Effects of Local External Magnetotherapy on the Appearance of Equine Metacarpal Skeletal Scintigraphy Images

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The local magnetotherapy device evaluated in this investigation did not affect the subjectively assessed appearance of soft-tissue-phase or bone-phase scintigraphic images of the metacarpus. It should not interfere with diagnostic scintigraphy. Authors’ addresses: Dept. of Small Animal Clinical Sciences (Roberts, Graham, and Newell); Dept. of Large Animal Clinical Sciences (Colahan); and Dept. of Statistics (Jones), College of Veterinary Medicine, University of Florida, Gainesville, FL 32610. © 1999 AAEP.

1. Introduction
Magnetotherapy has been proposed to have possible uses for the treatment of various musculoskeletal injuries.1 The exact mechanism of action of magnetic fields on living tissues is unknown. The effect of magnetotherapy on equine extremities has been evaluated with thermography and scintigraphic techniques.2–4 There are conflicting reports on the effects of magnetotherapy on scintigraphy imaging.2,3 With the use of magnetotherapy devices apparently increasing among our equine clientele, the possibility of misdiagnosis based on scintigraphy images is a concern. This study was designed to evaluate the effects of a magnetotherapy device on the appearance of skeletal scintigraphic images.

2. Materials and Methods
Six Thoroughbred horses without orthopedic problems in the regions of the metacarpis and metacarpophalangeal joints were chosen for this crossover study with repeated measures. The horses were boarded in approved nuclear medicine holding stalls during the days imaging was performed. They were placed in paddocks once the radiation levels declined.

The magnetic device tested was a commercially available magnetotherapy fetlock wrap that incorporated 30 2950-gauss ceramic magnets. The control wrap was identical in configuration; however, it incorporated 30 nonmagnetized ceramic disks.

A baseline scintigraphy examination was performed. The horses were then randomly assigned to two treatments: magnetic wrap on the left forelimb and placebo wrap on the right forelimb, or magnetic wrap on the right forelimb and placebo wrap on the left forelimb. During each treatment, wraps were removed immediately before imaging and replaced at the end of image acquisition. Images were obtained 24 and 96 hours after the wraps were placed on the limbs. After 96 hours, wraps...
were removed for 1 week. Treatment and control limbs were reversed, and images again were obtained 24 and 96 hours after the wraps were placed. Clinical investigators were blinded to treatment and control limbs.

Each horse was catheterized in the jugular vein for the scintigraphy examinations. Each horse was injected with 130 to 140 mCi of technetium 99m methylene diphosphonate (99mTcMDP) and soft-tissue images of the metacarpus were obtained starting 3 minutes after injection. A radioactive marker was placed 15 cm distal to the point of the accessory carpal bone on the first image of each study to ensure accurate reproducibility of location of the region of interest (ROI). Four lateral soft-tissue-phase images were acquired in the sequence left limb, right limb, right limb, left limb or the reverse. Three hours after injection, lateral and dorsal bone-phase images were also acquired.

Manual ROIs were determined on the lateral images (three ROIs: proximal metacarpus, distal metacarpus, and metacarpal condyles) and on the dorsal images (two ROIs: proximal metacarpus and distal metacarpus). The first two soft-tissue images of each series were chosen for analysis. Each ROI was the mean of three measurements. Subtle differences in overall limb activity were noted on subjective evaluation of the images. When a difference was noted, the limb with greater activity in the region of the metacarpophalangeal joint was recorded. Pairwise comparisons were made of detectable differences. ROIs were compared directly and as ratios of distal to proximal ROIs.

3. Results

Soft-tissue-phase images and lateral bone-phase images showed no significant difference in the limbs for treatment, period, time or time-treatment interaction. Dorsal bone-phase images showed no significant difference in the limbs for period, time or time-treatment interaction. Treatment had a small but statistically significant effect on dorsal bone-phase images; the leg with the magnetic wrap had less activity than the control limb \( (p = 0.0185) \). This effect was not detectable when images were evaluated subjectively and fell below the average variation in total activity in the ROI and in counts per pixel for each ROI seen on comparison of the same ROI in the same horse on the 4 scintigraphy scans after wraps were placed on the limbs.

4. Discussion

The results of our study agree with those of a recent study showing no effect of a magnetic pad on circulation in the equine metacarpus. We could find no detectable increase in activity on either soft-tissue-phase or bone-phase images. Because our major concern was misdiagnosis in clinical cases, we used 99mTcMDP to mimic the actual conditions under which horses are examined in our hospital. We used the quantitative scintigraphy technique of target-to-nontarget ratios to remove the variables of dose of radiopharmaceutical, gamma camera positioning and number of pixels in the ROI.

Paradoxically, in the current study we saw a statistically significant decrease in the activity observed on dorsal bone-phase images in the limb with the magnetotherapy device, but a similar effect was not seen on lateral images. However, this change was not detectable subjectively, and its magnitude was well within the normal variation seen on repeated scintigraphic examinations of the same horse in this study. We conclude that there is no subjectively detectable effect of the tested magnetotherapy device on soft-tissue-phase or bone-phase scintigraphic images of the equine metacarpus.

References