

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

SAMANTHA SHANKAR MD,
KAROLY VIRAGH MD,
SERENA MAK MD,
GREGORY T. SICA MD MPH

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COLUMBIA UNIVERSITY
MEDICAL CENTER

NewYork-Presbyterian
Lawrence 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



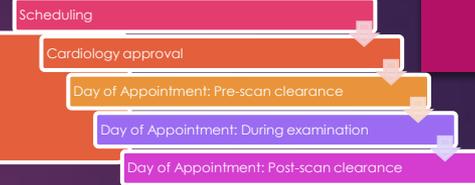
Scheduling



- ▶ Patient provides pacemaker ID card
- ▶ Documentation faxed to supporting cardiology group



Cardiology approval



- ▶ 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



Day of Appointment: Pre-scan clearance

Scheduling

Cardiology approval

Day of Appointment: Pre-scan clearance

Day of Appointment: During examination

Day of Appointment: Post-scan clearance

- ▶ 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**



Day of Appointment: During examination



- ▶ 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

Scheduling

Cardiology approval

Day of Appointment: Pre-scan clearance

Day of Appointment: During examination

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	Check List
1. Completed Cardiology consultation and clearance form completed	
2. Pacemaker interrogated and device programmed to MRI condition mode.	
Cardiologist: _____ Date: _____ Time: _____ am/pm Signature	
PRE-SCAN CLEARANCE: RADIOLOGY	Check List
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	
Radiologist: _____ Date: _____ Time: _____ am / pm Signature	
DURING EXAM: RADIOLOGY	Check List
1. Pacemaker ID card scanned into PACS.	
2. Pacemaker programmed to MR 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	
Radiology Technologist: _____ Date: _____ Time: _____ am / pm Signature	
POST SCAN CLEARANCE: CARDIOLOGY	Check List
1. Pacemaker interrogated and restored to pre-scan pacemaker settings	
2. Patient cleared by cardiology to return to unit / home.	
Cardiologist: _____ Date: _____ Time: _____ am/pm Signature	

**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

