Pacemaker Training Program

Special Functions
Managed Ventricular Pacing Modes

Scott Streckenbach, M.D.
Director of Perioperative Electrophysiology
Cardiac Anesthesia Division
Mass General Hospital
Harvard Medical School

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Introduction

- Pacemakers are programmed to ensure an adequate atrial and ventricular rhythm
- Sometimes the pacer will pace the ventricle even when intrinsic conduction is present, just slower than the pacer's programmed AV delay
- RV pacing is good for patients needing cardiac resynchronization therapy….
- But is not good for everyone

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Why should Pacemakers try to Reduce Ventricular Pacing?

- RV apical pacing leads to essentially a LBBB and suboptimal systolic contraction
- Late-systolic contraction delays the passive ventricular filling and thereby shortens the effective duration of diastole resulting in suboptimal diastolic filling

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Why should Pacemakers try to Reduce Ventricular Pacing?

- Excessive RV pacing has several suboptimal outcomes:
  - LV dysfunction and dilation
  - Higher rate of CHF hospitalization
  - Higher rate of AFib

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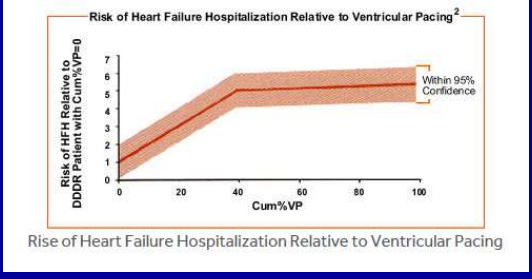
Detrimental V-Pacing



Rise of Heart Failure Hospitalization Relative to Ventricular Pacing

MOST Trial Sweeney et al; Circulation 2003; 107:2932-7

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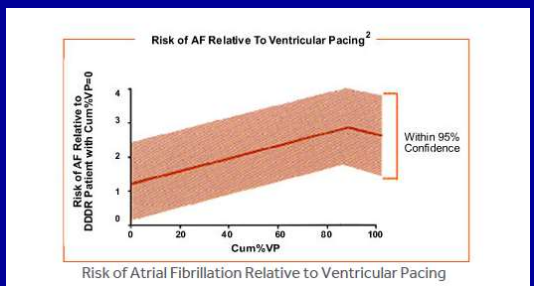
Detrimental V-Pacing



Risk of Atrial Fibrillation Relative to Ventricular Pacing

MOST Trial Sweeney et al; Circulation 2003; 107:2932-7

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Solution

- All manufacturers now have programs to minimize the amount of ventricular pacing when it is beneficial to do so

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Manufacturer Specific Programs to Minimize Ventricular Pacing

Manufacturer	Program Name
Medtronic	Managed Ventricular Pacing (MVP)
St Jude	Ventricular Intrinsic Preference (VIP)
Bost Sci	RHYTHMIQ
Biotronik	Intrinsic Rhythm Support (IRS)

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Objectives for Today

- Review how each manufacturer attempts to reduce unnecessary V-pacing
- Show how to determine if the special mode is active
- Show how to turn it off with the programmer

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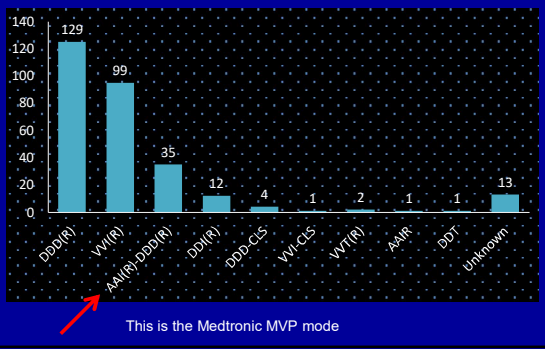
Pacing Mode Distribution

300 Cases Mar 2015-Mar 7, 2018



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Managed Ventricular Pacing Medtronic MVP

- Base mode is a hybrid of AAI(R) and DDD(R)
- If adequate AV conduction, the pacer is in AAI mode.
- If AV conduction fails for two consecutive beats, the pacer converts to DDD mode.
- When in DDD mode, the AV interval extends to up to 400 ms periodically to search for intrinsic conduction
- If intrinsic conduction is present the AAI mode resumes

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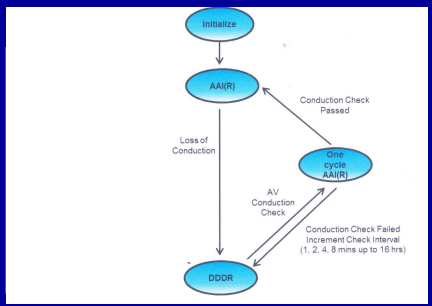
Medtronic MVP



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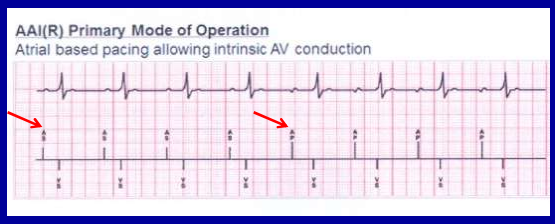
How Does MVP Work?



- AAI pacing at the LRL
- Intrinsic Ventricular rhythm consistent
- No V-pacing

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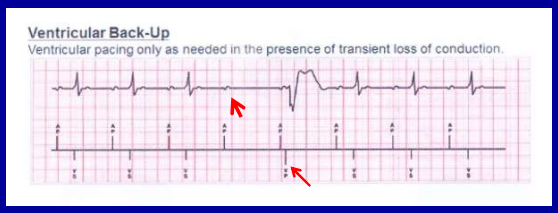
How Does MVP Work?



- One AP is not followed by an intrinsic R wave
- After the next AP, a backup VP occurs
- AAI mode remains

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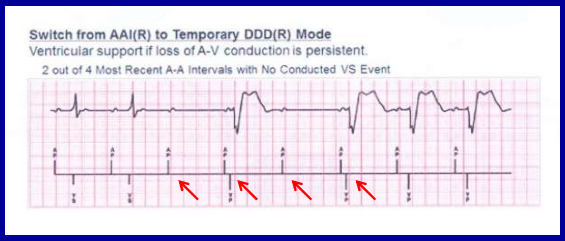
How Does MVP Work?



- Two AP events (2 out of 4) without intrinsic R-Waves
- DDDR with standard AVI (180 msec) begins

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Managed Ventricular Pacing Medtronic MVP

- When in DDD(R), the pacer drops a ventricular pacing beat periodically to determine if AV conduction is adequate again
  - 1 min, 2 min, 4 min, 8 min….16 hours
  - Every 16 hours thereafter

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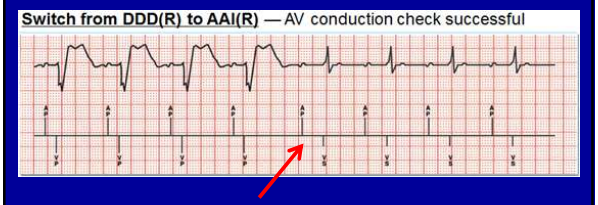
How does MVP work?



The A-V delay is prolonged at the arrow—since there is a VS event the mode converts back to AAI(R)

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Medtronic MVP

- In the OR you may see significant pauses from non-conducted atrial beats or you may see particularly long PR intervals
- This represents normal pacemaker function

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Medtronic Programmer

- You will know that MVP is on whenever your patient with a Medtronic Pacemaker is programmed into a AAI(R)-DDD(R) mode
- You can look at the programmer report or simply use the programmer itself…

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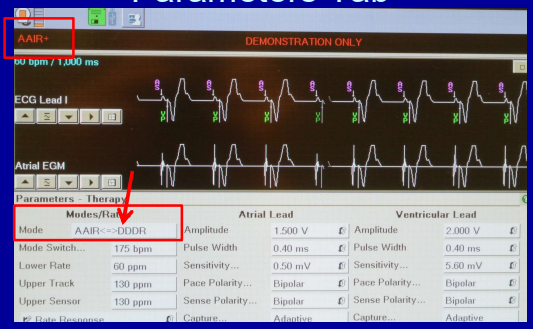
Medtronic MVP Programmer Parameters Tab



AAIR+ indicates that backup ventricular pacing is available

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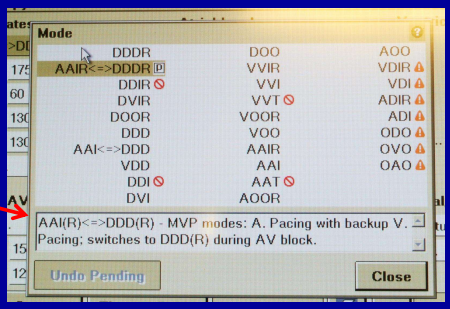
Medtronic MVP Mode Description



There is a description of the MVP right here if you forget

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When should you turn off MVP?

- When?
  - If there is persistent AV block
  - If there is persistent AF
  - If the patient is going to the OR and you do not want to be distracted by the normal function
- How?
  - In the parameters tab select the mode
  - Then choose a mode other than MVP, e.g. DDD

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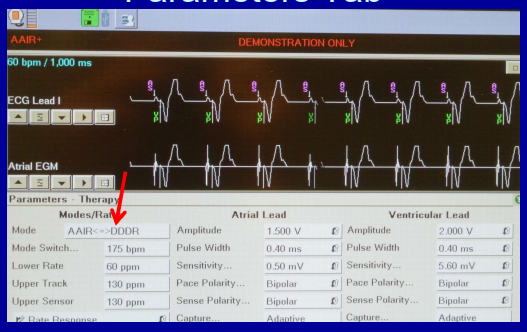
Medtronic MVP Programmer Parameters Tab



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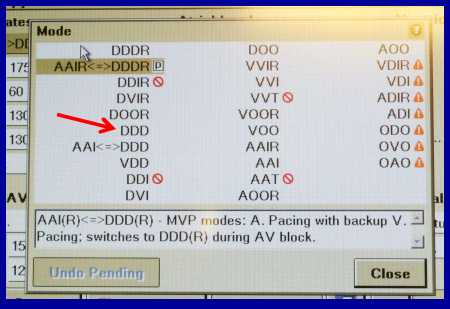
Turning off Medtronic MVP Mode



Select any mode other than the MVP modes, then press program

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St Jude Ventricular Intrinsic Preference (VIP)

- Periodic extension of the AV interval when in the DDD pacing mode by up to 450 msec to search for evidence of intrinsic conduction
- If AV conduction intact, the AV interval remains prolonged

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VIP using AV Search Hysteresis

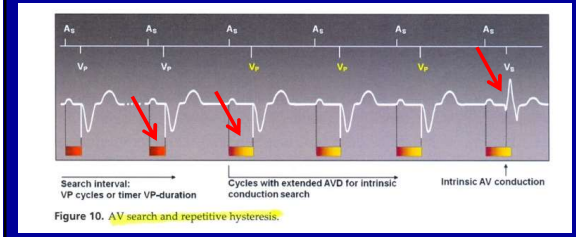

Figure 10. AV search and repetitive hysteresis.

1. The pacer is DDD with a relatively normal AV delay (AVD)
2. Periodic extension of the AVD by programmable degree to search for intrinsic cond.
3. If a VS is detected (last beat) the AVD stays prolonged to reduce V pacing

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How can one determine if VIP is Programmed ON?

- Programmer report
- Programmer interrogation

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St Jude Ventricular Intrinsic Preference (VIP) Report

Freeze Capture
Jun 13, 2012 8:06 am

Key Parameters	
Mode	DDD
Base Rate	60 bpm
Rest Rate	Off
Paced AV Delay	250 ms
Sensed AV Delay	225 ms
Max Track Rate	120 bpm
Max Sensor Rate	120 bpm
Hysteresis Rate	Off
ACap® Confirm	Monitor
V. AutoCapture	Off
AF Suppression™	Off
Ventricular Intrinsic Preference (VIP®)	On
Negative AV Hysteresis/Search	Off
Rate Responsive AV Delay	Off
Rate Responsive PVARP/V Ref	High
Ventricular Safety Standby	On

As you read the key parameters, you will see VIP is ON

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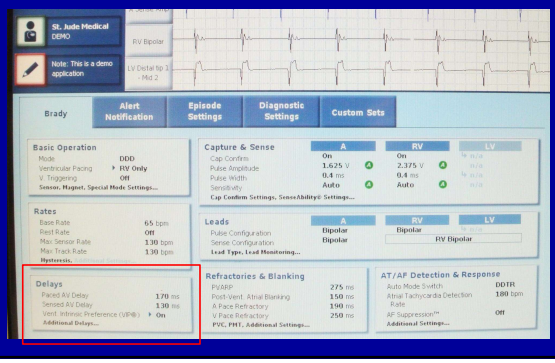
St Jude VIP Programmer: Is VIP On?



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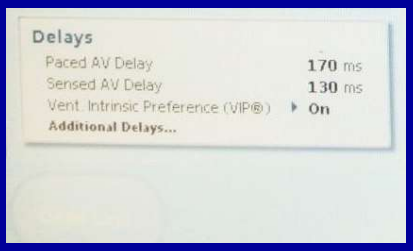
St Jude VIP



Click on the rectangular box to get more specific information

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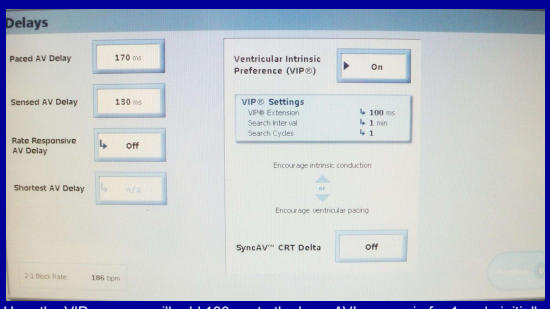
St Jude VIP Settings



Here the VIP program will add 100 ms to the base AVI every min for 1 cycle initially

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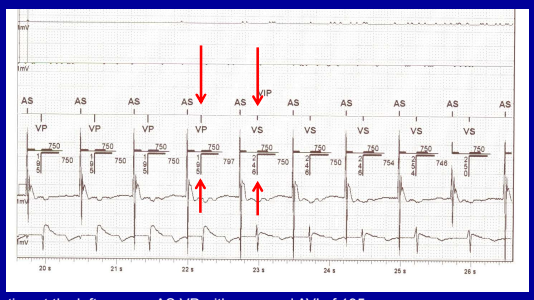
Example of VIP in Action



Starting at the left you see AS VP with a sensed AVI of 195 ms
When VIP activates, the PR interval clearly lengthens, and we see VS with PR=246 ms

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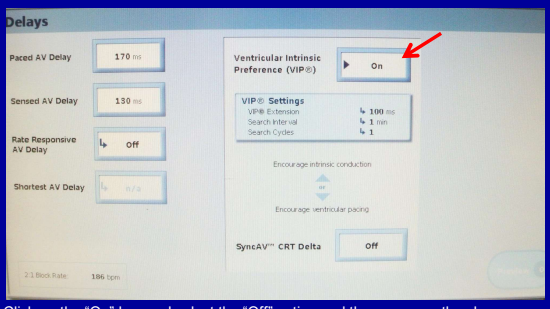
How to Turn Off the VIP



Click on the "On" box and select the "Off" option and then program the change

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Boston Scientific RHYTHMIQ

- Uses AAI(R) mode with a concurrent VVI backup pacing at a rate 15 bpm below the LRL
  - as if two separate pacers working simultaneously
- Does not allow "long" pauses due to unconducted atrial events like Medtronic's MVP
- If persistent loss of AV conduction (3 of 11 beats) the device changes to DDD(R)
- AV hysteresis is used periodically to search for the return of AV conduction

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How to determine if RHYTHMIQ is on

- Look at programmer report
- Interrogate the pacemaker

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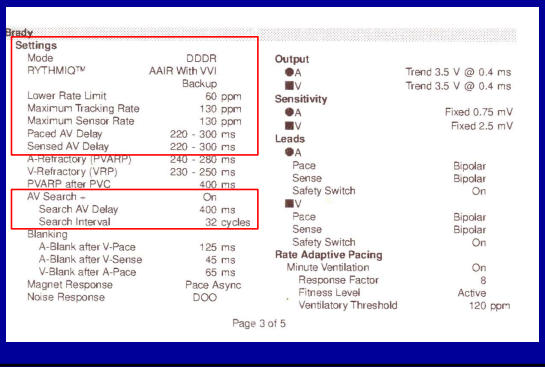
Boston Sci. Programmer Printout



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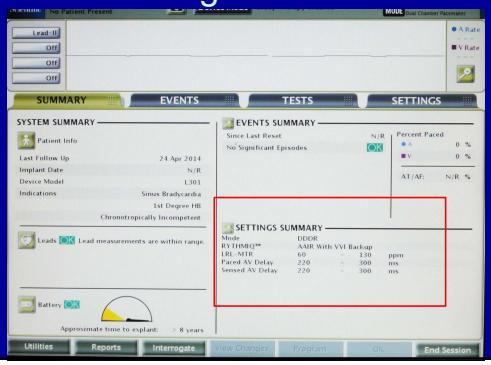
Boston Scientific RHYTHMIQ Programmer



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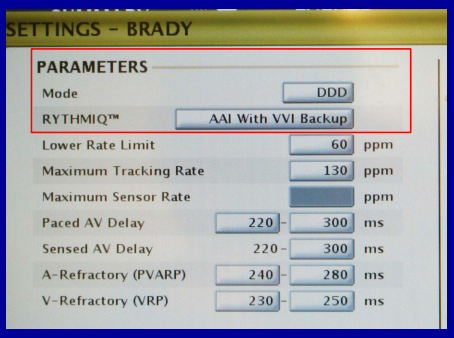
Boston Scientific RHYTHMIQ



You may click on the Box to get more information about RHYTHMIQ

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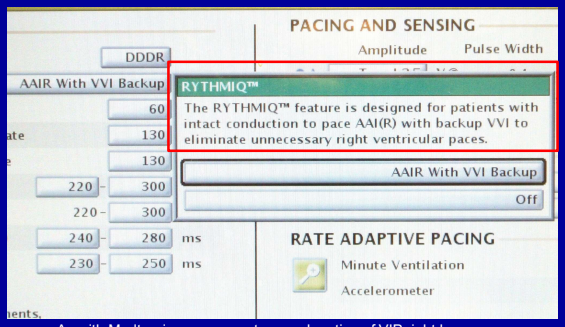
Boston Scientific RHYTHMIQ



As with Medtronic, you can get an explanation of VIP right here

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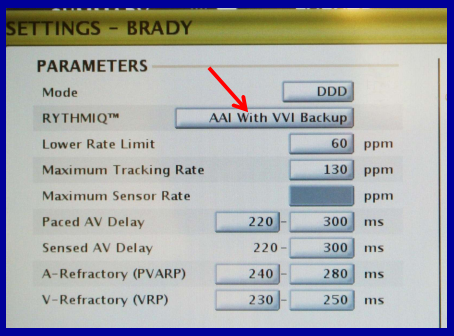
How to Turn off RHYTHMIQ



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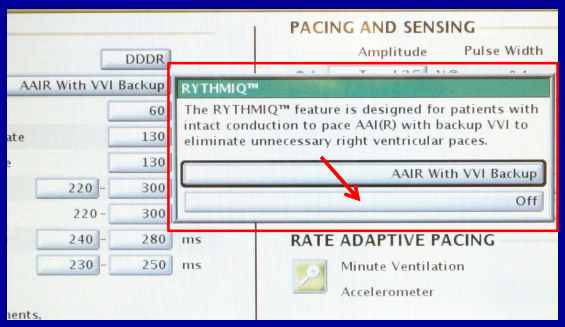
Boston Scientific RHYTHMIQ



Select the "OFF" option and program the change

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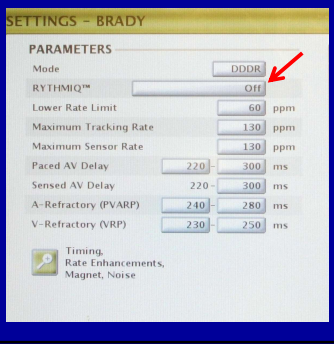
Boston Scientific RHYTHMIQ OFF



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Biotronik Intrinsic Rhythm Support (IRS)

- A.K.A. Vp Suppression
- Mode oscillates between DDD(R) and ADI(R) just like the Medtronic MVP system
  - Medtronic is really in ADI(R) mode also
- Starts in DDD(R)
- Extends the AVD to 450 ms to search over 8 cycles for intrinsic conduction
  - If present, pacer converts to ADI(R)
  - If not present DDD(R) is maintained, and the periodic search interval lengthens until 128 min and then to q 20 hrs

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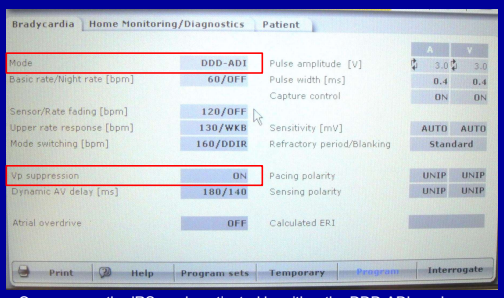
Biotronik Intrinsic Rhythm Support Programmer



One can see the IRS mode activated by either the DDD-ADI mode or by noticing the Vp Suppression is ON

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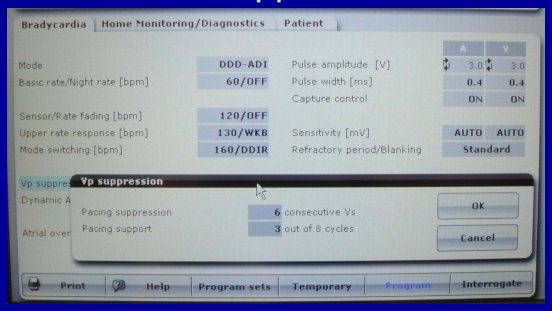
Biotronik Intrinsic Rhythm Support



To get more information about the Vp Suppression click on the box

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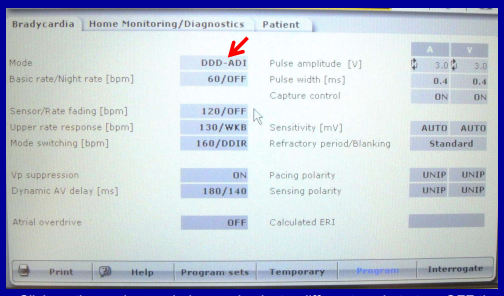
Biotronik Intrinsic Rhythm Support Programmer



Click on the pacing mode box and select a different mode to turn OFF the Vp Suppression (IRS) mode

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Minimize Ventricular Pacing Programs Summary

- Reducing ventricular pacing is a good thing for many patients with pacemakers or ICDs
- Each manufacturer has a method of trying to minimize ventricular pacing in patients who potentially have adequate intrinsic AV conduction

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Minimize Ventricular Pacing Programs Summary

- In the OR you may see periodic long AV intervals or even some non-conducted P-waves
- This does not indicate pacer malfunction (assuming one of the aforementioned programs are active), but rather normal function
- As long as you do not let it distract you, it should *usually* be well tolerated
- If you prefer to turn off these modes, you now know how to do so with the programmers

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The End

- Please contact me with any questions or concerns that have arisen during this lecture
  - Text 617 233 7564
  - Email sstreckenbach@mgh.harvard.edu

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