Initial Experience with a Radiologist-Managed MR Imaging Cardiac Pacemaker Program in an Academic-Affiliated Community Hospital

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Introduction

The increasing number of patients undergoing pacemaker device implantation and the concordant rising demand for MR imaging led to the era of "MRI Conditional Pacing Systems".

These FDA-approved implanted pacemakers require dedicated practice measures to ensure patients are imaged safely.
Purpose

To describe our first year experience with a radiology-managed program in an academic-affiliated community hospital
Methods

- Based on published literature review, FDA- and vendor-approved guidelines and experiences at other medical centers, a protocol was developed for screening, enrolling and imaging patients.
- A Workflow Checklist* was created and approved by the hospital safety and quality committees.
- Only patients with Medtronic and Biotronic MRI-conditional pacing devices were approved for the program.
Workflow

Scheduling
Cardiology approval
Day of Appointment: Pre-scan clearance
Day of Appointment: During examination
Day of Appointment: Post-scan clearance
- Patient provides pacemaker ID card
- Documentation faxed to supporting cardiology group
Patient information reviewed by cardiologist
Cardiology Clearance Form** completed and reviewed by radiologist
Patient cleared for scheduling
Appropriate vendor-specific technician scheduled for patient’s appointment
Chest radiograph performed (if no prior within past 4 weeks) to:
- Determine device integrity
- Evaluate for abandoned leads
- Radiologist discusses risks and benefits with patient
- Patient evaluated by cardiologist and implanted device interrogated for historical pacing information and pacing status
- Upon approval by cardiologist, patient is programmed to MRI safe mode
MRI technologist confirms pre-scan checklist complete

- Appropriate scan parameters set based on Vendor specific device recommendations
- Patient monitored by continuous cardiac gating and pulse oximetry
- ACLS-certified radiology nurse remains present for study and cardiologist and radiologist available within 2 minutes of MRI suite
Day of Appointment: Post-scan clearance

- Cardiology technician interrogates device
- Cardiologist assesses patient and device report
- Patient converted back to pre-scan parameters
- Cardiologist clears patient for discharge
- Workflow checklist completed
**Workflow Checklist**

**MRI CONDITIONAL PACEMAKER CHECKLIST**

**PRE-SCAN CLEARANCE: CARDIOLOGY**

1. Completed Cardiology consultation and clearance form completed
2. Pacemaker interrogated and device programmed to MRI condition mode.

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**PRE-SCAN CLEARANCE: RADIOLOGY**

1. Cardiology clearance form reviewed.
2. Pacemaker has been implanted for more than 6 weeks.
3. MRI conditional pacemaker confirmed by Pacemaker ID card.
4. Risks, benefits and alternatives to MRI were discussed with the patient.
5. Chest x-ray: Yes or No Date: ____________
   - No lead extenders, lead adaptors or abandoned leads

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**DURING EXAM: RADIOLOGY**

1. Pacemaker ID card scanned into PACS.
2. Pacemaker programmed to MRI condition mode.
3. ECG or Oximeter applied to patient for continuous monitoring.
4. Whole body averaged SAR must be less than or equal to 2 W/kg, head averaged SAR less than or equal to 3.2 W/kg

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<th>Radiology TECHNOLOGIST:</th>
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**POST SCAN CLEARANCE: CARDIOLOGY**

1. Pacemaker interrogated and restored to pre-scan pacemaker settings.
2. Patient cleared by cardiology to return to unit/home.

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**Cardiologist Clearance Form**

**MR Conditional Pacemaker Cardiology Clearance Form**

Patient Name: ________________________
DOB: _______________________________

MRI Conditional Pacer System:

Implanted Pulse Generator:
Manufacturer: ________________ Model: ______________________
Lead #1:
Manufacturer: ________________ Model: ______________________
Lead #2:
Manufacturer: ________________ Model: ______________________

Patient has a complete MRI Conditional Pacer System  □ Yes  □ No
Device has been implanted more than 6 weeks ago  □ Yes  □ No
Patient is cleared to have device placed in MR-compatible mode  □ Yes  □ No

I have reviewed the Pacemaker ID card and confirm that the patient has an MRI conditional pacer system.

_________________________  ______________________  ____________________
Cardiologist Signature        Print Name                  Date/Time
Results

- **11 patients** with confirmed FDA-approved MRI conditional pacing devices enrolled into the program over a twelve month period

- MR Imaging exams included:
  - 5 MRI Brains
  - 2 MRI Lumbar Spines
  - 2 MRI Cardiac studies
  - 3 MRI Abdomens (one of which underwent two exams)

- All studies deemed medically necessary and technically optimal

- **No adverse events** were detected at the time of imaging, nor subsequently reported
Discussion and Conclusion

► MRI-conditional pacemaker device safety has been proven in the literature when used in accordance with vendor-specific imaging conditions
  ► I.E. 30 minute imaging time limitations with Biotronic device unlike Medtronic devices

► Growing demand for imaging patients with MRI-conditional pacing systems require imaging sites to develop a process to manage these patients safely

► We describe a program developed through successful collaboration between radiology and cardiology