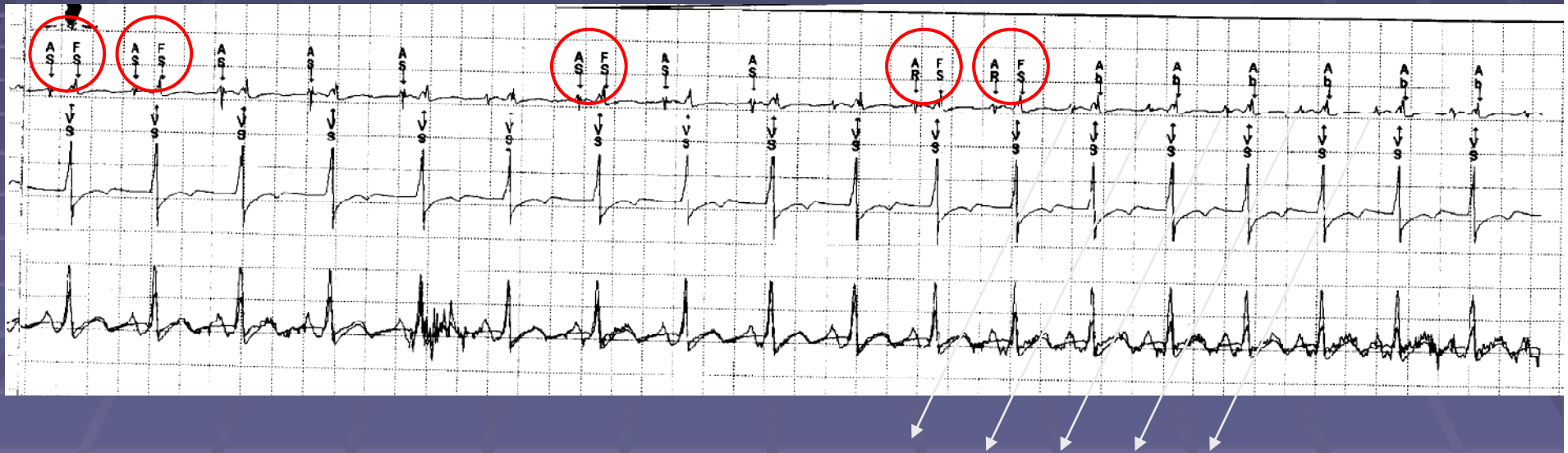
The device detects VT, VT Monitor, or FVT via VT in the presence of SVT if the ventricular cycle length is very regular (regularity of at least 75%).

Dual Tach Detected due to Regularity of the Vent



Vent is very regular

Interrogation of the device reveals Far Field R Wave



AndAtrial Undersensing

Sensing test reveals paroxysmal low Atrial Amplitude

002-031 30061947-5
Device: Virtuoso II DR D294DRG
Serial Number: PZS601086S

Sensing Test Report

Sensing Test

	Test Value	Permanent
Mode	VVI	AAI<=>DDD
AV Delay		180 ms
Lower Rate	30 bpm	50 bpm

Last Sensing Measurement

10-Feb-2011
P-Wave Amplitude 0.5 mV
R-Wave Amplitude 11.0 mV

Sense Polarity

P-wave Bipolar
R-wave Bipolar

Hence the following Programming Changes:

- Changed the PVAB to 150 ms and the blanking – Oversensing solution
- Changed the PVAB from partial to Absolute - Oversensing solution
- Changed Atrial Sensitivity from 0.45 to 0.3 – Undersensing Solution
- Changed the cutoff of VF zone to 200bpm

Reminder of PVAB options

5.2.5.4 Post-ventricular atrial blanking methods

The auto-adjusting sensitivity threshold operates in the same way if either the Partial method (the nominal method) or the Absolute method is programmed (see Figure 5-1). However, the auto-adjusting sensitivity threshold operates in a different way if the Partial+ method is programmed (see Figure 5-2). When the Partial+ method is programmed, the atrial sensitivity threshold is increased (less sensitive) following ventricular events to provide amplitude-based discrimination between far-field R-waves and intrinsic atrial events.

The following are details about the three PVAB methods:

Partial PVAB (nominal) – When the Partial PVAB method is programmed, atrial sensed events in the PVAB interval are ignored by bradycardia pacing features but are used by arrhythmia detection features.

See Section 7.2.6.4, page 109 for details about the Partial PVAB method.

Absolute PVAB – When the Absolute PVAB method is programmed, atrial sensed events in the PVAB interval are not used by either arrhythmia detection features or bradycardia pacing features. This method is recommended only for addressing complications not addressed by the other PVAB methods.

See Section 7.2.6.4, page 109 for details about programming the Absolute PVAB method.

Continue

Partial+ PVAB – When the Partial+ PVAB method is programmed, atrial sensed events in the PVAB interval are ignored by bradycardia pacing features but are used by arrhythmia detection features. The atrial sensitivity threshold is increased during the PVAB interval following a ventricular paced or sensed event for a period of time. This period of time, called the desensitization period, reduces the chances of sensing far-field R-waves. Extending the PVAB interval may affect intrinsic and far-field R-wave sensing.

Following a ventricular sensed or paced event, the length of the desensitization period is similar to the length of the programmed PVAB interval. The length of the desensitization period is 40, 60, 80, or 100 ms. The length of the desensitization period is determined by the longest of these four lengths that does not exceed the length of the PVAB interval. The desensitization period following a ventricular paced or sensed event decays back to the atrial sensing threshold.

Print out of changes

Final: Session Summary

Parameter Summary

Mode	AAI<=>DDD	Lower Rate	50 bpm	Paced AV	180 ms
Mode Switch	171 bpm	Upper Track	130 bpm	Sensed AV	150 ms
		Upper Sensor	130 bpm		

Detection	Rates	Therapies
AT/AF	On (2 zones)	>171 bpm
VF	On	>207 bpm
FVT	via VF	207-231 bpm
VT	On	200-207 bpm
Enhancements On: AF/AF, Sinus Tach, 1:1 SVT, VT Monitor		

Changes This Session	Session Start	Current Value
VT Detection Interval	330 ms (182 bpm)	300 ms (200 bpm)
Other 1:1 SVT	Off	On
PVAB	150 ms	80 ms
PVAB Method	Partial+	Absolute
A. Blank Post AS	100 ms	150 ms
A. Sensitivity	0.45 mV	0.30 mV

Final recommendations

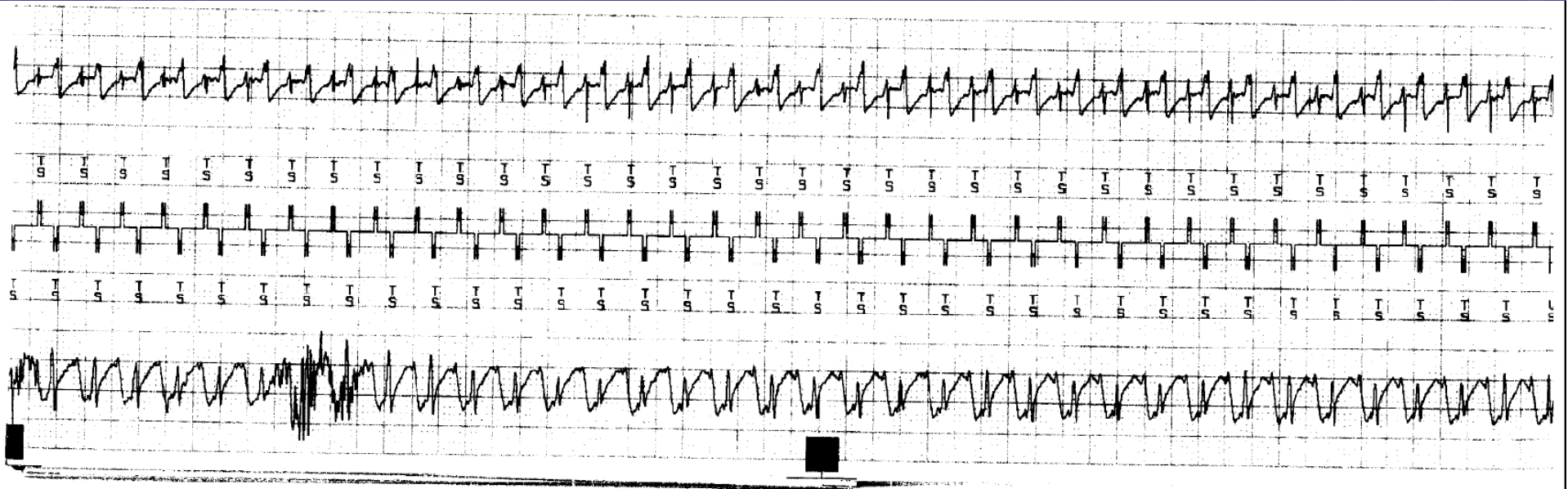
לסיכום:

סינוס טכיקרדיה קיצונית תוך מאמץ גופני שהביאה לשתי מכות לא מוצדקות מהמכשיר. זאת על טיפול בדימיטון, אך לא ברור האם אכן מקפיד על נטילת התרופות כסדרן. מאז האירוע נוטל דרלין.

להעלות מינון חוסמי בטא למקסימום שסובל מבחינת לחצי הדם.

הבקורת הבאה בעוד שנה (Carclink).

Checking the new programming- Rhythm after short fast walk



The device identifies Sinus Tach, thus no detection, no over/under sensing

Quick thought: If the device was PROTECTA family, it could operate WAVELET algorithm along with PR LOGIC

- **Wavelet** - Uses EGM morphology to improve SVT discrimination

V. Detection

		Initial	Redetect	V. Interval (Rate)
VF	<input type="checkbox"/> On	18/24	<input checked="" type="checkbox"/> 12/16	320 ms (188 bpm)
FVT	<input type="checkbox"/> OFF			240 ms (250 bpm)
VT	<input type="checkbox"/> On	16	12	360 ms (167 bpm)
Monitor	<input type="checkbox"/> Monitor	20		450 ms (133 bpm)

PR Logic/Wavelet **Other Enhancements** **Sensitivity**

AF/Afl	<input type="checkbox"/> On	Stability	<input type="checkbox"/> Off	Atrial	0.30 mV
Sinus Tach	<input type="checkbox"/> On	Onset...	<input type="checkbox"/> Off	RV	0.30 mV
Other 1:1 SVTs	<input type="checkbox"/> Off	High Rate Timeout...	<input type="checkbox"/> Off		
Wavelet...	<input checked="" type="checkbox"/> On	TWave	<input type="checkbox"/> On		
SVT V. Limit	260 ms	RV Lead Noise...	<input type="checkbox"/> Timeout		

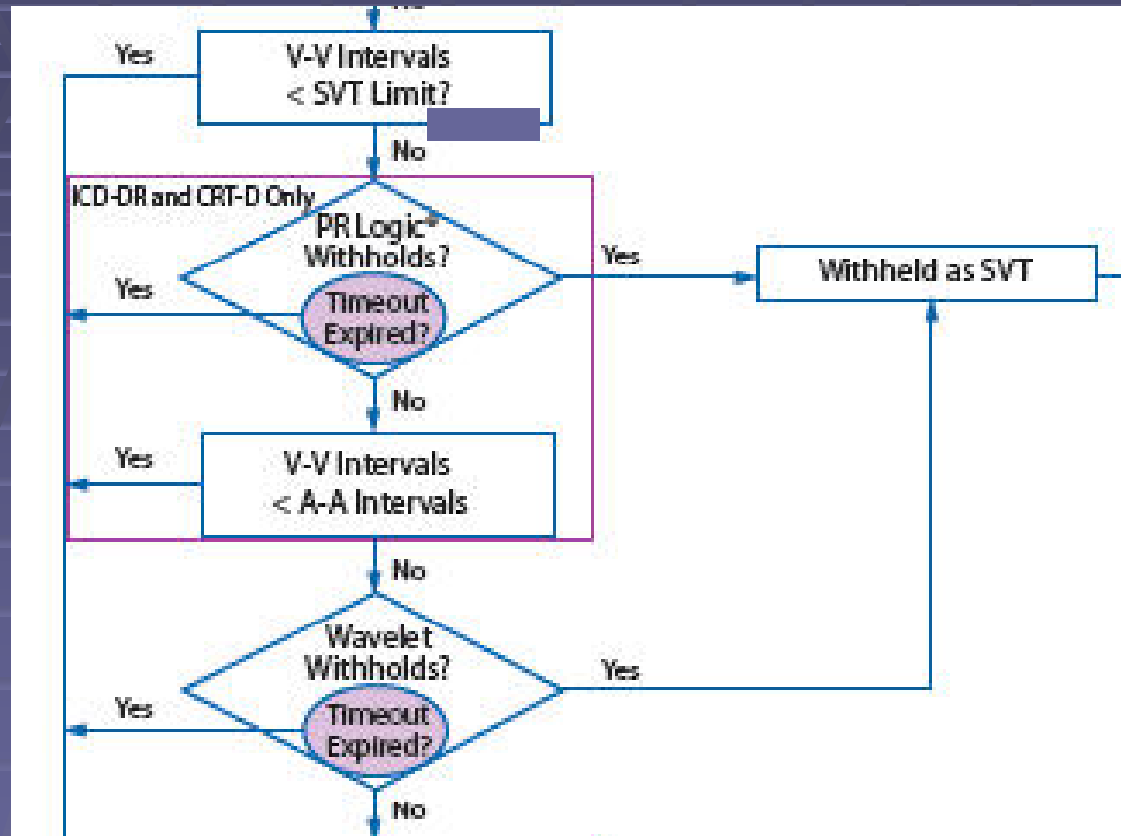
SVTV Limit = 260 ms

320 ms
360 ms
450 ms

Undo Pending OK

Improved SVT Discrimination

PR Logic[®] + Wavelet



The operation of both PR Logic and Wavelet SVT discrimination features remain unchanged if programmed on independently, however minor modifications were made if programmed on sequentially to allow for the application of Wavelet in double tachycardias, and for those rhythms with **V-V intervals are equal to or slower than A-A intervals to activate Wavelet**

Wavelet in Dual and Triple Chamber Devices

- **Wavelet Auto Template Collection:**
 - Excludes templates where atrial pacing occurs before a ventricular sense to avoid template corruption
 - Auto Template Collection shipped OFF in CRT-D
 - **Manual collection recommended**
- **Wavelet EGM:**
 - EGM 2 source shipped Can to RV-coil nominally (same far-field vector used in VR devices)
- **When PR Logic® is OFF and Wavelet is ON, Wavelet operates the same as in VR devices**

Summaries

- Looking at the EGM's reveals that the rhythm is not AF like it seems thus its Sinus Tach.
- PVAB's can be great help for dealing with oversensing
- Wavelet in dual chamber devices can be helpful if PR logic rules are not meet
- SVT limit needs to be wide for tachy patients.
- Medication's for slowing the rates are necessary.

“Tracking your images” from the original book... enjoy!

Tracking your images

"I shall have to wait until I catch up with it," said Winnie-the-Pooh. "Now, look there." He pointed to the ground in front of him. "What do you see there?"

"Tracks," said Piglet. "Paw-marks." He gave a little squeak of excitement. "Oh, Pooh! Do you think it's a--a--a Woozle?"

"It may be," said Pooh. "Sometimes it is, and sometimes it isn't. You never can tell with paw-marks."

With these few words he went on tracking, and Piglet, after watching him for a minute or two, ran after him. Winnie-the-Pooh had come to a sudden stop, and was bending over the tracks in a puzzled sort of way.

"What's the matter?" asked Piglet.

"It's a very funny thing," said Bear, "but there seem to be two animals now. This--whatever-it-was--has been joined by another--whatever-it-is--and the two of them are now proceeding in company. Would you mind coming with me, Piglet, in case they turn out to be Hostile Animals?"

Piglet scratched his ear in a nice sort of way, and said that he had nothing to do until Friday, and would be delighted to

