

Electromagnetic Interference (EMI) of Implanted Cardiac Devices by MP3 Player Headphones

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Background: Potential MP3 player (iPod) interactions with pacemakers (PM) and implantable defibrillators (ICD) have received much attention. Yet, little is known about the effects of MP3 player headphones, most of which contain the magnetic substance, neodymium. A magnetic field strength of ≥ 10 gauss at the PM or ICD has the potential to interact with the device.

Methods: PM or ICD function was assessed in 60 pts during exposure to various headphones and iPods. Pts were monitored continuously via ECG and the device programmer. Abnormal device behavior was defined as oversensing, undersensing, inappropriate pacing, and reprogramming. Headphone magnetic field strength was also measured *in vitro*.

Results: No significant EMI from MP3 players was noted. However, device interference by headphones was documented in 14/60 (23%) pts (TABLE). Inappropriate (asynchronous) pacing was observed in 4/27 (15%) PM pts while inhibition of ICD detection occurred in 10/33 (30%) ICD pts. One PM pt experienced device reprogramming (1/27, 4%). Headphones with a measured magnetic field strength of ≥ 10 gauss at 2 cm were more likely to interact than those with lower magnetic strength (17/60, 28% vs. 1/60, 2%, $P < 0.0001$). EMI was not observed when headphones were placed ≥ 3 cm from the skin surface.

Conclusion: Clinically significant EMI can occur when headphones are placed in close proximity to implanted PMs and ICDs. *In vitro* measurements of headphone magnetic strength at 2 cm accurately predict clinical interaction with implanted devices. The magnetic strength of headphones varies depending on the model and design. Device pts should be advised to keep headphones at least 3 cm from their device.

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TABLE

MP3 Player Headphone Clinical Interactions with PM-ICD					
Brand	Model/ Type	Magnetic Field Strength (gauss)*	Clinical Interactions		
			PM (n=27)	ICD (n=33)	Total (n=60)
Sony	MDR-Q22LP (clip-on)	20	4 (15%)	10 (30%)	14 (23%)
Phillips	SBC HS430 (clip-on)	10	2 (7%)	1 (3%)	3 (5%)
Phillips	SHE5920 (in ear)	4	0	0	0
Bose	In ear	4	0	0	0
Sony	MDR-E828LP (in ear)	3	0	0	0
JVC	HA-F130-A (in ear)	2	0	1 (3%)	1 (2%)
Apple	In ear	2	0	0	0
JVC	HA-FX33-A (in ear)	0	0	0	0
Total			4 (15%)	10 (30%)	14 (23%)
* At 2 cm from Gaussmeter					