Implanted Cardiac Pacemaker and Defibrillator Management

**INITIAL EVALUATION**

All patients with a cardiac implantable electronic device (CIED) and scheduled for procedure and/or radiation therapy are to be seen prior to treatment at the Cardiac Device (Pacemaker/ICD) Clinic in the Cardiopulmonary Center.1,2,3

**SURGERY/PROCEDURE**

- **Above the waist**
  - Surgery or
  - Endoscopy with electrosurgery or
  - IR procedure

- **Below the waist**
  - Surgery or
  - Procedure with electrosurgery

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**Central line placement**

See Page 2

**Radiation therapy**

See Page 3

**MRI**

See Page 4

**Patients with Do Not Resuscitate (DNR) status**

See Page 5

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**Implantable cardioverter defibrillator (ICD)**

- ICD pacing dependent?
  - Yes
    - Therapy OFF
    - Asynchronous pacing mode
  - No
    - Asynchronous pacing mode

- Pacemaker dependent or non-dependent

- Pacemaker dependent?
  - Yes
    - Post-operative/procedure check to be completed prior to the patient leaving a monitored area.
    - Turn therapy ON
    - Check pacing mode
  - No
    - Consider post-operative/procedure check

- Magnet application for temporary Therapy OFF

- Consider magnet application for temporary asynchronous pacing mode

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**Post-operative/procedure check within 30 days**

All patients to follow-up with their treating cardiologist(s)

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Note: This algorithm is intended for outpatient use. For inpatients needing evaluation, please place “Cardiac Device Check Inpatient (Bedside)” order for the patient to be evaluated at bedside.

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1 Device check not needed if completed within the prior 3 months and with documented NORMAL battery, impedances, and pacing safety margins. Device to be rechecked when transitioning from one treatment to another (i.e., radiation, surgery). After 4:30 PM, weekends, and holidays, cardiology service on-call can be contacted for emergency device checks.
2 Patients in the Houston Area Locations (HALs) receiving radiation therapy can be evaluated in the Cardiac Device (Pacemaker/ICD) Clinic or have a documented plan from an outside cardiologist
3 Recommend all surgical procedures to be scheduled early in the morning
   - Pacing dependent or surgery above the waist: Recommend scheduling surgery in main operating room
   - Pacing non-dependent and surgery below the waist: Recommend scheduling surgery in Main, ACB, or Northwest HAL operating room (see Appendix A)
4 Abdominal implants: If surgery between thorax and pelvis, refer to above the waist; if outside thorax and pelvis, refer to below the waist
5 IR procedures that need a post-procedure check prior to the patient leaving a monitored area and being discharged include radiofrequency ablation, microwave ablation and irreversible electroporation
6 Follow Cardiac Device (Pacemaker/ICD) Clinic’s recommendations note
7 Refer to Appendix A for Conditions Under Which Post-Operative/Procedure Interrogation is Not Necessary
8 Refer to Appendix B for Magnet Application
9 Referred to Appendix A for Conditions Under Which Post-Operative/Procedure Interrogation is Not Necessary

IR = Interventional Radiology
CENTRAL LINE/PERIPHERALLY INSERTED CENTRAL CATHETER (PICC) PLACEMENT

Patient presents for CVC/PICC placement or exchange

Note: Avoid placement of CVC/PICC on the same side of cardiac device

PICC → Proceed with procedure as clinically indicated

ICD

CVC

Pacemaker → Pacemaker dependent?

 ARRANGEMENTS FOR INTRA-PROCEDURE MONITORING MUST BE COMPLETED BY DIRECT COMMUNICATION BETWEEN THE PROCEDURALIST AND CARDIAC DEVICE (PACEMAKER/ICD) CLINIC

Yes

No

Proceed with procedure as clinically indicated

CVC = central venous catheter

PICC = peripherally inserted central catheter

1 Special circumstance: If CIED was implanted within the prior 3 months, procedure should be performed under fluoroscopy or in the Cardiac Catheterization Lab

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**PRIOR TO START OF RADIATION THERAPY**

Patient with CIED to be scheduled for radiation therapy

Cardiac Device (Pacemaker/ICD) Clinic consult

High risk device exposure?

Yes

Multidisciplinary conference (clinician to clinician communication) to discuss treatment plans along with other options

No

Treatment plan per Radiation Oncology Team

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**POST- RADIATION THERAPY**

Refer to Cardiac Device Management plan in electronic health record (EHR) and schedule follow-up as clinically indicated

Start radiation therapy

At completion of radiation therapy, schedule patient with Cardiology for final pacemaker/ICD assessment

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1 Radiation dose specification and intended use of neutron producing beams (protons or photons ≥ 10MV) documented in clinic note is recommended prior to Cardiac Device (Pacemaker/ICD) Clinic consult

2 Patients in the Houston Area Location (HALs) clinics receiving radiation therapy can be evaluated in the Cardiac Device (Pacemaker/ICD) Clinic or have a documented plan from an outside cardiologist

3 Start radiation treatment in accordance with Division of Radiation Oncology Electronic Medical Device Clinical Policy
**PRIOR TO SCHEDULING MRI**

**MRI**
- MRI conditioned device
- MRI approved and scheduled?
  - Yes: MRI protocolled for implanted devices by DI
  - Consent patient 2, if not previously obtained
- No: Cardiology to collaborate with Diagnostic Imaging (DI) faculty regarding clinical indication of MRI

**PRE-MRI**
- Monitors applied:
  - Cardiac monitoring
  - Pulse oximetry
  - Blood pressure
  - Program CIED as indicated 3
- Cardiac Device (Pacemaker/ICD) Clinic to discuss risks and benefits of MRI with patient 4
- MRI approved?
  - Yes: Post-imaging CIED check
  - Reprogram device back to original settings
- No: Cardiac Device (Pacemaker/ICD) Clinic to notify primary team and DI that patient cannot proceed with MRI
  - DI to recommend alternative imaging study

**POST-MRI**
- Follow-up within 3 months or as documented in the Cardiac Device Management note in the EHR

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1 An appropriate, qualified and credentialed clinician to monitor patient during procedure
2 Patient will need two consents: one for MRI study and one for MRI with CIED
3 Follow Cardiac Device (Pacemaker/ICD) Clinic’s recommendations note
4 Ensure appointment is scheduled for discussion

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PATIENTS WITH DO NOT RESUSCITATE (DNR) STATUS

Advanced care planning\(^1\) has been established. Patient is DNR status and has a CIED.

- It is recommended to turn OFF shock therapy
- An order must be placed by the physician to turn OFF shock therapy
  - Contact Cardiac Device (Pacemaker/ICD) Clinic during business hours
  - Notify manufacturer representative after 5 PM and weekends\(^2\)

Continue advanced care plan

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\(^1\) The advanced care planning discussion with the patient, or if clinically indicated, Patient Representative should clearly include and be documented whether or not shock therapy will be turned OFF

\(^2\) Manufacturer’s information may be obtained in the following manner:
  - Cardiac Device (Pacemaker/ICD) Clinic progress note
  - Patient/Patient Representative has manufacturer’s card
APPENDIX A: Conditions Under Which Post Operative/Procedure Interrogation is Not Necessary

1. Device is checked pre-operative/procedure and found to be working correctly, and
2. No programming of device took place peri-operative/procedure, and
3. No monopoloelectrosurgery used (bipolar is acceptable), and
4. No blood transfused, and
5. No hemodynamic issues noted, and
6. Procedures not involving electrosurgery (e.g., endoscopic ultrasonography)

APPENDIX B: Magnet Applications

<table>
<thead>
<tr>
<th>Pacemaker Manufacturer</th>
<th>Most Common Magnet Effect (For ranges listed below, the lower rate indicates a shorter remaining battery life)</th>
<th>Programmable (On-Off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotronik</td>
<td>No sustained asynchronous pacing</td>
<td>Yes</td>
</tr>
<tr>
<td>Boston Scientific</td>
<td>Asynchronous pacing at 100 or 90 bpm</td>
<td>Yes</td>
</tr>
<tr>
<td>Medtronic</td>
<td>Asynchronous pacing at 85 bpm</td>
<td>No</td>
</tr>
<tr>
<td>Sorin</td>
<td>Asynchronous pacing at 85 - 96 bpm</td>
<td>No</td>
</tr>
<tr>
<td>St. Jude Medical</td>
<td>Asynchronous pacing at 86 - 100 bpm</td>
<td>Yes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Defibrillator Manufacturer</th>
<th>Most Common Magnet Effect (NO defibrillator has asynchronous pacing with magnet)</th>
<th>Magnet Confirmation</th>
<th>Programmable (On-Off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotronik</td>
<td>Disables tachy therapy</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Boston Scientific</td>
<td>Disables tachy therapy</td>
<td>Defibrillator will beep with each R wave or 1/second</td>
<td>Yes</td>
</tr>
<tr>
<td>Medtronic</td>
<td>Disables tachy therapy</td>
<td>None</td>
<td>No</td>
</tr>
<tr>
<td>Sorin</td>
<td>Disables tachy therapy</td>
<td>Change pacing rate to 90 bpm</td>
<td>No</td>
</tr>
<tr>
<td>St. Jude Medical</td>
<td>Disables tachy therapy</td>
<td>None</td>
<td>Yes</td>
</tr>
</tbody>
</table>

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SUGGESTED READINGS


Crossley, G. H., Poole, J. E., Rozner, M. A., Asirvatham, S. J., Cheng, A., Chung, M. K., … Irefin, S. (2011). 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: this document was developed as a joint project with the American Society of Anesthesiologists (ASA), and in collaboration with the American Heart Association (AHA), and the Society of Thoracic Surgeons (STS). *Heart Rhythm, 8*(7), 1114-1154. doi: https://doi.org/10.1016/j.hrthm.2010.12.023

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DEVELOPMENT CREDITS

This practice consensus statement is based on majority opinion of the Pacemaker workgroup at the University of Texas MD Anderson Cancer Center for the patient population. These experts included:

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