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

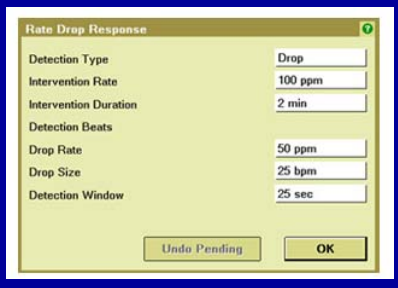
Rate Drop Response/Auto Drop Rate

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

Manufacturer Programs

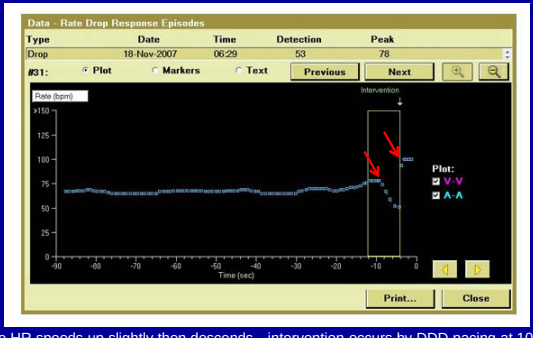
Manufacturer	Name
Medtronic	Rate Drop Response
Boston Sci	Sudden Brady Response
St Jude	Hysteresis variation
Biotronik	None

Medtronic Rate Drop Response



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.

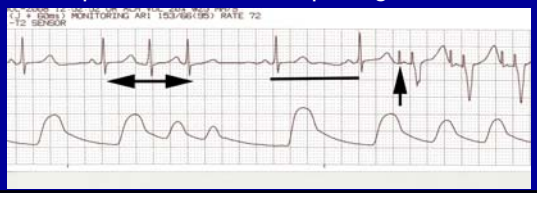
Example of RDR Intervention



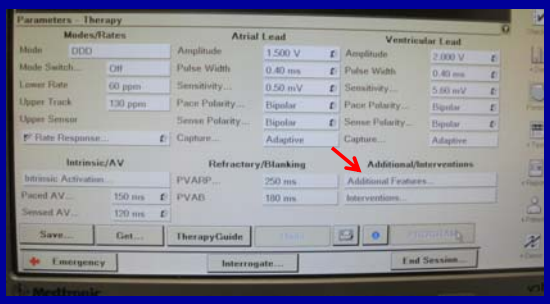
The HR speeds up slightly then descends—intervention occurs by DDD pacing at 100

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

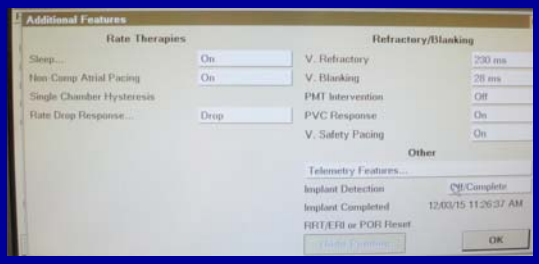


Medtronic Programmer: Rate Drop Response



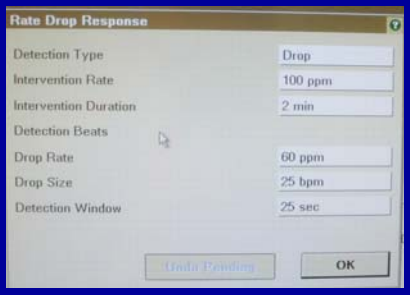
To access the Rate Drop Response Settings, click on Additional Features

Medtronic Rate Drop Response



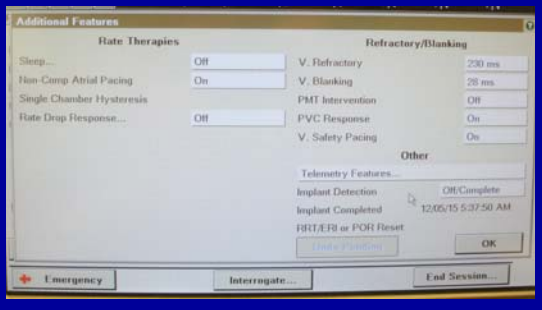
RDR is typically not on but when it is, you will find the settings here—either OFF, Low Rate, Drop, or Both. Here we see it set for Drop.

Medtronic Rate Drop Response



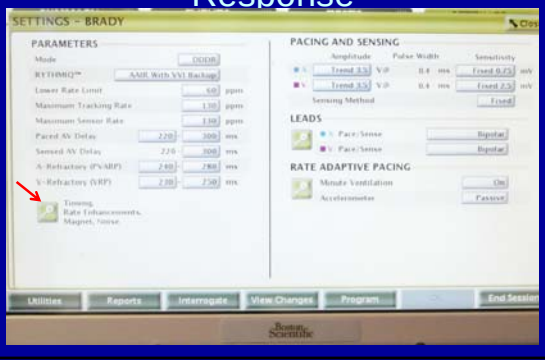
If the heart rate abruptly drops by 25 bpm, the device will pace at 100 for 2 min

Medtronic Rate Drop Response OFF

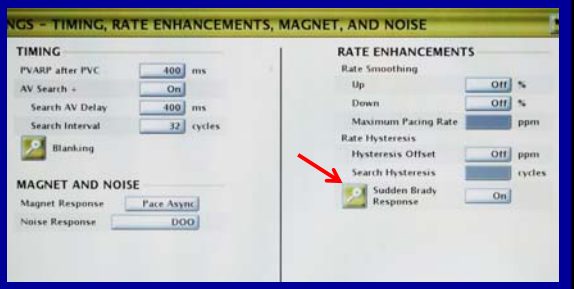


Most often, RDR is programmed OFF

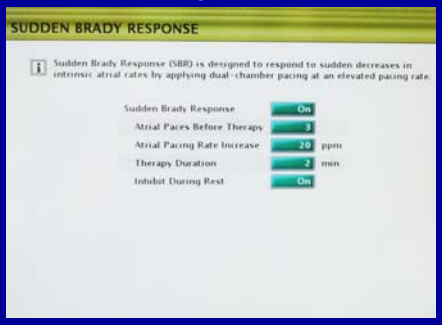
Boston Scientific Sudden Brady Response



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

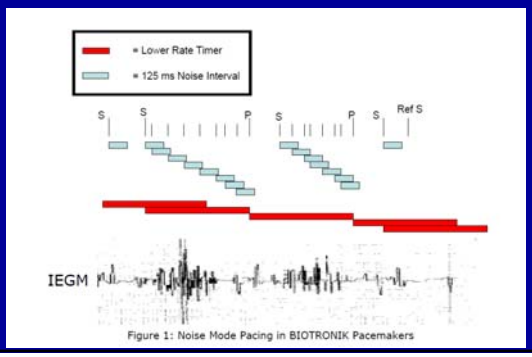
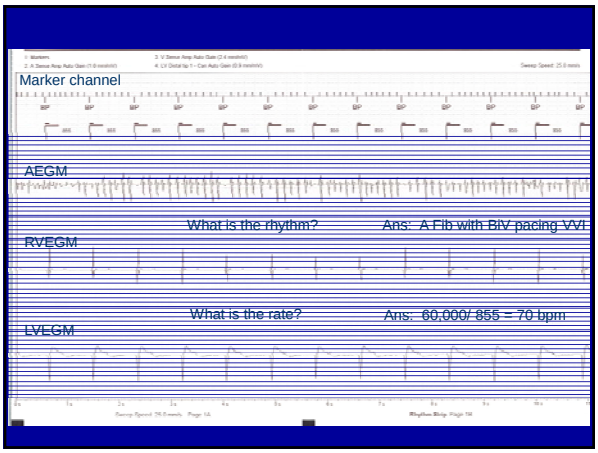
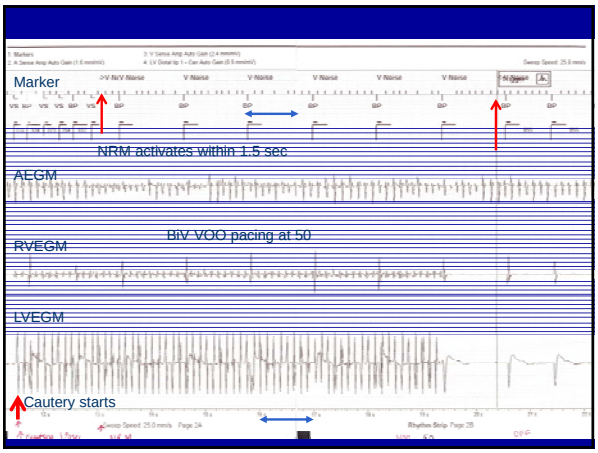
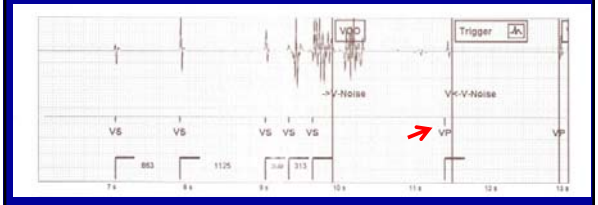


Figure 1: Noise Mode Pacing in BIOTRONIK Pacemakers





Noise Reversion Mode: Another Example

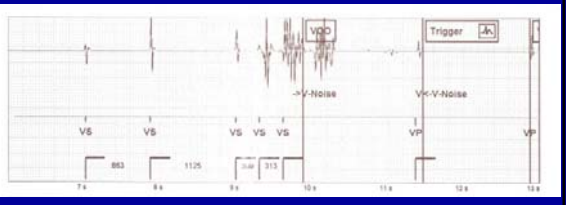


This patient was not pacing at all—then all of sudden he started to pace after a short burst of cautery---Is it a malfunction?

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?



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

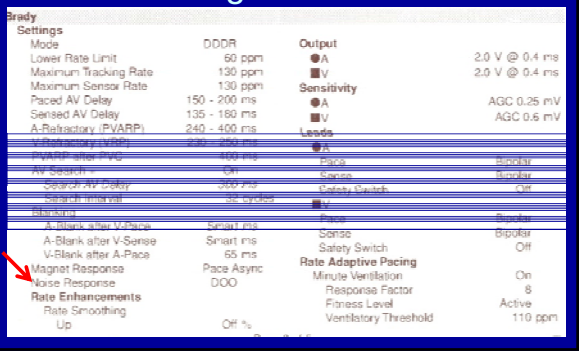
Noise Reversion Mode can be Helpful

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

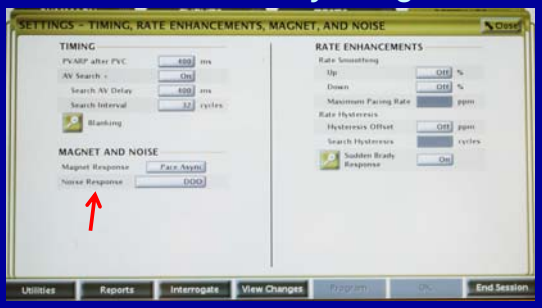
Noise Reversion Mode can be harmful

- 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

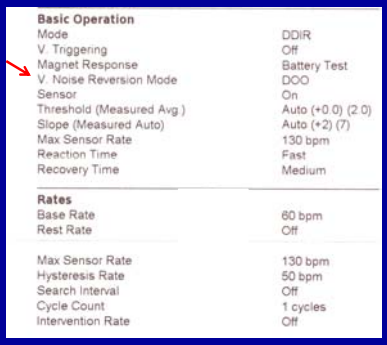
Boston Scientific Noise Response on the Programmer Printout



Boston Scientific Noise Reversion Mode by Programmer



St Jude Noise Reversion Mode



Noise Reversion Mode Summary

- Noise Reversion mode provides protective asynchronous pacing when the pacer 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 pacer to a fixed VVI mode
  - Medtronic 65
  - Boston Sci 65
  - St Jude 67.5
  - Biotronik 70
- Must reprogram

MRI converts Pacer 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 "Pseudomalfunctions" 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
  - Text 617 233 7564
  - Email sstreckenbach@mgh.harvard.edu