Evaluation of microchip migration in horses, donkeys, and mules

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Microchips used for identification of animals were first developed in 1978 for surgical implantation into horses and reported in the literature in the early 1980s as different applications evolved. A microchip is an electronic identification device that does not have an internal power source, measures 12 mm × 2.1 mm, weighs 0.06 g, has a life expectancy of >1,000,000 read activations, and consists of an integrated circuit programmed with a unique identification number attached to an antenna. This electronic subassembly is hermetically sealed in biocompatible glass and coated with an FDA-approved biostable coating for medical applications, which acts as a tissue interface. Cells readily proliferate on the coated microchip, and thin adherent layers of morphologically normal tissue are formed that likely assist in stopping the microchip from migrating. The microchip is packaged in a 12-gauge needle, sterilized, and attached to a syringe or delivery gun for implantation. Low-frequency radio signals (125 kHz) transmitted by microchip readers are picked up by the microchip antenna and activate the microchip. The current generated by inductive coupling powers the integrated circuit containing the unique identification code, which then transmits the identification number to the reader for validation and display, which takes <0.04 seconds.

A number of studies have been published in the scientific literature describing use of microchips for identification in many species, including monkeys; rats; rabbits, guinea pigs, woodchucks, and amphibians; cattle; dogs and cats; and horses. Nonscientific reports discourage use of microchips for identification of horses because of migration of the microchip from the implantation site, difficulty in locating the microchip for identification purposes, and lack of availability of a universal microchip reader that is capable of reading the different types of microchips. Horse owners, especially racehorse owners, are also concerned that microchips may migrate to locations that would hinder normal performance.

The purpose of the study reported here was to determine if microchips used for identification migrate after implantation in horses, donkeys, and mules.


designed study.

Animals—53 horses, donkeys, and mules.

Procedure—Twenty horses that had had microchips implanted in the nuchal ligament at a veterinary teaching hospital from 1996 through early 2000 were included (group 1), and the poll-to-withers distance and location of the microchip were determined, measured, and recorded. Additionally, the poll-to-withers distance was measured in 16 horses, 12 donkeys, and 5 mules (group 2), and microchips were implanted in the nuchal ligament on the left side of the neck. Forty-two to 67 days after implantation, the location of the microchip was determined, measured, and recorded.

Results—Microchips implanted in the nuchal ligament ≤4 years previously did not migrate. All microchips were detected with a multimode identification tag reader from the left side of the neck in the midcervical region, and microchips were located at the midpoint between the poll and withers for all 53 horses, donkeys, and mules.

Conclusions and Clinical Relevance—Microchips implanted in the nuchal ligament ≤4 years earlier did not migrate in horses. Microchips may be useful for identification in horses. (J Am Vet Med Assoc 2003; 223:1316–1319)
either side of the neck with the multimode ID tag reader, a range reader, except it is not able to read microchips that are presently sold in the United States as well as other microchips that are used predominantly in Europe and made by other manufacturers. Because the purpose of the study was to consider long-term stability of the site of the microchip, a subset of group 1 consisting of horses that had microchips implanted 2 to 4 years before the study was analyzed separately.

Twenty-six adult and 7 juvenile horses, donkeys (mini, standard, and mammoth), and mules that were scheduled to have microchips implanted were also included in the study (group 2). Animals were measured from the poll to the withers on the left side of the neck by use of an aluminum meter bar or a seamstress cloth-coiled tape. Measurements obtained by use of a cloth tape were more accurate than those obtained with the aluminum meter bar when the animal’s neck was flexed. Many of the animals became alert and jumped when the aluminum meter bar was used; therefore, initial measurements for 7 animals in group 2 were obtained with the cloth tape before implantation of the microchip, and subsequent measurements for all animals in both groups were obtained with the cloth tape. After the initial measurement was obtained, the midpoint of the poll-to-withers distance was located, and the implantation site was cleansed with isopropyl alcohol. The microchip was implanted into the nuchal ligament on the left side of the neck 2.54 cm below the dorsal midline perpendicular to the skin surface with a pistol-type delivery system. Certain animals moved or jumped during implantation. Immediately after implantation, the microchip was read from the left and right side of the neck with a multimode ID tag reader. If a microchip could not be read at all or from either side of the neck with this reader, a multimode extended range reader was used. For animals in groups 1 and 2, if the microchip could not be read in the midsection of either side of the neck with the multimode ID tag reader or the multimode extended range reader, the poll-to-dot distance (measured from the poll to the location of the microchip, measured from the poll to the location of the microchip) and the poll-to-dot distance, at the final measurements were 38.19 ± 7.55 cm for group 1 and group 2, and 7.55 cm for group 2, and 7.90 cm for group 1 and group 2, respectively. Breeds of horses in size than horses, and a potential use of microchips is for the identification of racehorses, data were analyzed for horses alone; for all horses, donkeys, and mules in groups 1 and 2, and for each group separately. Statistics were performed by use of a computer software program. A value of P < 0.05 was considered significant for all comparisons.

Results

Three of 12, 7 of 14, and 10 of 10 horses in group 1 that had microchips implanted in 1996, 1998, and 2000, respectively, were located. Breeds of horses in group 1 included Appaloosa (n = 1), Arabian (2), Oldenburg (1), Paint (4), Quarter Horse (4), Tennessee Walking Horse (2), and Thoroughbred (6). There were 16 horses (Pony of the Americas [n = 2], Quarter Horse [5], and Paint [9]), 12 donkeys, and 5 mules in group 2, of which 3 horses (1 Quarter Horse and 2 Paints), 3 mules, and 1 donkey were juveniles.

Mean ± SD values for the location of the microchip, measured from the poll to the location of the microchip (poll-to-dot distance), at the final measurement were 38.19 ± 7.55 cm for group 1 and group 2, combined, 35.79 ± 7.55 cm for group 2, and 42.15 ± 5.80 cm and 37.44 ± 7.90 cm for group 1 and horses alone in group 2, respectively. There was no significant difference between the mean ± SD values for half of the poll-to-withers distance (expected location of the microchip) and the poll-to-dot distance (measured location) for group 1 and group 2 combined (P = 0.10) and horses in group 2 (P = 0.46). However, there was a significant difference between the poll-to-withers distance and poll-to-dot distance of 1.31 cm (P = 0.003) for all horses in groups 1 and 2 and 2.03 cm (P = 0.002) for group 1. There was no significant difference between the poll-to-withers distance and poll-to-dot distance between the horses in group 1 that had microchips implanted 2 to 4 years before the study and those in group 1 that were implanted months before the study (P = 0.47).

Microchips in all horses in group 1 were detected at the midcervical region with a multimode ID tag reader from the left side of the neck (Table 1). This reader detected microchips in 16 of 20 horses from the right side of the neck, and all 20 microchips were because the orientation of the microchip antenna to the reader can cause variation in read distances. More precise measurements would require use of computer tomography or tissue dissection.

Statistical analyses—Descriptive statistics were performed on the data. Confidence intervals for rates of success in locating the microchip with the multimode ID tag reader were determined by use of the normal approximation to the binomial distribution or by the exact binomial distribution for those too close to 100% for the normal approximation to be valid. Horses that had microchips implanted from 1996 to 1998 (2 to 4 years before the study) were analyzed separately. The measured location of the microchip was compared with half the poll-to-withers distance (ie, the expected location) for all animals in groups 1 and 2 and all horses in groups 1 and 2 by use of a paired t test if the assumptions were met, and a Wilcoxon signed-rank test if the assumptions were not met. If differences were found, further tests (t test or Wilcoxon signed-rank test) were performed on subsets to determine where there were differences from the expected location. Because donkeys and mules were smaller in size than horses, and a potential use of microchips is for the identification of racehorses, data were analyzed for horses alone; for all horses, donkeys, and mules in groups 1 and 2, and for each group separately. Statistics were performed by use of a computer software program. A value of P < 0.05 was considered significant for all comparisons.

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detected from the right side of the neck by 1 of the multimode extended range readers. The 2 horses that required use of the multimode extended range reader to detect the microchip from the right side of the neck had thick dorsal neck areas. All microchips in the 10 horses in group 1 that had microchips implanted 2 to 4 years before the study were detected with a multimode ID tag reader from the left side of the neck. In those horses, 9 microchips were detected with the multimode ID tag reader on the right side of the neck, and all 10 microchips were detected from the right side of the neck by the multimode extended range reader. Because the ability to detect microchips after an extended period of time was important, 95% confidence intervals for those 10 horses in group 1 were calculated.

Immediately after implantation, microchips in all horses, donkeys, and mules in group 2 were detected in the midcervical region from the left side of the neck with the multimode ID tag reader. This reader detected microchips in 28 of 33 animals and 16 of 16 horses from the right side of the neck immediately after implantation. The 5 animals with microchips that could not be read from the right side of the neck with this reader were donkeys with extremely thick dorsal neck areas. Two of the microchips in those donkeys could be read with a multimode extended range reader, and 3 could not. During the final reading, microchips in all horses, donkeys, and mules could be read from the left side of the neck with the multimode ID tag reader. This reader detected microchips in 29 of 33 animals and 16 of 16 horses from the right side of the neck, including 1 that could not be read by the multimode extended range reader immediately after implantation. Microchips were detected in the remaining 4 animals with the other multimode extended range reader.

Because all microchips in all horses, donkeys, and mules could be read from the right side of the neck by a multimode extended range reader, the 95% confidence intervals were the same as those for a multimode extended range reader immediately after implantation. The 2 horses that could not be read from the right side of the neck by 1 of the readers were used to detect implanted microchips in this study, and previous experience suggested that 1 of the readers had an ability to read microchips from a slightly greater distance than the other. However, because only 3 microchips could not be read from the right side of the animals' neck by the multimode extended range tag reader, the sample size was small, and no significant difference was detected between the 2 multimode extended range readers.

Because there was no significant difference between the mean values for half of the poll-to-withers distance (expected location) and the poll-to-dot distance (measured location) of the microchip between the 10 horses in group 1 that had microchips implanted 2 to 4 years before the study and the 10 horses that had microchips implanted 2 to 4 years before the study, the significant difference of 2.03 cm between the poll-to-dot distance and half the poll-to-withers distance in group-1 horses may have been caused by the method of implantation in which half the poll-to-withers distance was estimated before the microchip was implanted and may not have been caused by movement of the microchip. Moreover, although the difference of 2.03 cm was significant, it was not important because all readers found the microchips in the midcervical region. Also, the precision of the method of location of the microchip by the readers is unknown; however, orientation of the microchip antenna to the reader causes variation in read distances.

Discussion

Before September 1996, the injection triangle, an area on the side of a horse's neck bounded dorsally by the accessory nerve, ventrally by the bodies of the cervical vertebrae, and caudally by the subclavius muscle, was the recommended site for microchip implantation in horses. Because of concerns about the microchip...
microchips that were implanted in horses, donkeys, and mules in this study were detected and read regardless of variations in implantation techniques (estimated or measured) or the animals' responses during the implantation procedure. Results of studies with larger numbers of animals are not yet known.

References

New Veterinary Biologic Products

<table>
<thead>
<tr>
<th>Product name</th>
<th>Species and indications for use</th>
<th>Route of administration</th>
<th>Remarks</th>
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<tr>
<td>West Nile Virus Antibody, Equine Origin (Novartis Corp, US Vet Lic No. 303)</td>
<td>For use in yearling and older horses as an aid in the control of disease caused by West Nile virus</td>
<td>IV</td>
<td>USDA conditionally licensed 8/7/03</td>
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