Every year in the United States, millions of pets are lost or abandoned by their owners, causing shelters and rescue agencies to struggle with increasing numbers of unclaimed pets and decreasing resources. In the Knoxville area, 1 animal center took in 15,750 animals in 2010.\(^1\) In addition, lack of identification is a common factor leading to the euthanasia of animals in the United States,\(^2\) which indicates a need for the use of a reliable and cost-effective identification system, such as implanted microchips. The implantation of a microchip can help a lost pet to be reunited with its owner.\(^3\)\(^4\)

In the past few years, there has been an increase in the number of pets implanted with microchips. Also, advances in medical technology have made MRI more available and relevant to veterinary medicine. Both procedures involve the use of radio waves with various frequencies. Microchip marketing companies in the United States use carrier frequencies of 125, 128, or sometimes 134.2 kHz.\(^5\) In most other countries, microchips operate at a frequency of 134.2 kHz, as instituted by the International Organization for Standardization.\(^6\) Magnetic resonance imaging scanners operate on various radio frequencies depending on the strength of the scanner (in units of Tesla). A 1.0-T MRI unit has a core frequency of 42.57 MHz.

Magnetic resonance imaging units are surrounded by a magnetic field and are shielded to protect from ferromagnetic matter, both for safety and to decrease imaging interference. Microchips currently implanted in pets in the United States have a ferrite core with a radio frequency microtransponder which is bonded to a copper antenna.\(^7\)\(^8\) There is potential for damage to ferromagnetic components of microchips because of exposure to the magnetic environment within an MRI suite.\(^7\) Microchips are activated by radio frequency pulses emitted from a microchip scanner. A unique number is transferred to the scanner through deflected radio frequency pulses and is read and displayed by the microchip scanner. The number of the chip is registered by the owner in a database with the owner’s contact information, linking owner and pet.\(^7\)\(^8\)

As the use of MRI as a diagnostic imaging modality increases and the number of patients with implanted microchips increases, it is important to examine whether there is potential for interference between the radio frequency pulses used in each procedure or damage to the ferromagnetic components of the microchip from the magnetic environment. To our knowledge, there are currently no independent clinical studies that indicate whether MRI interferes with the functionality or the life of a microchip. However, some major microchip manufacturers\(^9\)\(^10\) will guarantee the function of an implanted microchip for the life of the animal. The purpose of the study reported here was to determine whether MRI with a 1.0-T magnet affects the functionality of microchips implanted in small animal patients.

**Materials and Methods**

The experimental protocol was approved by the Institutional Animal Care and Use Committee of the Uni-
Results

Of the 53 patients, there were 2 cats and 51 dogs. Twenty-one patients underwent MRI of the brain, and 23 patients underwent MRI of the spine. Of those 23, 6 dogs had imaging of the cervical spine, 10 dogs had imaging of the thoracolumbar spine, and 7 dogs had imaging of the lumbosacral spine. Seven of the dogs undergoing spinal MRI were administered contrast medium IV, and additional T1-weighted spin echo with fat suppression scans were completed. The mean image scan time was longer in patients requiring contrast administration and postcontrast imaging. The additional image scan time ranged from 6 to 12 minutes, depending on the size of the animal and the area to be imaged. The mean scan time for patients undergoing MRI of the brain was 42 minutes (median, 42 minutes; range, 39 to 46 minutes) including postcontrast imaging. Five patients had 2 sites imaged, with a mean image scan time of 84.6 minutes (median, 83 minutes; range, 75 to 99 minutes). One patient had 3 areas imaged, with an image scan time of 155 minutes. Three patients had other areas scanned, including bilateral shoulder joints, bilateral brachial plexus, and right stifle. The mean image scanning time for these 3 patients was approximately 43 minutes (median, 41 minutes; range, 28 to 60 minutes). The mean scan time for all patients was 33 minutes (median, 45 minutes; range, 21 to 135 minutes).

In each of the 53 clinical cases, the patient’s microchip number before MRI matched the recorded number after MRI. These data indicate that the site of imaging, mean MRI scan time, brand or frequency of microchip, patient age, or patient weight did not affect the function of the microchip. In addition, we did not identify any malfunctioning microchips in the patients that received repeated MRI. This indicated that MRI did not interfere with the functionality of the implanted microchips.

Discussion

The results of the present study indicated that MRI with a 1.0-T magnet in small animal patients did not interfere with the functionality of the microchips tested. Another study of microchip function after implantation in dogs and cats not undergoing MRI indicated that microchip failure rate could be 0.4%. The information reported here is important to eliminate MRI as a potential cause for microchip failure. The results are useful for veterinarians recommending MRI to their clients and also for the thousands of owners whose pets have an implanted microchip which have already undergone MRI.

Although providing valuable information, the present study had several limitations. We did not collect information on the age of the microchip (ie, the length of time each pet had been implanted with the microchip). Also, we examined patients during a short portion of the life of the pet and microchip. Some of the patients underwent >1 MRI; however, all imaging procedures were completed within a 3-month period and no follow-up testing was completed. Consequently, the longevity of the microchips was not examined. An additional limitation is the strength of the magnet. This study was conducted with the 1.0-T MRI unit at our institution. Currently, clinical veterinary MRI units range in strength from 0.2 to 3.0-T. The effect of higher-strength MRI units on microchip functionality was not investigated in the present study. Finally, the sample size of 53 patients was very small. Similar studies of implanted microchips set in shelter environments have collected data for thousands of animals. It may be useful to examine a larger sample size in the future, but this will always be limited by clinical case load for this type of study. A recent study reported the occurrence of imaging artifact caused by microchip implantation, microchip migration, and damage to the tissues surrounding an implanted microchip following MRI. The authors found the incidence of susceptibility artifact (ie, focal signal void and image distortion) to be 100%, with no evidence of microchip migration. The damage to surrounding tissues was negligible. Future studies with stronger MRI scanners and larger numbers of cases are suggested. However, the results of the present study indicate that MRI with a 1.0-T magnet is not a potential cause for microchip failure, which is valuable information for practitioners recommending MRI for their patients and for clients who have invested in implanting a microchip in their pets.

a. American Veterinary Identification Devices (AVID), Norco, Calif.
b. Home Again, East Syracuse, NY.
References


Effect of environmental conditions on degree of hoof wall hydration in horses
Brian A. Hampson et al

Objective—To determine the effect of various environmental conditions on the degree of hydration in hoof wall horn tissue from feral horses and investigate the effect of short-term foot soaking on moisture content in hoof wall and sole tissue in domestic horses.

Animals—40 feral horses from 3 environments (wet and boggy [n = 10], partially flooded [20], and constantly dry desert [10]) and 6 nonferal Quarter Horses.

 Procedures—The percentage of moisture content of hoof wall samples from feral horses was measured in vitro. In a separate evaluation, the percentage of moisture content of hoof wall and sole tissue was measured in the dry and soaked forefeet of Quarter Horses.

Results—Mean ± SD percentage of moisture content was 29.6 ± 5.1%, 29.5 ± 5.8%, and 29.5 ± 2.9% for feral horses from the wet and boggy, partially flooded, and constantly dry desert environments, respectively. Moisture content did not differ among the 3 groups, nor did it differ between dry and soaked hoof wall samples from nonferal horses. However, soaking in water for 2 hours resulted in a significant increase in the percentage of moisture content of the sole.

Conclusions and Clinical Relevance—Environmental conditions did not appear to affect moisture content in the hoof wall horn. Soaking horses’ foot regularly in water would be unlikely to change the degree of hydration in the hoof wall horn but may further hydrate the sole. (Am J Vet Res 2012;73:435–438)