

Pacemaker Training Program

Rate Drop Response and Noise Reversion Modes

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Special Programming that impacts the Anesthesiologist

- Rate drop response
- Noise reversion mode
- Pacer reset

Rate Drop Response/Auto Drop Rate

- Designed for patients who develop syncope from abrupt decrease in HR
 - Sick sinus syndrome
 - Vasovagal syncope
 - Carotid sinus hypersensitivity

Manufacturer Programs

Manufacturer	Name
Medtronic	Rate Drop Response
Boston Sci	Sudden Brady Response
St Jude	Hysteresis variation
Biotronik	None

Medtronic Rate Drop Response

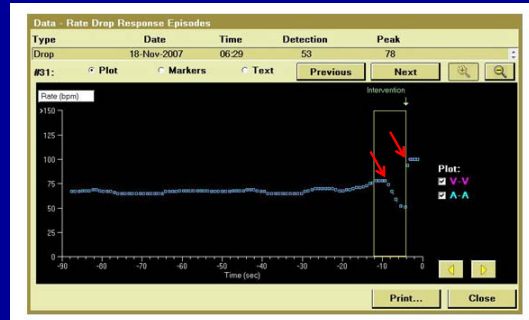
The screenshot shows a configuration window for the Rate Drop Response mode. The settings are as follows:

- Detection Type: Drop
- Intervention Rate: 100 ppm
- Intervention Duration: 2 min
- Detection Beats: 50 ppm
- Drop Rate: 25 bpm
- Drop Size: 25 sec
- Detection Window: 25 sec

Buttons at the bottom include "Undo Pending" and "OK".

If the intrinsic atrial rate drops rapidly after a 25 sec period of intrinsic atrial beats, the pacer will DDD pace at 100 ppm for 2 min then gradually decrease.

Example of RDR Intervention



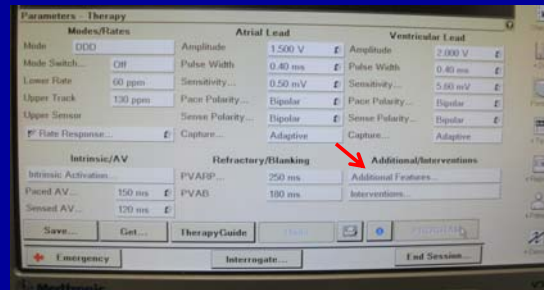
The HR speeds up slightly then descends—intervention occurs by DDD pacing at 100

Rate Drop Response Case

- A pt having knee surgery with a DDD pacemaker
- Kept pacemaker in DDD mode
- Anesthesiologist called me to report unexplained intermittent pacing

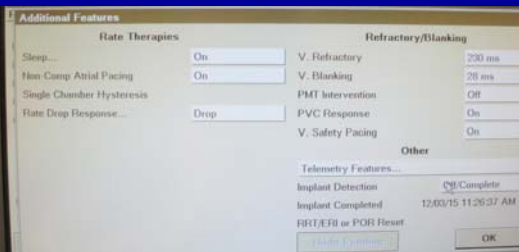


Medtronic Programmer: Rate Drop Response



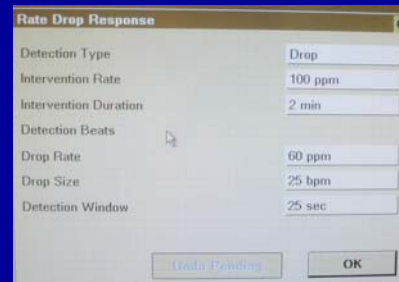
To access the Rate Drop Response Settings, click on Additional Features

Medtronic Rate Drop Response



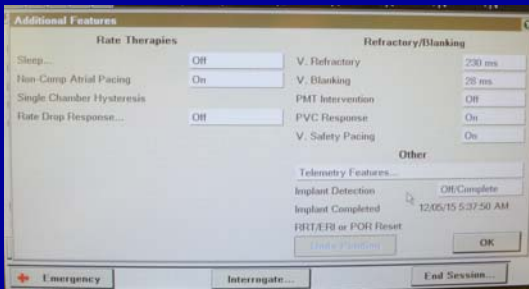
RDR is typically not on but when it is, you will find the settings here—either OFF, Low Rate, Drop, or Both. Here we see it set for Drop.

Medtronic Rate Drop Response



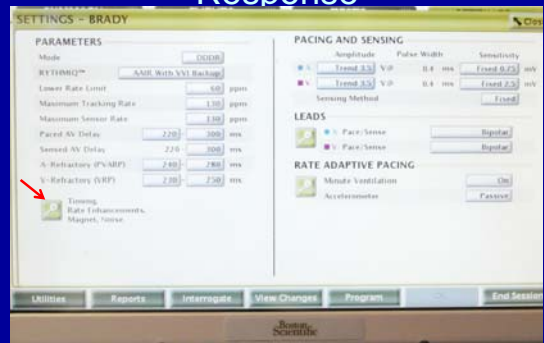
If the heart rate abruptly drops by 25 bpm, the device will pace at 100 for 2 min

Medtronic Rate Drop Response OFF

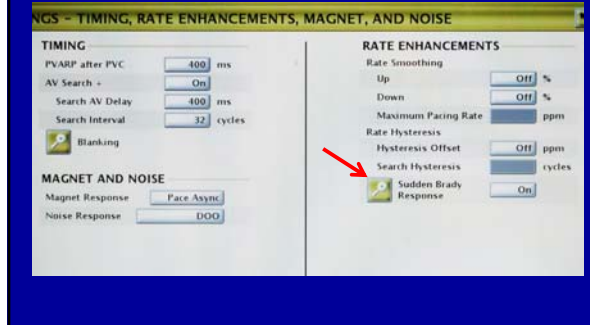


Most often, RDR is programmed OFF

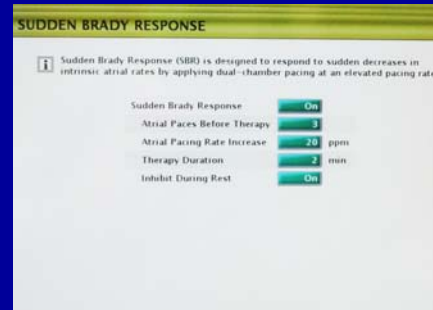
Boston Scientific Sudden Brady Response



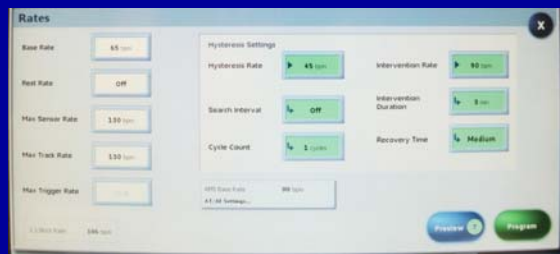
Boston Scientific Sudden Brady Response



Boston Scientific Sudden Brady Response



St Jude Rate Drop Response Equivalent



Here a St Jude device is programmed to pace at 90 for 3 minutes if the HR abruptly falls below 45

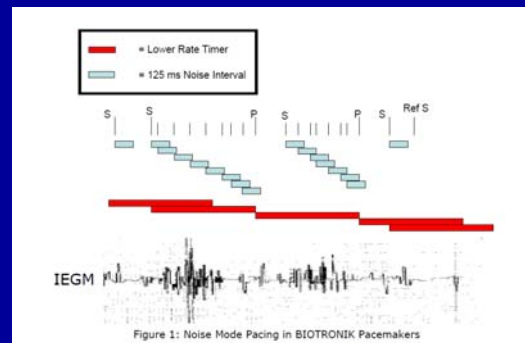
Rate Drop Response

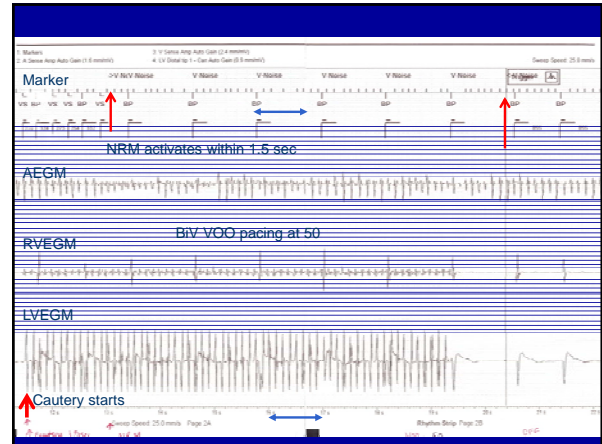
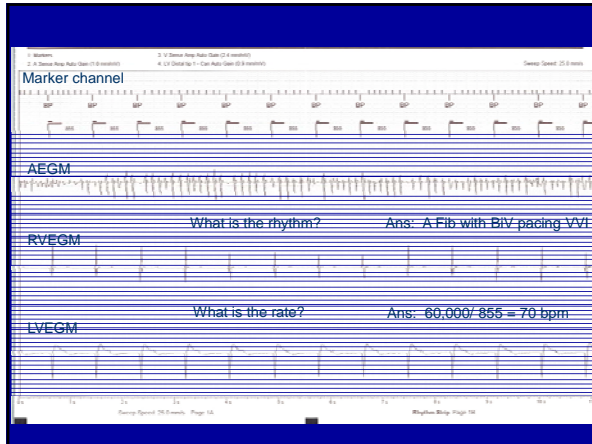
- Special program for patients with Vasovagal syncope and carotid hypersensitivity
- If you see unexpected high-rate, temporary pacing after the intrinsic heart rate slows abruptly, the likely etiology is a rate drop response
- If it is causing a problem, you now know how to turn it off

Noise Reversion Mode

- Excessive EMI will convert many pacemakers to an asynchronous mode to prevent asystole in pacemaker dependent patients:
 - Temporary
 - Short term EMI
 - Noise Reversion mode
 - Permanent until reprogrammed
 - Prolonged EMI of high intensity
 - Pacemaker Reset

A Close Look at Biotronik Noise Reversion Mode





Noise Reversion Mode: Another Example

VS VS VS VS VS VP

V-V-Noise

VP

This patient was not pacing at all—then all of sudden he started to pace after a short burst of cautery—Is it a malfunction?

Do a full analysis of the electrogram

1. What do we see on the strip?
2. What is the likely pacing mode?
3. Notice how the V-Noise activates and VP ensues

What would the Anesthesiologist see?

VS VS VS VS VS VP

V-V-Noise

VP

He or she will see ventricular pacing that may seem inappropriate (could be immediately after an intrinsic R-wave). This may seem like a malfunction, but it is actually what is called a PSEUDOMALFUNCTION

Noise Reversion Mode can be Helpful

- If a pacer dependent patient is exposed to prolonged EMI, the NRM can prevent asystole

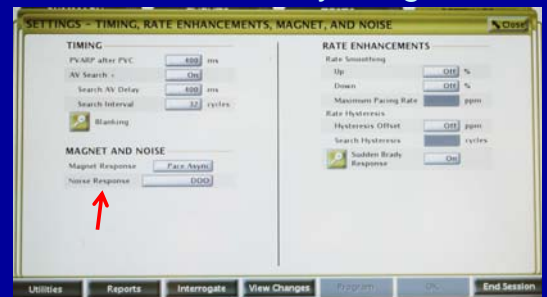
Noise Reversion Mode can be harmful

- If the patient is not pacer dependent, and in a NSR, cautery can lead to DOO or even worse, VOO pacing.
 - Lose the intrinsic AV synchrony
 - Theoretical R on T

Boston Scientific Noise Response on the Programmer Printout

Brady Settings			
Mode	DDDR	Output	2.0 V @ 0.4 ms
Lower Rate Limit	60 ppm	Output	2.0 V @ 0.4 ms
Maximum Tracking Rate	130 ppm	Sensitivity	AGC 0.25 mV
Maximum Sensor Rate	130 ppm	Sensitivity	AGC 0.6 mV
Paced AV Delay	150 - 200 ms	Leads	
Sensed AV Delay	135 - 160 ms		
A-Retractory (PVARPI)	240 - 400 ms		
V-Retractory (VVRPI)	240 - 250 ms		
V-Retractory (VVRPI)	400 ms	Pace	On/Off
AV-Sensor	On	Search	On/Off
Search AV Delay	400 ms	Search Interval	File
Search Interval	22 cycles	Search Interval	File
Blanking	On	Search Interval	File
A-Blank after V-Sense	Smart ms	Search Interval	File
A-Blank after V-Sense	Smart ms	Search Interval	File
V-Blank after A-Pace	65 ms	Search Interval	File
Magnet Response	Pace Async	Search Interval	File
Noise Response	DOO	Search Interval	File
Rate Enhancements		Search Interval	File
Rate Smoothing	Off %	Search Interval	File
Up		Search Interval	File

Boston Scientific Noise Reversion Mode by Programmer



St Jude Noise Reversion Mode

Basic Operation	
Mode	DDIR
V. Triggering	Off
Magnet Response	Battery Test
V. Noise Reversion Mode	DOO
Sensor	On
Threshold (Measured Avg.)	Auto (+0.0) (2.0)
Slope (Measured Auto)	Auto (+2) (7)
Max Sensor Rate	130 bpm
Reaction Time	Fast
Recovery Time	Medium
Rates	
Base Rate	60 bpm
Rest Rate	Off
Max Sensor Rate	130 bpm
Hysteresis Rate	50 bpm
Search Interval	Off
Cycle Count	1 cycles
Intervention Rate	Off

Noise Reversion Mode Summary

- Noise Reversion mode provides protective asynchronous pacing when the pacemaker is exposed to prolonged EMI.
- It can be helpful
- It can be harmful
- It is usually only associated with pacemakers—not ICDs

Pacer Reset/Back-Up Mode

- Caused by a surge of energy coursing through the pulse generator
- Converts pacemaker to a fixed VVI mode
 - Medtronic 65
 - Boston Sci 65
 - St Jude 67.5
 - Biotronik 70
- Must reprogram

MRI converts Pacemaker to VVI

- 83 yo Cantonese speaking patient to OSH
- Had acute pancreatitis
- An MRI was performed
- When patient transferred to the MGH, the patient was hypotensive and the pacemaker was “malfunctioning”

MRI converts Pacer to VVI

- Dec 2012 interrogation (1 year earlier):
 - DDD mode
 - 97% atrial pacing with intact ventricular conduction
- At MGH, she was in VVI mode due to pacer reset
 - Lost the effective atrial kick

Pacer Reset Summary

- If the patient's pacemaker is pacing at a slower than expected rate and the pacer does not respond to a magnet, that pacemaker is either in the PACER RESET Mode or the pacer's battery is at end of life.
- The only solution is to interrogate the pacemaker

Summary for Special Functions

- Special Functions improve patient function
- They frequently cause "Pseudomalfuctions" that may confuse the Anesthesiologist who is not familiar with these special functions
- Usually the functions do not need to be programmed OFF as long as you understand what the functions are doing

Summary for Special Functions

- But if you need to disable these functions, now you know how to do so safely
- You just have to make sure that you have a baseline printout of the settings and make sure you reprogram the device post op.

The End

- Please contact me with any questions or concerns that have arisen during this lecture
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