Magnet Application on CIEDs

Do we really know what we're doing?

12th International Winter Arrhythmia School
Collingwood, Ontario
February 7, 2015

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Rouge Valley HEALTH SYSTEM

HEART HEALTH INSTITUTE
Compassionate Cardiology • Leading-edge Technology

Dr. Derek Yung - Disclosures

Presenter: Dr. Derek Yung

Relationships with industry:

Educational material provided by Biotronik, Guidant, Medtronic, St. Jude Medical, Sorin

Grant / Research Support: Not applicable

Commercial Support: No honorarium

Mitigation of Bias: Review of peer-reviewed literature and industry provided manuscripts to support the content of this presentation.

Outline

- Background
- Magnet Application
  - Why and How?
- Magnet Response
  - Pacemakers
  - Implantable Cardioverter Defibrillators
- Summary

"If you suddenly get the urge to kick it, press the call button immediately"


ST. JUDE MEDICAL
Sylmar, CA USA
QUADRA ASSURA
Model CD3265-40Q
High Voltage Can
VVED DDDRV
S/N 123456
Medtronic
Protecta XT CRT-D
Boston Scientific
Medtronic
SYNC II MARQUIS
MODEL 7289
VVE-DDDR
USA
IS-1
RV
A
LV
ST. JUDE MEDICAL
Sylmar, CA USA
FRONTIER II
Medtronic
Consulta CRT-D
Medtronic
Syncra CRT-P
KORA 100 SR
SSIR IS-1 BI
SN C24ZZ098
SORIN GROUP
Lumax 740 HF-T
Medtronic
Concerto II CRT-D
Medtronic
Protecta CRT-D
COGNIS 100-D
Boston Scientific
ST. JUDE MEDICAL
FORTIFY
UNIFY
INCEPTA CRT-D
Boston Scientific
ST. JUDE MEDICAL
UNIFY ASSURE
Lumax 640 HF-T
Home Monitoring
60410510
BIOTRONIK
Made in Germany
PROMOTE+
Model CD3211-36Q High Voltage Can
S/N DEMO
VVED DDDRV
ST. JUDE MEDICAL
Medtronic
Maximo II CRT-D
D284TRK
DDE-DDDR
USA
REPLY 200 DR
DDDR IS-1 BI IS-1 BI
SN C24ZX098
SORIN GROUP
Medtronic
Consulta CRT-P
Evia HF-T
Home Monitoring
BIOTRONIK
66127192
Made in Germany

Background

- 3 Million North Americans living with CIEDs
- 250,000 devices implanted each year
- Increasing dramatically due to the aging population
- Profound impact on morbidity and mortality

With Great Power Comes Great Responsibility

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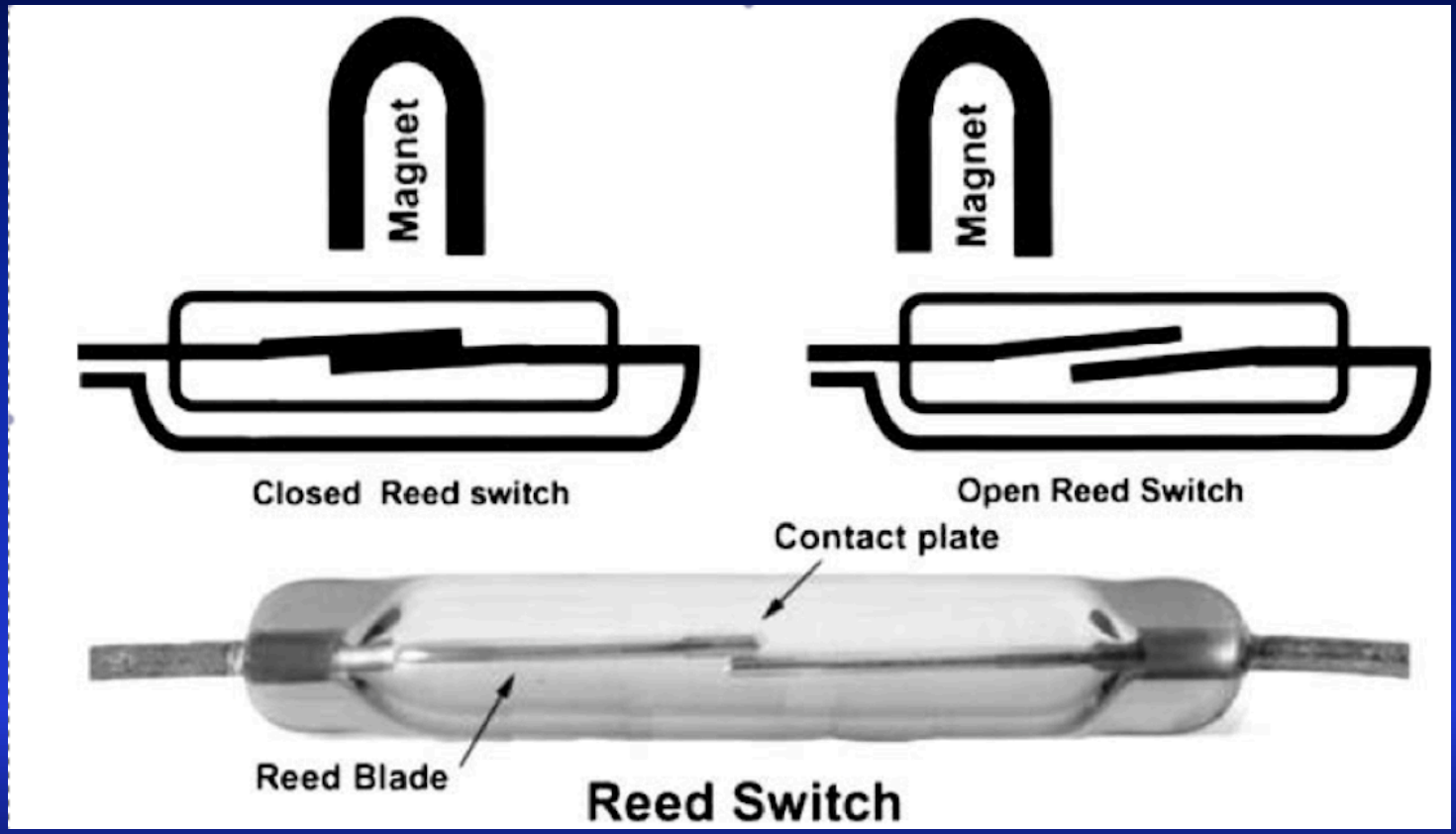
Magnets



Jacob et al., Europace 2011, 13: 1222-1230

Which of the following is NOT an indication for magnet placement on a CIED?

A. Assessment of battery status in a pacemaker

B. Inappropriate ICD shocks due to a lead fracture.

C. Inappropriate ICD shocks due to rapid atrial fibrillation

D. Dependent ICD patient requiring thoracic electrocautery

E. Termination of pacemaker mediated tachycardia

Magnet Indication

MITIGATES CONSEQUENCES OF OVERSENSING / NOISE

PPM +  =

ASYNCHRONOUS PACING

ICD +  =

TACHY RX OFF

Indications for Magnet Application

EMI is anticipated

1. PERIOPERATIVE / ELECTROCAUTERY
2. Extracorporeal shock-wave lithotripsy
3. Therapeutic radiation
4. RF ablation
5. TENS units
6. Electroconvulsive therapy

Device Troubleshooting

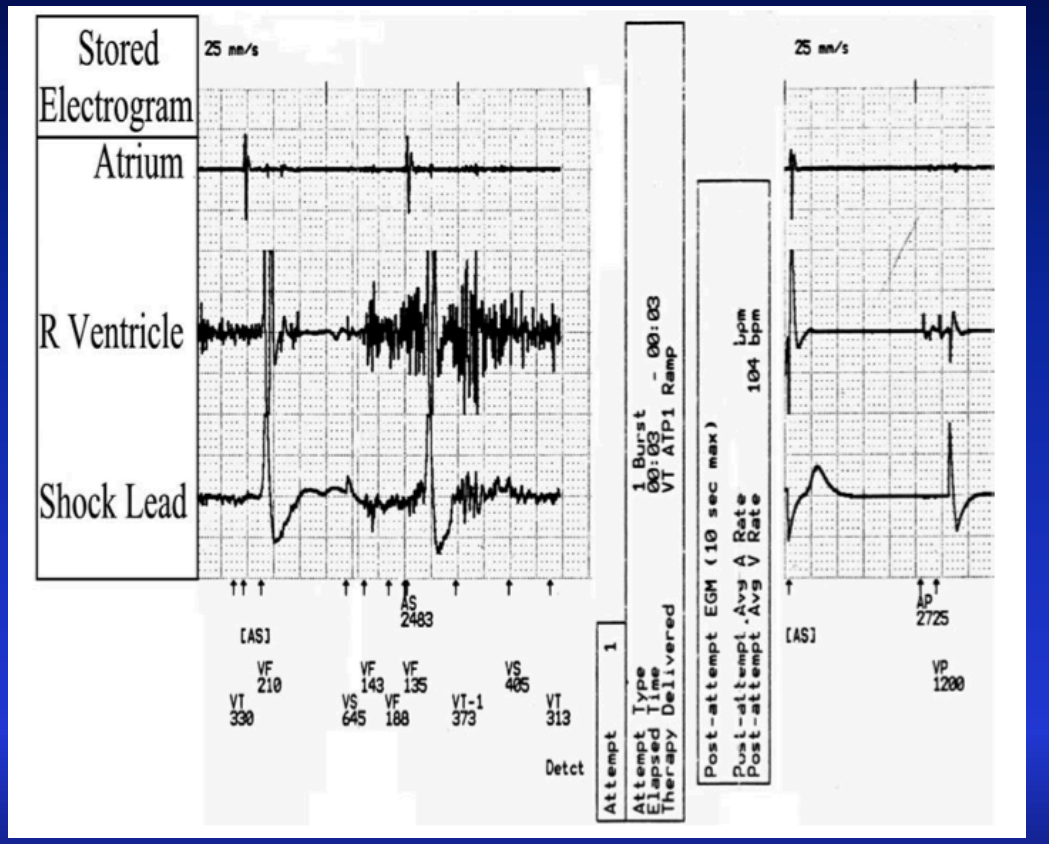
1. Battery status
2. Capture threshold
3. Device identification

Therapeutic

1. PMT intervention
2. Inappropriate therapies (ie. Lead fracture, cross-talk / far-field sensing, non life-threatening arrhythmias etc)
3. Palliation

Electrocautery and CIEDs

- Inappropriate CIED sensing of EMI
  - No effect
  - Inhibition
  - Tracking (rapid pacing)
  - ICD therapy (ATP or shocks)
- Physical damage or reprogramming



Schulman et al., Anesth Analg 2013;117, 422–7

Perioperative Management

The Heart Rhythm Society (HRS)/American Society of Anesthesiologists (ASA) Expert Consensus Statement on the Perioperative Management of Patients with Implantable Defibrillators, Pacemakers and Arrhythmia Monitors: Facilities and Patient Management

Crossley et al., Heart Rhythm 2011, 7:1114-54

Society Position Statement

Canadian Cardiovascular Society/Canadian Anesthesiologists' Society/Canadian Heart Rhythm Society Joint Position Statement on the Perioperative Management of Patients With Implanted Pacemakers, Defibrillators, and Neurostimulating Devices

Healey et al., CJC 2012, 28:141-154

CIEDs and Surgery

Table 2. Recommended minimum CRD data collection for perioperative assessment

- Device type, manufacturer, model
- Is the device or lead under recall or advisory?
- Date and hospital of implant and date of most recent follow-up
- Follow-up clinic and physician
- Minimum anticipated battery longevity
- Pacing dependency, pacing mode, and rate-modulation sensor
- Recent activity: atrial and ventricular pacing activity, VT, and VF detection
- Response to magnet (eg, asynchronous pacing, suspended tachycardia detection)
- Expected response to magnet removal (eg, resume original settings, other)

CRD, cardiac rhythm device; VF, ventricular fibrillation; VT, ventricular tachycardia.

Healey et al, CJC 2012, 28:141-154

Perioperative Magnet Use

- Identify patient has CRD
- Identify responsible CRD clinic or physician
- Determine patient "dependency"
- Estimate likelihood of EMI depending on (1) nature of CRD and (2) surgery
- Estimate likelihood of CRD complications
- Develop collaborative plan to minimize risk
- Consider referral to higher-acuity institution in selected cases

Jacob et al., Europace 2011, 13: 1222-1230

Greater Probablity for EMI:

- Anatomical considerations (above > below the umbillicus)
- < 15 cm from the CIED or leads
- Monopolar > Bipolar cautery
- Long (> 5 seconds) or frequent (< 5 seconds in between bursts) of cautery
- Unipolar leads or bipolar leads programmed to unipolar

Contraindication to Perioperative Magnet Use

- NOT accessible and visible
- Poor positioning - Prone or lateral
- CIED is in the surgical field
- Magnet response to the CIED is not known
- Low battery
- Pacer dependent ICD patients

Guidelines for Peri-op Magnet Use

	MINIMAL / NO ELECTROCAUTERY	SIGNIFICANT / UNAVOIDABLE ELECTROCAUTERY	
		DEPENDENT	NON-DEPENDENT
Pacemaker	NO changes to programming	Consider MAGNET (if not reprogram to asynchronous pacing)*	Synchronous mode (at physiologically acceptable rate)
Brady Function of ICD	NO changes to programming	Consider REPROGRAMMING to asynchronous pacing*	Synchronous mode (at physiologically acceptable rate)
Tachy Function of ICD	NO changes to programming	Use MAGNET (if not reprogram to disable tachy therapies)	

*Biotronik has a Noise Mode and does NOT require any action for dependent patients.

At your center, how would you manage a pacemaker dependent patient undergoing total knee replacement with monopolar electrocautery?

A. No treatment needed

B. Synchronous pacing, but reprogram the lower rate and turn off rate response

C. Magnet on device

D. Reprogram to asynchronous pacing

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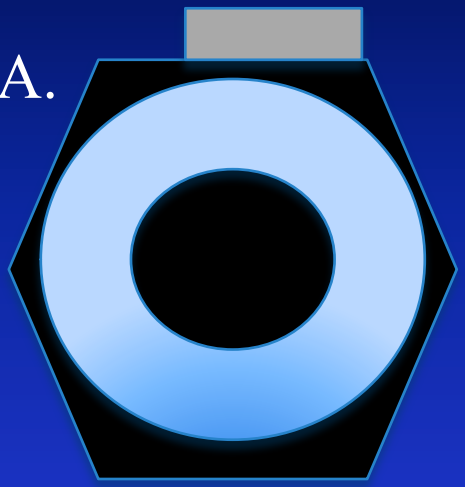
Which is the most correct position of applying a ring magnet on an ICD?

A.



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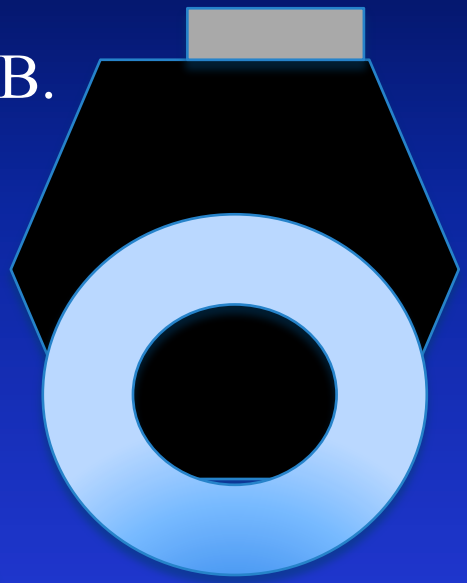

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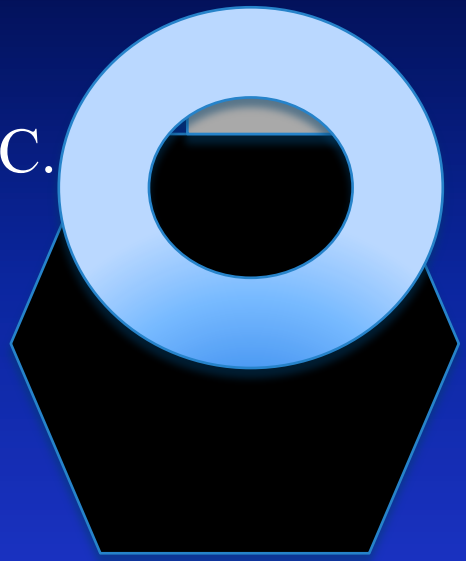
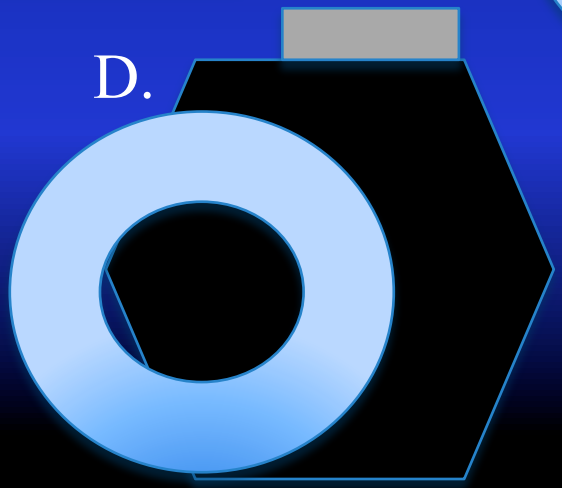
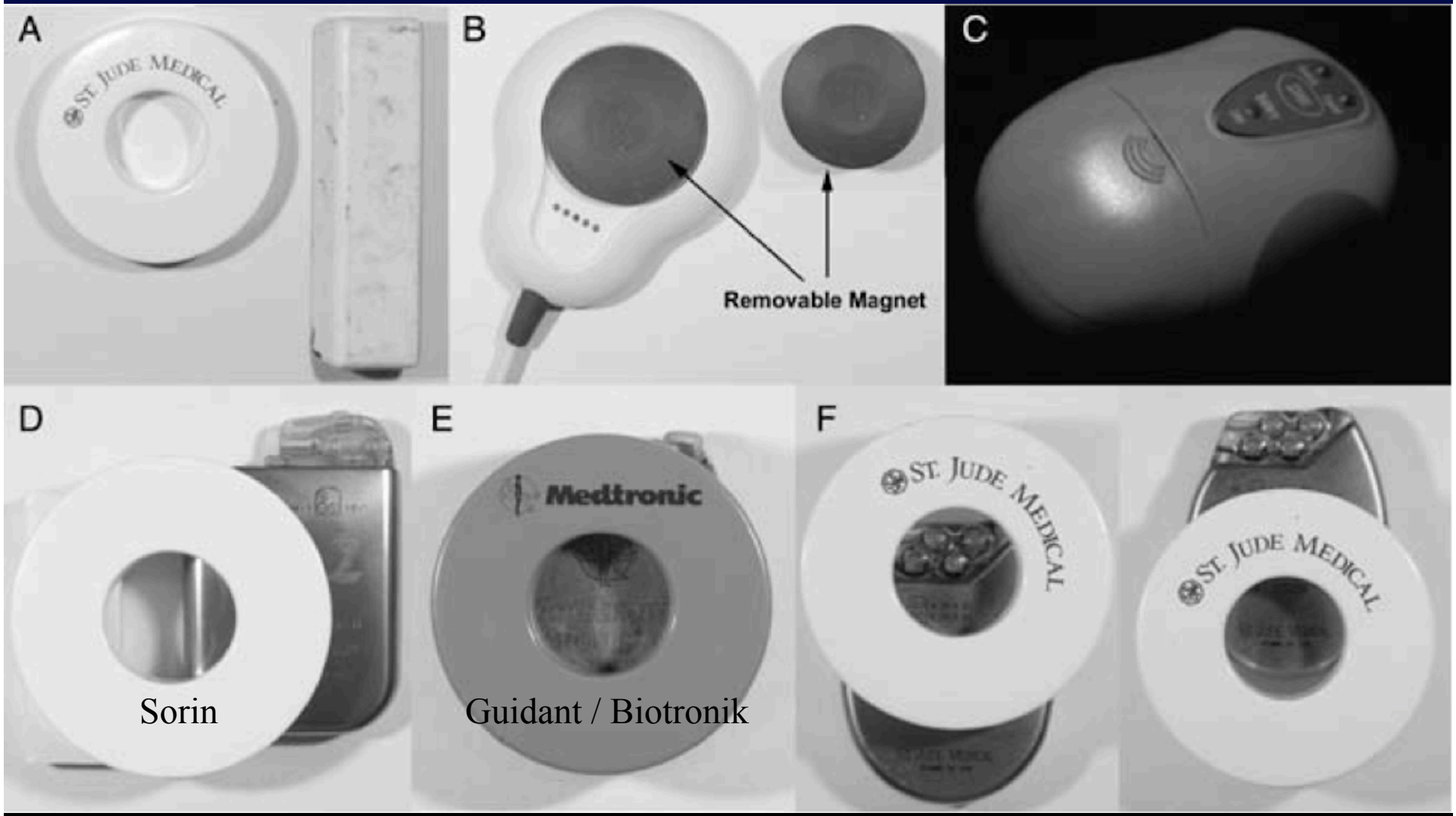


D.



E. IT DEPENDS

Magnet Position



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Magnet Response

PPM +  =

ASYNCHRONOUS PACING

ICD +  =

TACHY RX OFF

WHAT ARE THE UNIQUE CONSIDERATIONS?

What is a potential response of a magnet on a pacemaker?

A. A DDD pacemaker will pace DOO

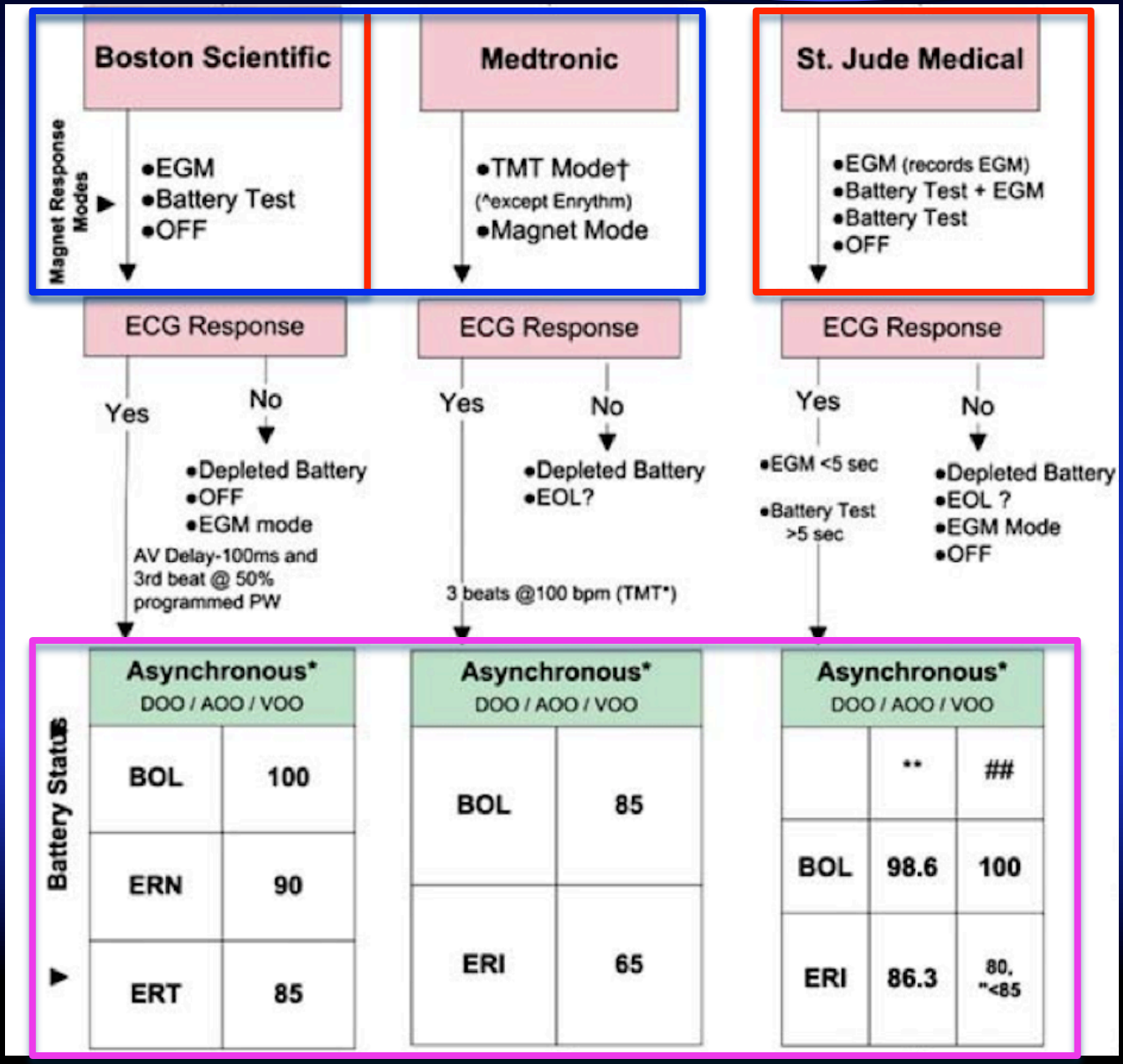
B. A dual chamber pacemaker programmed in VVI mode will pace VOO

C. A device programmed in AAI <==> DDD mode will pace DOO

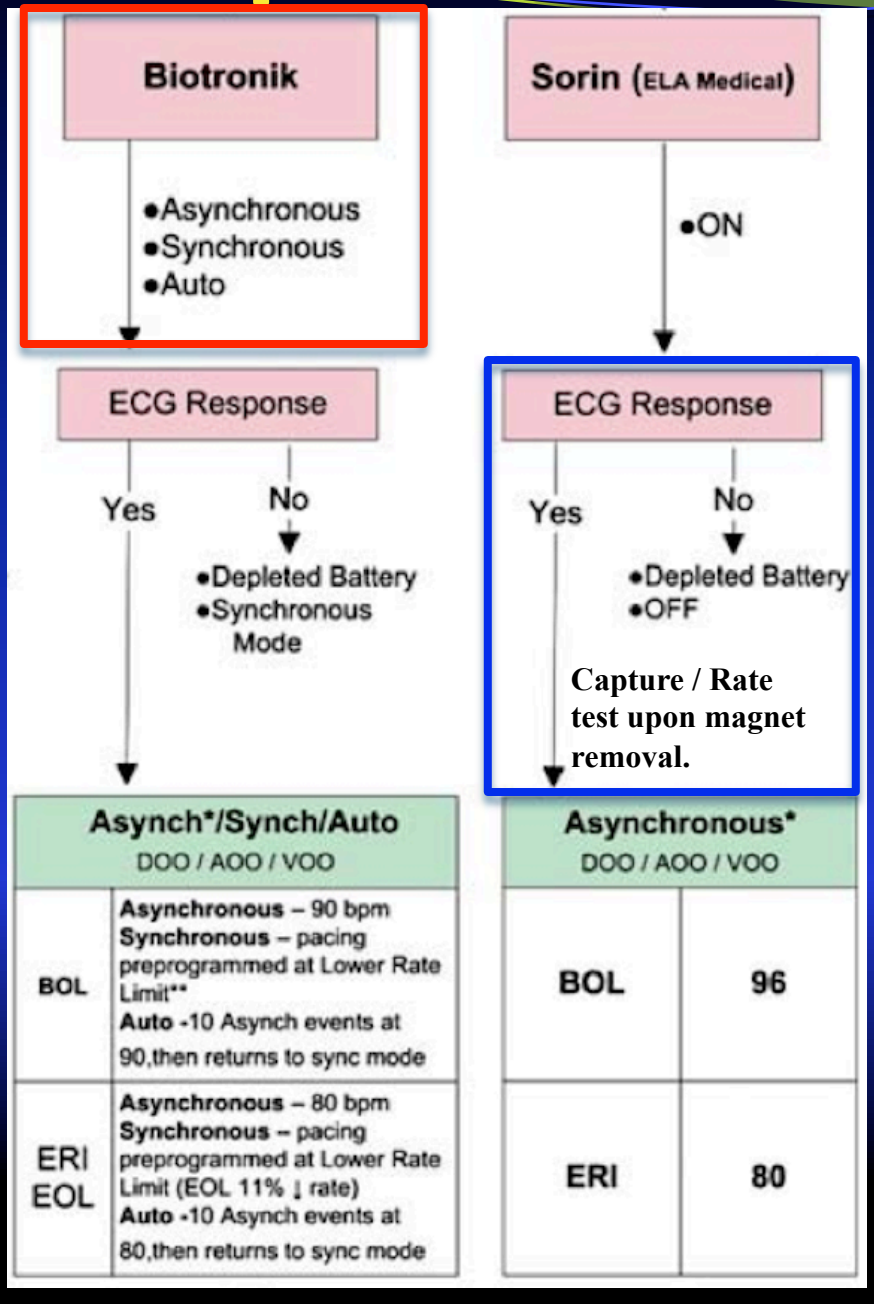
D. Synchronous pacing

E. All of the above

Magnet Response in PPMs



Magnet Response in PPMs



Europace 2011, 13: 1222-1230

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How do you know if a magnet is appropriately applied to an ICD?

A. A sustained alert tone is heard

B. An intermittent beep is heard

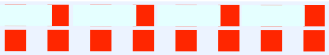
C. Asynchronous pacing

D. There is no way to know

E. It depends (all of the above are possible)

ICD Magnet Application

MAGNET = TACHY Rx SUSPENDED

DEVICE	RESPONSE		
Boston Scientific *	 Tachy Rx ON but Supressed	 Tachy Rx OFF	 Toggle Mode
Medtronic *	 All Clear Tone	 Low Urgency	 High Urgency
St. Jude	No Audio		
Biotronik	No Audio (must reapply after 8 hours)		
Sorin	No Audio. Pacing at 80-96 bpm (no change in pacing mode)		

* If NO tone heard = magnet position, battery depleted, wrong manufacturer

Jacob et al., Europace 2011, 13: 1222-1230

Boston / Guidant - Toggle mode

1. APPLY Magnet for 30 Seconds
2. Remove for 10 seconds (2 ft from device)
3. REAPPLY Magnet to test

BOSTON SCIENTIFIC /GUIDANT MODELS – TOGGLE MODE	
Toggle mode available	PRIZM 1 (1850-1853, 1857-1858), PRIZM 2 (1860-1861) VITALITY 1 (T125, T127, T135)
NO Toggle mode	VITALITY 2 (T165, T167, T175, T177, T180, A135, A155) CONFIENT (E030), TELIGEN (E110) COGNIS (N118, N119), LIVIAN (H220, H225, H227, H229) INCEPTA (E160-163), PUNCTUA (E050-053) ENERGEN (E140-143)
Software patch to "inactivate" Toggle mode	CONTAK RENEWAL 1 – H135 CONTAK RENEWAL 3/4 – H170, H175, H177, H179 CONTAK RENEWAL 3RF – H210, H215, H217, H219

A patient receives an ICD shock due to electrocautery despite magnet application. These are potential explanations EXCEPT?

A. The patient is obese

B. Store EGM mode was turned ON 3 months ago

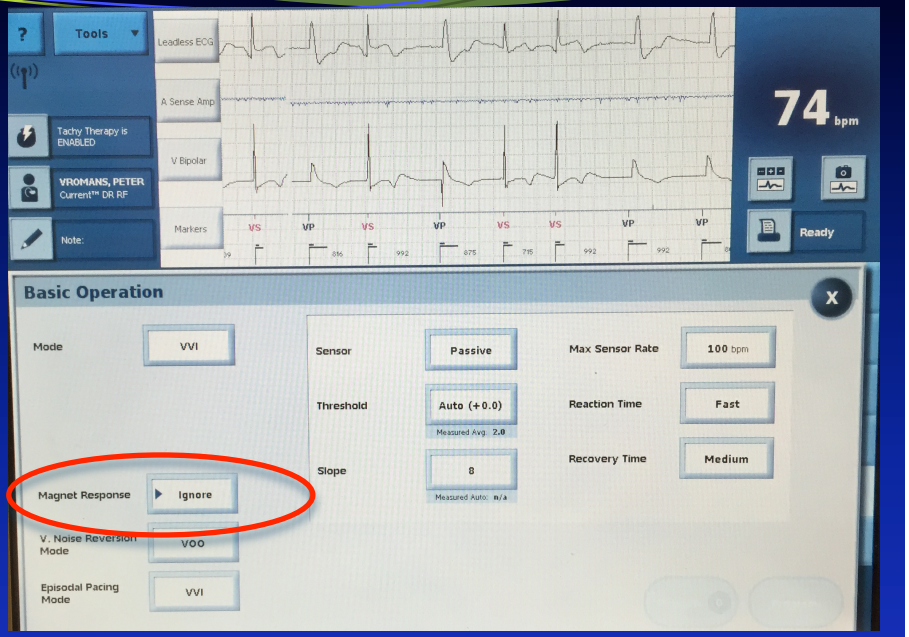
C. Magnet is not in the correct position

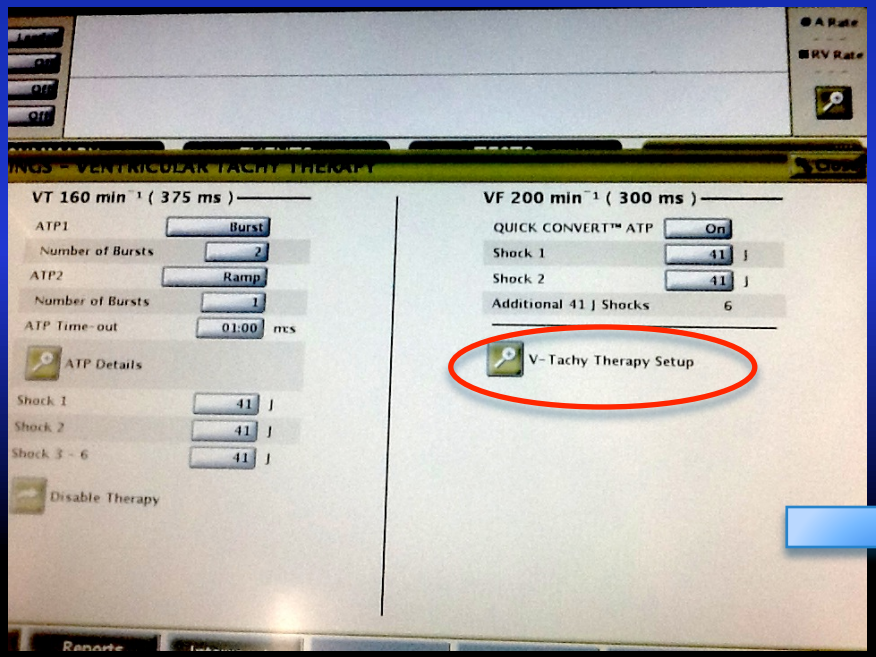
D. Magnet mode is OFF

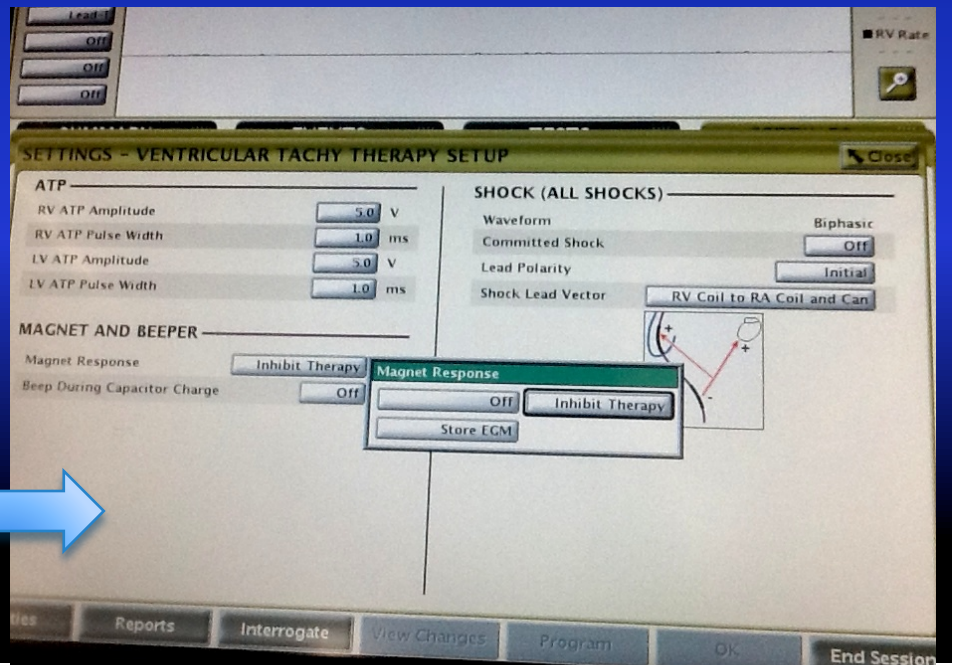
E. Low battery status

ICD Magnet Mode OFF

- St. Jude (right)
  - NORMAL / IGNORE
- Boston / Guidant (below)
  - ON / STORE EGM / OFF

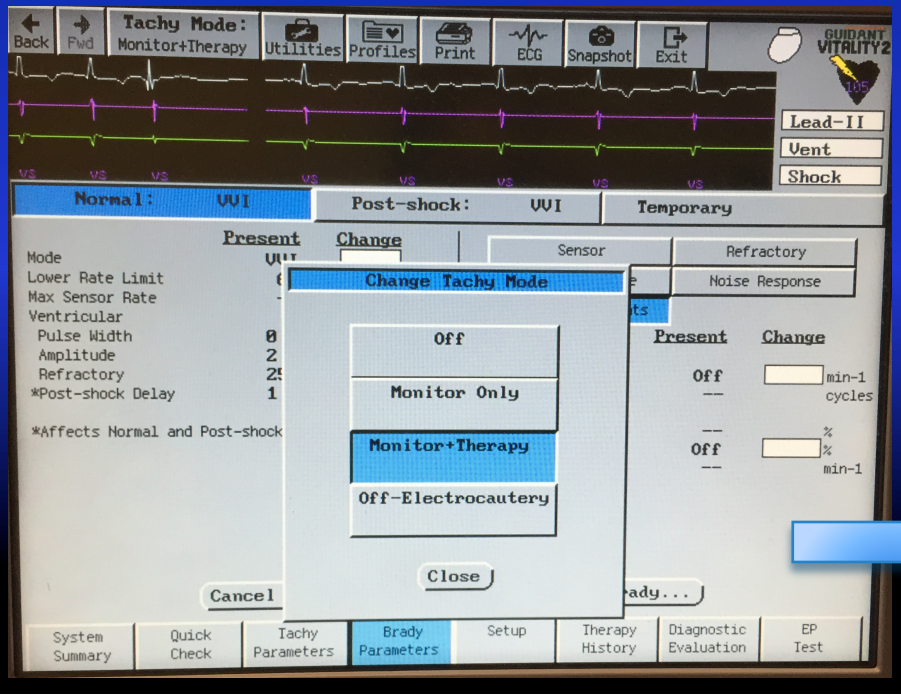


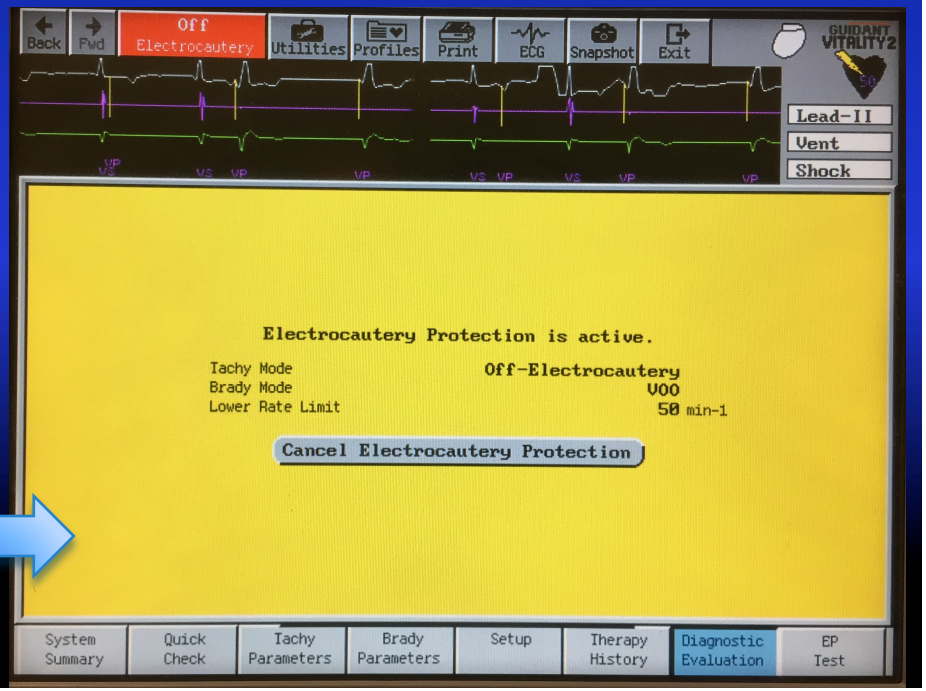




Magnet Mode OFF

- Boston / Guidant
  - Store EGM
    - 2 min beore, 1 min after
    - Resets to inhibit mode after one stored EGM OR after 60 days
  - Electrocautery mode
    - Magnet has no effect





Caveats to Magnet Application

1. Improper magnet position
   - ICDs - Boston / Medtronic (Alert), Sorin (96-80 bpm)
   - Submuscular implants and obese patients
2. Magnet swtich is OFF
   - ICD - Boston / SJM
   - PPM – BOS, SJM, Biot, Sorin
3. Low battery voltage
   - Unpredictable at EOL
4. Magnet Reapplication
   - Biotronik devices (after 8 hours)

The Future

- MRI Conditional devices – "MRI mode"
  - Medtronic – SureScan overrides magnet mode
  - Biotronik – Pro MRI mode overrides magnet mode
  - Sorin (Kora 100) – Programmable during monitoring window

- S-ICD
  - Alert: – – – –
  - Magnet Inhibits Tachy Rx

SUMMARY

- Magnet application on CIEDs remains a useful diagnostic and therapeutic tool
- It can be used to prevent interaction with electrocautery in selected patients
- The conventional response is asynchronous pacing for pacemakers, and inhibition of tachytherapy for ICDs
- Unexpected effects and adverse consequences can result from improper magnet use or an incomplete understanding of manufacturer specific magnet settings


SPEED
LIMIT
EVERYTHING HAPPENS FOR A
REASON. SOMETIMES THE
REASON IS YOU'RE STUPID AND
MAKE BAD DECISIONS

THANK YOU

PPM Magnet Mode OFF