Heating Safety from MRI Radiofrequency Energy Demonstrated in Variety of Simulated Spinal Cord Stimulation Scenarios

March 6, 2014, Phoenix, AZ -- Scientific investigators demonstrated the conditional heating safety of a new spinal cord stimulation (SCS) lead designed to be compatible with magnetic resonance imaging (MRI) across a range of clinical scenarios. The results presented in a scientific poster today at the 30th Annual Meeting of the American Academy of Pain Medicine are expected to have implications for improved patient safety and access to MRI.

The radiofrequency (RF) field in an MRI causes a rise in temperature at the electrode of an implanted medical lead. Heating safety during MRI is complex and requires complete understanding of the MRI system, lead behavior and individual patient characteristics, study authors said. The confirmation of their model’s ability to accurately predict RF electrode heating (i.e., temperature changes) in animals provides confidence in the ability to predict heating in patients, the authors said.

"This work was used to demonstrate safety for the first FDA-approved, full-body MRI, conditionally-safe SCS system," said lead study author Heather Orser, PhD, principal electrical engineer with the Neuromodulation business of Medtronic (NYSE: MDT), a medical device company based in Minneapolis that funded the study. “Approval of the system allows SCS patients safe access to the diagnostic benefits provided by MRI for scans of any part of the body.”

The research team implanted leads and temperature probes in the spinal canals of anesthetized pigs, then scanned them in a 1.5T MRI system at multiple landmarks. The animal model simulations were then compared to animal electrode temperature measurements to confirm model accuracy.

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Next, researchers sought to simulate the electromagnetic effects that occur due to variations in human morphology using several MRI coils. They performed simulations for hundreds of clinical lead paths in each human model, combining the results with lead characterization analyses to predict the temperature rise at the electrodes in the spinal cord for each patient situation.

While the rises in temperature varied significantly across 10,000 different patients, device scenarios and MRI scenarios, the resulting temperature predictions demonstrated that a lead designed for reduced RF heating produced temperatures below 43 °C for the full range of implant scenarios during 30 minutes of active scanning.

*Poster 147 – Predicting MRI Radiofrequency (RF) Heating Risks in Spinal Cord Stimulation (SCS) Patients*

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