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Perioperative Management of Cardiac Implantable Devices

Financial Disclosures

- None

Let's Talk Pacemakers!

Practice Advisory for the Perioperative Management of Patients with Cardiac Implantable Electronic Devices: Pacemakers and Implantable Cardioverter-Defibrillators

An Updated Report by the American Society of Anesthesiologists Task Force on Perioperative Management of Patients with Cardiac Implantable Electronic Devices

Where did the rec's come from?

- Heart Rhythm Society
- ASA
- Tried to find evidence and then gain consensus

Goals

- Why you should care?
- Review the article (society rec's)
- Practical recommendations
- Who you should fear!

Perioperative Experts!

- 3 million people worldwide with pacemakers
- 600,000 pacemakers implanted every year
- Most patients >60 years old
- They often need surgery
- We should know what's going on!

Main Points of the talk

- Get help
- Interrogate the device
- Don't fly blindly
- Device Product reps get paid a lot of money
- Device companies make a lot of money
- They work to help you
- They are always on call
- **Figure out what your hospital has**
 - EP nurse, cardiologist, product rep

Interrogate! Interrogate! Interrogate!



Ask for something that looks like this!



Endorsement

- [American Society of Anesthesiologist Annual Meeting](#)
- [Workshop](#)
- [811. Pacing and ICD Workshop](#)

Goals

- Why you should care?
- **Review the article (society rec's)**
- Practical recommendations
- Who you should fear!

Evidence Grade

- Category A
 - Supportive literature
- Category B
 - Suggestive literature
- Category C
 - Equivocal literature
- Category D
 - Insufficient evidence from the literature

The Sublevels of evidence

LEVEL A

- 1A Multiple randomized controlled trials, summarized with a meta-analysis
- 2A Multiple randomized controlled trials, not enough for a good meta-analysis
- 3A Single randomized controlled trial

LEVEL B

- 1B Observational comparisons (cohorts/case controlled studies)
- 2B Noncomparative observational studies
- 3B Case Reports

Sublevels of evidence

LEVEL C

- 1C Meta-analysis without statistical significance
- 2C Insufficient studies to conduct a meta-analysis/inconsistent findings
- 3C Observational studies with inconsistent findings

LEVEL D

- Silent
- Inadequate

There is no level 1 A evidence

- You will not find level 1 A evidence for the perioperative management of pacemakers
- You will not find level 1 A evidence for the use of pulse oximetry either

Preoperative Evaluation

(Anesthesiology 2011; 114:247-61)

- Establish if patient has a CIED
- Determine whether patient is CIED-dependent for antibradycardia pacing function
- Define the type of device
- Determine Device function
- **LEVEL B Evidence**
 - Suggestive literature

Preoperative Evaluation

(Anesthesiology 2011; 114:247-61)

- Focused history
- Medical records review
- Review of Chest x-ray
- EKG
- Check for scars palpate device

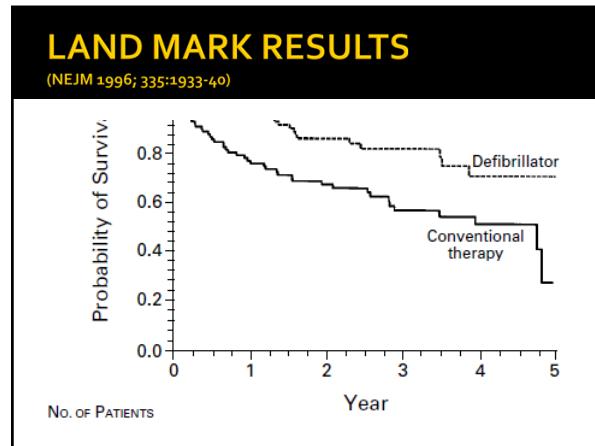
Peroperative Evaluation

(Anesthesiology 2011; 114:247-61)

- Obtaining the manufacturer's ID card
- Order Chest x-ray
 - I found fluro works best because you can magnify
- Refer to supplemental resources
 - Manufacturer's database
 - Pacemaker clinic record
- Consultation with a cardiologist
 - Rarely necessary if you know dangers of asynchronous pacing

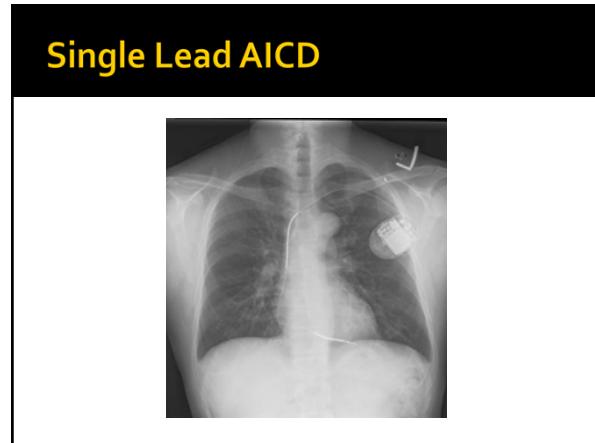
The New England Journal of Medicine
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VOLUME 335 DECEMBER 26, 1996 NUMBER 26

- MADIT I
- NYHA class I, II, III
- Previous MI, EF < 35%
- Episode of asymptomatic unsustained v-tach
- An inducible non-suppressible ventricular tachyarrhythmia on EP study
- Randomized
 - Internal defibrillator
 - Possible anti-arrhythmic medications



Results
(NEJM 1996; 335:1933-40)

- 196 patients enrolled
- 27 month follow up
- 15 deaths in defibrillator group
- 39 deaths in conventional therapy group
- Mortality reduction of 56%
- P < 0.009



The New England Journal of Medicine
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VOLUME 346 MARCH 21, 2002 NUMBER 12

- MADIT II
 - 1232 pt enrolled
 - Previous MI with documented EF < 30%
 - AICD vs medical therapy
 - Average 2 year follow up
 - AICD group mortality group decreased by 31%
 - Conclusion:
 - In patients with prior MI and advanced LV dysfunction, prophylactic implantation of a defibrillator improves survival and should be recommended therapy

The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1822 OCTOBER 3, 2002 VOL. 346 NO. 44

Cardiac Resynchronization Therapy for the Prevention of Heart Failure Events

- MADIT-CRT
 - EF < 30%, QRS > 130 ms
 - AICD vs AICD plus Bi-ventricular pacemaker
- Primary outcomes
 - Death
 - Non Fatal Heart Failure Event
- 1820 pts
- Results
 - No change in mortality
 - 41% decrease in heart failure events!

Preoperative Evaluation

(Anesthesiology 2011; 114:247-61)

- CIED dependence
 - Verbal history or indication patient has experienced a bradyarrhythmia that has caused syncope or other symptoms requiring CIED implantation

Painful Nomenclature

Position I Pacing Chamber(s)	Position II Sensing Chamber(s)	Position III Response(s) to Sensing
O = None	O = None	O = None
A = Atrium	A = Atrium	I = Inhibited
V = Ventricle	V = Ventricle	T = Triggered
D = Dual (A+V)	D = Dual (A+V)	D = Dual (T+I)

Preoperative Evaluation

(Anesthesiology 2011; 114:247-61)

- CIED dependence (cont'd)
 - History of successful AV node ablation
 - No evidence of spontaneous ventricular activity when the pacemaking function of the CIED is programmed to VVI pacing mode at lowest programmable rate

Preoperative Preparation

(Anesthesiology 2011; 114:247-61)

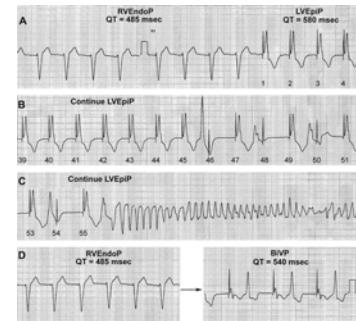
- Determine if electromagnetic interference is likely to occur during the procedure
 - Electrosurgery
 - Radiofrequency ablation
 - MRI
 - Lithotripsy

Preoperative Preparation

(Anesthesiology 2011; 114:247-61)

- Determine:
 - Preoperative programming to an asynchronous mode or disabling special algorithms is needed

Figure 4. Pacing site-dependent changes in QT interval, R-on-T ventricular extrasystoles, and the onset of TdP.



Medina-Ravell V A et al. Circulation 2003;107:740-746

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Preoperative Preparation

(Anesthesiology 2011; 114:247-61)

- Suspend:
 - Antitachyarrhythmia function if present
 - Rate Adaptive Therapy

Preoperative Preparation

(Anesthesiology 2011; 114:247-61)

- Advise:
 - The individual performing the procedure to consider bipolar or ultrasonic (harmonic) scalpel to minimize adverse effects on the pulse generator or leads

Preoperative Preparation

(Anesthesiology 2011; 114:247-61)

- Additional Programming
 - Pace maker dependent patients should be programmed to an asynchronous mode before surgery

Preoperative Preparation

(Anesthesiology 2011; 114:247-61)

- Assure:
 - The availability of temporary pacing and defibrillation equipment

Preoperative Preparation

(Anesthesiology 2011; 114:247-61)

- Numerous descriptive studies and case reports suggest the following are associated with EMI
 - Electrocautery
 - Radiofrequency ablation
 - MRI
 - ±Radiation therapy
 - No STUDIES were found that reported EMI during ECT

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Monitor the operation of the device
- Prevent potential CIED dysfunction
- Perform emergency defibrillation, cardioversion, or heart rate support

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Continuous EKG
- Peripheral pulse monitoring
 - Pulse ox, **A-line**, ultrasound peripheral pulse(?)
- Category B₃ Evidence

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Electrosurgery
- Assuring cautery tool, current return pad positioning
- Current pathway does not pass through or near CIED pulse generator and leads
- **B₂-B₃ evidence**
 - Two case reports
 - One Observational study

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Encourage Short Bursts at lowest feasible energy level
- **B₂-B₃**
 - One case report
 - Total pacemaker failure when short burst of cautery used
- Multiple Case reports
 - Uneventful surgery with bipolar cautery or harmonic scalpels (**B₃ Evidence**)
 - One case report pacemaker failure with bipolar cautery

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

Experts opinion/Summary

- Position the cautery tool and current return pad away from device
- Avoid proximity of the cautery electrical field to the pulse generator and leads
- Use short intermittent and irregular bursts at the lowest feasible energy level
- Use bipolar or ultrasonic (harmonic) scalpel if possible

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Radiofrequency Ablation
 - High frequency alternating current
 - We will see it in OR and IR
 - Treatment of solid organ tumors/metastatic disease
- Keep RF current path as far away from the pulse generator and lead system as possible

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Lithotripsy
- Avoid focus of the lithotripsy beam near the pulse generator
- Disable atrial pacing if the lithotripsy system triggers on the R wave

Hemodynamics of Pacing

- Hierarchy of rhythm
 - Normal sinus rhythm
 - If rate is fast enough
- Atrial Pacing
- AV pacing
- V pacing
- Switching Modes of pacing
 - Can have serious hemodynamic consequences

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Magnetic Resonance Imaging
- Observational studies and case reports suggest MRI can be done safely
- Expert Opinion
 - **MRI is contraindicated**
- If absolutely necessary
 - Consult
 - Manufacturer
 - Cardiologist
 - Ordering Physician
 - Radiologist

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Electroconvulsive Therapy
 - No studies exist
 - Two case reports
 - ICD's turned off for procedure
 - No mention of effect on device
- Radiation
 - The device should be out side of the field of radiation

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Electroconvulsive Therapy
- Expert Opinion
 - If patient has a defibrillator
 - Disable defibrillator
 - Interrogate device before procedure
 - Be prepared to treat ventricular arrhythmias
 - Pacer dependent patients may need to be placed in a asynchronous mode to preserve cardiac function

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- Emergency Defibrillation or cardioversion
- Minimize the current through the pulse generator
- Expert Opinion
 - Anterior-Posterior Position should be used

Intraoperative Management

(Anesthesiology 2011; 114:247-61)

- If life-threatening arrhythmia occurs
- Don't screw around
- ACLS protocol
- Remember the MADIT, MADIT II, MADIT-CRT
- These patients are sick!

WHAT ABOUT A MAGNET?

- Asynchronous ?
- Turns off AICD ?
- No industry standard
- Usually does...
- Would not depend on it if you have time
 - Interrogate
 - Interrogate
 - Interrogate

Postoperative Management

(Anesthesiology 2011; 114:247-61)

- Interrogate and restore defibrillation function
- Observational study + case report
- Postoperative pacemaker check revealed the need to alter pacing mode or other parameters which include increasing ventricular thresholds
- **B2-B3 evidence**
- **My opinion**
 - Don't take the pads off until the device is interrogated and activated!

Conclusion

- Find out all the information you can
- Interrogate, interrogate, interrogate
- Prepare for the worst
 - These patients are sick
- Have a back up plan
- GO RAIDERS!