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Cardiac MRI is safe in patients with pacemakers and defibrillators

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Background

MRI has generally been contraindicated in patients (pts) with pacemakers (PM) or defibrillators (ICD) due to concern of a variety of potential complications. Several recent series have suggested potential safety of MRI in pts with cardiac devices, but most excluded cardiac or thoracic imaging. Additionally there is very limited data on safety of CMR in pts with devices, especially in pts with ICD.

Methods

Pts with devices underwent CMR on a 1.5-T Siemens Avanto scanner utilizing a pre-specified protocol that involved device interrogation and programming prior to, and immediately after CMR to assess lead impedance, battery voltage, and pacing capture/sensing thresholds. Devices in PM dependent pts (intrinsic HR < 60 bpm) were reprogrammed to asynchronous pacing mode, whereas devices in non-PM dependent pts were reprogrammed to pacing function deactivated. All underwent rhythm, pulse oximetry, and visual monitoring during CMR. All pts were scheduled for follow up device interrogation to evaluate for later changes in device parameters. For hospitalized pts troponin levels were measured prior to and 8 hours after CMR.

Results

Seventy nine CMR exams were performed in 64 pts [26 men, age 64.7±14.2 years, 34 with PM, and 30 with ICD]. Of these, 47 exams [24 with PM, and 23 with ICD] were on inpatients who had troponin levels drawn before and after CMR. All pts underwent CMR without complications, specifically none complained of heating, and there were no malignant arrhythmias or device malfunctions noted. Follow up device interrogation was performed after 68 (86%) of the exams at 13.2 ± 20.8 days after CMR. No device complications were noted during the follow up period. Table 1 and Table 2 summarize the changes in device parameters. We detected no significant rise in troponin levels with CMR (0.046 ± 0.200 and 0.037 ± 0.132, p = 0.596 for pts with PM; and value

	Pacemaker			ICD		
	Pre-test	Post-test	*p*-value	Pre-test	Post-test	*p*-value
LI Atrium	445 ± 96	444 ± 96	0.7269	490 ± 108	491 ± 108	0.7289
LI Ventricle	478 ± 92	476 ± 93	0.1465	509 ± 153	503 ± 148	0.1030
Battery Voltage	2.79 ± 0.11	2.79 ± 0.11	0.3242	3.03 ± 0.21	3.02± 0.70	0.0010*
Atrial Capture	0.51 ± 0.13	0.52 ± 0.13	0.1846	0.44 ± 0.15	0.51 ±0.25	0.1425
Ventricular Capture	0.46 ± 0.12	0.51 ± 0.17	0.0192*	0.44 ± 0.22	0.45 ± 0.28	0.6914
Atrial Sense	1.98 ± 1.57	2.28 ± 1.82	0.0885	2.70 ± 1.75	2.58 ± 1.67	0.1078
Ventricular Sense	9.2 ± 4.7	9.3 ± 4.7	0.0139*	12.3 ± 6.6	12.0 ± 6.5	0.2170

Figure 1 Device parameters for PM and ICD measures before and immediately after CMR.

	Pacemaker			ICD		
	Pre-test	Follow up	*p*-value	Pre-test	Follow up	*p*-value
LI Atrium	435 ± 105	426 ± 109	0.0609	479 ± 96	442 ± 89	0.0785
LI Ventricle	465 ± 95	478 ± 126	0.4758	476 ± 90	466 ± 90	0.2036
Battery Voltage	2.80 ± 0.12	2.80 ± 0.11	0.1744	3.02 ± 0.22	3.01 ± 0.22	0.0187*
Atrial Capture	0.52 ± 0.14	0.70 ± 0.19	0.0004*	0.43 ± 0.52	0.51 ± 0.27	0.1644
Ventricular Capture	0.47 ± 0.15	0.75 ± 0.32	0.0007*	0.48 ± 0.25	0.53 ± 0.28	0.2973
Atrial Sense	1.76 ± 1.26	1.97 ± 1.41	0.4206	2.63 ± 1.60	2.29 ± 1.60	0.0023*
Ventricular Sense	9.58 ± 4.59	9.02 ± 4.01	0.1380	12.36 ± 6.75	11.42 ± 6.32	0.0517

Figure 2 Device parameters for PM and ICD measures at follow up compared with the pre-test values.

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0.099 ± 0.263 and 0.108 ± 0.247, p = 0.434 for pts with ICD).

Conclusions

Patients with PM or ICD may safely undergo CMR using a pre-designed protocol without any clinically meaningful change in device function.

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