Electromagnetic interference induced by magnetic resonance imaging

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A 76-year-old man with a biventricular implantable cardioverter defibrillator (ICD) implanted for secondary prevention underwent a magnetic resonance imaging (MRI) scan of the head. The 1.5 T MRI was performed to guide 'gamma-knife' surgery for intractable Parkinsonian tremor. Device therapies were switched off during the procedure. On investigation of the device at follow-up, the device electrograms were noted to demonstrate a unique and intriguing pattern (Figure 1).

Analysis of the local right ventricular apical electrogram (upper tracing) revealed the following two dissociated patterns:

- High-amplitude spikes at a regular interval of 1560 ms; and
- Clusters of high-frequency spikes (20 ms to 40 ms apart) that progressively increased in amplitude, then dissipated. Each cluster persisted for 960 ms and they were separated by isoelectric intervals of approximately 400 ms. This pattern was presumably generated by the oscillating magnetic pulse during scanning. The far-field electrogram (lower tracing) showed a rapid series of sinusoidal deflections concordant with the clusters described above. The ICD inappropriately diagnosed the interference as ventricular fibrillation (device annotations below tracings) based on rate.

No residual effects on device function or lead integrity were noted following the procedure.

Current barriers to performing MRI in patients with ICDs include under/oversensing, thermogenic damage, device malfunction and inappropriate recognition of electromagnetic interference that may lead to unnecessary ICD therapies. Recent research (1) has demonstrated the improved safety of a new pacemaker system designed to minimize complications from MRI.

The present image illustrates a cause of ICD malfunction during MRI exposure and emphasizes the importance of further research into developing MRI-safe devices.

DISCLOSURE: Dr Baranchuk has received honoraria from Medtronic, Boston Scientific and St Jude Medical for delivering conferences.

REFERENCE

1. Wilkoff BL, Sommer T, Taborsky M, et al. Worldwide randomized clinical trial to evaluate new pacemaker system designed for use during magnetic resonance imaging. LBCT I. Heart Rhythm 2009. Boston, May 13 to 16, 2009.

Figure 1

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