This practice algorithm has been specifically developed for MD Anderson using a multidisciplinary approach and taking into consideration circumstances particular to MD Anderson, including the following: MD Anderson’s specific patient population; MD Anderson’s services and structure; and MD Anderson’s clinical information. Moreover, this algorithm is not intended to replace the independent medical or professional judgment of physicians or other health care providers. This algorithm should not be used to treat pregnant women.

### INITIAL EVALUATION

- **Implanted cardioverter defibrillator (ICD)**
  - Pacemaker dependent?
    - Yes: Therapy OFF, Asynchronous pacing mode
    - No: Therapy OFF
  - Pacemaker dependent?
    - Yes: Asynchronous pacing mode
    - No: Consider post-op check
  - Central line: See Page 2
  - Radiation: See Page 3
  - MRI: See Page 4
  - Advanced care planning for patients with pacemaker and defibrillator: See Page 5

- **Surgery or procedure with electrosurgery**
  - Surgery or procedure with electrosurgery above the waist?
    - Yes: Post-op check prior to leaving a monitored area
    - No: Turn ON therapy, Check pacing mode
  - Surgery or procedure with electrosurgery below the waist?
    - Yes: Consider magnet for temporary Therapy OFF
    - No: Consider magnet for temporary asynchronous pacing mode
  - All patients need to follow-up with their physician

---

1. Device check not needed if completed within the last 3 months and with documented NORMAL battery, impedances, and pacing safety margins. Device to be rechecked when transitioning from one treatment to another (Radiation, Surgery). After 5pm, weekends and holidays, cardiology service on-call can be contacted for emergency device checks.

2. Recommend all surgical procedures to be scheduled early AM:
   - Pacing dependent or surgery above the waist: Recommend schedule surgery in main operating room
   - Pacing non-dependent and surgery below the waist: Recommend schedule surgery in either main or ACB

3. Abdominal implants: If surgery between thorax and pelvis refer to above the waist; if outside thorax and pelvis refer to below the waist.

4. Follow pacemaker clinic recommendations note.

5. Conditions under which postoperative interrogation is not necessary. (see Appendix A on Page 6)

6. Refer to magnet application page for proper application. (see Appendix B on Page 6)
Implanted Cardiac Pacemaker and Defibrillator Management

This practice algorithm has been specifically developed for MD Anderson using a multidisciplinary approach and taking into consideration circumstances particular to MD Anderson, including the following: MD Anderson’s specific patient population; MD Anderson’s services and structure; and MD Anderson’s clinical information. Moreover, this algorithm is not intended to replace the independent medical or professional judgment of physicians or other health care providers. This algorithm should not be used to treat pregnant women.

1 Special circumstance: If ICD or pacemaker implanted less than 6 weeks ago, planning for other venous access device should be considered.

2 Refer to Appendix B- Magnet Application

---

1. Patient presents for central line/peripheral inserted central catheter (PICC) placement

2. Cardiac Cath Lab available?
   - Yes
     - Therapy OFF
     - Monitoring by Licensed Healthcare Provider (LHP) during procedure
     - Immediately following procedure: return device to pre-procedural settings
   - No
     - Therapy OFF
     - Procedure to be done under fluoroscopy in the Cardiac Cath Lab

3. Dependent?
   - Yes
     - Therapy OFF
     - Procedure to be done under fluoroscopy in the Cardiac Cath Lab
   - No
     - Monitoring by LHP during procedure

4. Pacemaker
   - Yes
     - Arrangements must be completed by direct communication between Infusion Therapy Team and the Cardiac Catheter (Cath) Lab
   - No
     - Procedure to be done under fluoroscopy in the Cardiac Cath Lab

5. ICD
   - Yes
     - Arrangements must be completed by direct communication between Infusion Therapy Team and the Cardiac Catheter (Cath) Lab
   - No
     - Procedure to be done under fluoroscopy in the Cardiac Cath Lab

---

1 Special circumstance: If ICD or pacemaker implanted less than 6 weeks ago, planning for other venous access device should be considered.

2 Refer to Appendix B- Magnet Application
Implanted Cardiac Pacemaker and Defibrillator Management

This practice algorithm has been specifically developed for MD Anderson using a multidisciplinary approach and taking into consideration circumstances particular to MD Anderson, including the following: MD Anderson’s specific patient population; MD Anderson’s services and structure; and MD Anderson’s clinical information. Moreover, this algorithm is not intended to replace the independent medical or professional judgment of physicians or other health care providers. This algorithm should not be used to treat pregnant women.

THERAPEUTIC RADIATION

Patient to be scheduled for radiation treatment  \( \rightarrow \) Pacemaker or ICD  \( \rightarrow \) Pacemaker Clinic consult\(^1\)

- High risk device exposure?
  - Yes → Multidisciplinary conference (Clinician to clinician communication) to discuss treatment plans along with other options
  - No → Treatment plan per Radiation team (AM radiation treatment appointment recommended)

Start radiation treatment

Refer to Pacemaker Management plan in OneConnect and follow-up as clinically indicated

At completion of radiation treatment, patient scheduled with Cardiology for final pacemaker/ICD assessment

\(^1\) Radiation dose specification documented in clinic note is recommended prior to Pacemaker Clinic consult.
Implanted Cardiac Pacemaker and Defibrillator Management

This practice algorithm has been specifically developed for MD Anderson using a multidisciplinary approach and taking into consideration circumstances particular to MD Anderson, including the following: MD Anderson’s specific patient population; MD Anderson’s services and structure; and MD Anderson’s clinical information. Moreover, this algorithm is not intended to replace the independent medical or professional judgment of physicians or other health care providers. This algorithm should not be used to treat pregnant women.

PRIOR TO MRI
- Consult to Pacemaker Clinic noting patient to be scheduled for MRI and has a CIED

AT THE TIME OF MRI
- Cardiology to collaborate with Diagnostic Imaging faculty regarding clinical indication of MRI
- MRI approved and scheduled
- Monitors applied:
  - Cardiac monitoring
  - Pulse oximetry

FOLLOWING MRI
- MRI completed
- Pacemaker/CIED checked
- Reprogrammed as needed
- Follow-up less than or equal to 3 months or as noted in the Pacemaker Management note in OneConnect

1 There will be an appropriate, qualified and credentialed clinician to monitor patient during procedure.

CIED = cardiovascular implantable electronic device
PATIENTS WITH DO NOT RESUSCITATE (DNR) STATUS

- Advanced care planning\(^1\) has been established.
- Patient is DO NOT Resuscitate status with an implanted cardiac device

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

- Pacemaker
  - No need for any intervention
  - Continue advanced care plan

---
\(^1\) The advanced care planning discussion with the patient/family member should clearly include and document whether or not shock therapy will be turned OFF.
\(^2\) Manufacturer’s information may be obtained in the following manner:
  - Pacemaker Clinic Progress Note
  - Patient/Family member has manufacturer’s card
**APPENDIX A: Conditions under which Postoperative Interrogation is not Necessary**

1. Device is checked preoperatively and found to be working correctly, and
2. No programming of device took place perioperatively, and
3. No monopolar electrosurgery 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**

### Pacemaker Magnet Application

<table>
<thead>
<tr>
<th>Pacemaker Manufacturer</th>
<th>Most Common Magnet Effect</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/Guidant CPI</td>
<td>Asynchronous pacing at 100 or 90 bpm</td>
<td>Yes</td>
</tr>
<tr>
<td>Intermedics</td>
<td>No sustained asynchronous pacing</td>
<td>No</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/Pacesetter</td>
<td>Asynchronous pacing at 86 - 100 bpm</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Defibrillator Magnet Application

<table>
<thead>
<tr>
<th>Defibrillator Manufacturer</th>
<th>Most Common Magnet Effect</th>
<th>Magnet Confirmation</th>
<th>Programmable (On-Off)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biotronik</td>
<td>Enables tachy therapy</td>
<td>none</td>
<td>No</td>
</tr>
<tr>
<td>Boston Scientific/Guidant CPI</td>
<td>Enables tachy therapy</td>
<td>Defibrillator will beep with each R wave or 1/second</td>
<td>Yes</td>
</tr>
<tr>
<td>Medtronic</td>
<td>Enables tachy therapy</td>
<td>none</td>
<td>No</td>
</tr>
<tr>
<td>Sorin</td>
<td>Enables tachy therapy</td>
<td>Change pacing rate to 90 bpm</td>
<td>No</td>
</tr>
<tr>
<td>St. Jude Medical/Pacesetter</td>
<td>Enables tachy therapy</td>
<td>none</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Implanted Cardiac Pacemaker and Defibrillator Management

This practice algorithm has been specifically developed for MD Anderson using a multidisciplinary approach and taking into consideration circumstances particular to MD Anderson, including the following: MD Anderson’s specific patient population; MD Anderson’s services and structure; and MD Anderson’s clinical information. Moreover, this algorithm is not intended to replace the independent medical or professional judgment of physicians or other health care providers. This algorithm should not be used to treat pregnant women.

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.
Implanted Cardiac Pacemaker and Defibrillator Management

This practice algorithm has been specifically developed for MD Anderson using a multidisciplinary approach and taking into consideration circumstances particular to MD Anderson, including the following: MD Anderson’s specific patient population; MD Anderson’s services and structure; and MD Anderson’s clinical information. Moreover, this algorithm is not intended to replace the independent medical or professional judgment of physicians or other health care providers. This algorithm should not be used to treat pregnant women.

DEVELOPMENT CREDITS

This practice algorithm is based on majority expert opinion of the Pacemaker work group for the management of Implanted Cardiac Pacemaker and Defibrillator patients at the University of Texas MD Anderson Cancer Center. It was developed using a multidisciplinary approach that included input from the following:

Margaret Bell, DNP, RN
Jean-Bernard Durand, MD
Olga N. Fleckenstein*
Daniel Gomez, MD
Kaveh Karimzad, MD
Darla Labasse, RN, BSN
Donelo Lopez Jr, MBA
Elie Mouhayar†, MD
Shirlene Tabao, MSN, RN, OCN*
Dilip Thakar, MD
January Tsai, MD

† Core Development Lead
* Clinical Effectiveness Development Team