Clinical, histologic, and bacteriologic findings in dairy cows with digital dermatitis (footwarts) one month after topical treatment with lincomycin hydrochloride or oxytetracycline hydrochloride

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**Objective**—To compare the effectiveness of lincomycin and oxytetracycline for treatment of digital dermatitis (DD) in dairy cows through gross visual examination, histologic evaluation, and bacteriologic evaluation.

**Design**—Randomized controlled clinical trial.

**Animals**—25 cows with DD lesions from a commercial Holstein dairy herd.

**Procedures**—Cows with DD lesions were randomly assigned to 1 of 3 groups: topical treatment with 10 g of lincomycin hydrochloride (n = 11), topical treatment with 10 g of oxytetracycline hydrochloride (11), and no treatment (3) on days 1 and 2 (d1). Biopsy specimens were obtained for histologic examination from DD lesions prior to treatment and 28 or 31 days (d30) after treatment for histologic examination. Cows were clinically examined on d1, days 12 or 14 (d14), and d30.

**Results**—No difference was evident in clinical responses to lincomycin and oxytetracycline, so data were pooled; at d30, 8 of 11 of lincomycin-treated lesions and 7 of 11 oxytetracycline-treated lesions appeared visually healed, respectively. Gross visual examination suggested 73% (16/22) of treated cows were healed at d14 and 68% (15/22) of treated cows were healed on d30. Of the 15 lesions that appeared healed on d30, 7 of 15 were classified histologically as active (ulceration and bacterial invasion; 2/15) or incipient (5/15).

**Conclusions and Clinical Relevance**—Clinical responses to lincomycin and oxytetracycline did not differ. Agreement was good between gross visual and histologic assessments of DD lesions before treatment; agreement 1 month after treatment was variable. Histologic evaluation could not distinguish incomplete healing from lesion recurrence. (*J Am Vet Med Assoc* 2010;237:555–560)

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**Abbreviations**

- CI: Confidence interval
- DD: Digital dermatitis
- GEE: Generalized estimating equation

Digital dermatitis, also known as papillomatous DD or footwarts, is a worldwide, contagious, painful dermatitis affecting the feet of cattle, typically resulting in clinical lameness, reduced milk production, and decreased reproductive efficiency. The precise etiology of DD is unknown, although several novel Treponema spp appear to play a major role in its pathogenesis. Common treatments include chemical disinfectants and extralabel use of antimicrobials applied under a bandage as a paste, as a topical spray, or as footbath additives.

No antimicrobials are currently approved for treatment of DD in the United States. Lincomycin and oxytetracycline are reportedly effective treatments, when applied topically as a spray or under a light bandage. Recurrence of lesions after antimicrobial treatment reportedly ranges from 48% to 60% by 49 to 100 days after treatment. Few studies have involved following treated cattle to determine recurrence rates or the mechanisms of recurrence of DD lesions after antimicrobial treatment. The objectives of the study reported here were to determine whether lincomycin was as effective as oxytetracycline in the treatment of DD lesions, whether results of gross visual assessment of treated and untreated DD lesions agreed with results of histologic evaluation, and whether epidermal flora from DD lesions was similar to the flora of healthy digital skin.

**Materials and Methods**

**Cows and case definition**—Twenty-five cows from a commercial free stall–housed, 1,200-cow Holstein dairy herd with a high (approx 45%) prevalence of DD were enrolled in the study. A cow was deemed as affected with DD when it had solitary or multiple digital skin lesions with diagnostic pathological features as described elsewhere. A healed lesion was defined as grossly healed skin on the originally affected foot. Footbaths and individual cow treatments were not used on this dairy during the study. The study protocol was...
approved by an institutional animal care and use committee, and owner consent was obtained.

**Experimental procedure**—Cows with DD were identified by examining the hind feet after cleaning with a water hose during milking from the side in the herringbone-style parlor. Eligible cows had apparently painful, characteristic gross lesions of DD as described elsewhere.10 Existence of pain was assessed by spraying water from the hose directly on the lesions. The following 2 days (baseline; day 1), enrolled cows were separated for treatment upon leaving the parlor. Each cow was positioned on a hydraulic tilt table. Lesions (including the interdigital space) were washed with water from a hose with a nozzle, and lesions were visually scored according to severity as follows: 0 = no visible lesion; 1 = early, ulcerative, flat lesion; 2 = intermediate, raised, ulcerative, granular-appearing lesion; 3 = proliferative, raised lesion with early papillae formation; and 4 = highly proliferative, raised lesion with advance papillae formation. The scoring system was not validated as such but was based on gross pathological observations and was used by our research group in a previous study.11 Visual lesion scores were also reevaluated by the senior author prior to statistical analysis. Photographs were taken of all lesions by use of a 100-mm macro lens at 1:4 magnification.

Prior to enrollment of cows, a random number generator5 was used to generate a list of 25 random values (3 for the control group, 11 for the oxytetracycline group, and 11 for the lincomycin group), and the values were sorted from smallest to largest. Cows were assigned to 1 of the 3 treatment groups from the sorted list of random numbers as they entered the chute for treatment on days 1 or 2 of the study. Cows were subsequently treated as follows: topical treatment with 10 g of lincomycin HCl soluble powder7 (n = 11 cows), topical treatment with 10 g of oxytetracycline HCl soluble powder7 (11), or no treatment (3; control group). Prior to the onset of the trial, it was agreed that only 3 cows would be allocated to the control group to minimize the number of cows not receiving potentially useful medication yet still providing a control group for comparisons.

For treatments, lincomycin or oxytetracycline was mixed with sufficient deionized water (3 to 4 mL) to create a paste and applied to 10 × 10-cm gauze, placed on the lesion, and held in place with a bandage. Control cows had their feet bandaged after biopsy specimen collection but did not receive any antimicrobial. Dairy personnel were instructed to remove all bandages 4 days after application.

Cows were reexamined on the hydraulic tilt table on days 14 and 30 after treatment application; lesions and healed lesion sites (including the interdigital space) were washed with water from a hose with a nozzle, visually scored, and photographed. On day 30, biopsy specimens were collected from the same sites as day 1 for histologic examination and bacteriologic evaluation. All untreated lesions in control cows were treated at the conclusion of the study on day 30.

**Histologic evaluation**—Lesions from each of the 25 cows were anesthetized locally with 2% lidocaine, and 6-mm-diameter, full-thickness punch biopsy specimens from lesions were collected and placed in neutral-buffered 10% formalin. The specimens were routinely paraffin embedded, sectioned at a thickness of 4 μm, and stained with H&E and Steiner silver to allow visualization of bacterial morphology.12

Histologic evaluation consisted of scoring the samples on the basis of degree of activity (0 = absent; 1 = focal; 3 = segmental; and 5 = continuous) of the pathological criteria for diagnosing DD, namely ulceration, invasion of the stratum spinosum and papillary dermis by spirochete-dominant bacteria, and reactive inflammation. Each process was interdependent and was therefore given equal weight to yield a total histologic score. Grading consisted of arbitrary assessment of the extent and intensity of each pathological criterion.

Lesions were classified histologically as active, incipient, or healed. Active lesions had ulceration and invasion by profuse mats of spirochetes in the stratum spinosum, papillary dermis, or both, associated with an inflammatory response. Active lesions were subclassified into high (diffuse involvement), moderate (segmental involvement), or slight (focal involvement). Incipient lesions differed from active lesions in that they had no ulceration, bacterial invasion, or inflammation; changes were confined to the stratum corneum, which was involved by parakeratotic hyperkeratosis and spirochetal colonization. Healed lesions had a continuous, fully cornified stratum corneum, no colonization or invasion by spirochetes, and slight to absent perivascular lymphoplasmacytic dermatitis. Those performing the histologic evaluations were unaware of treatment group assignment.

**Bacteriologic evaluation**—Full-thickness skin biopsy specimens were collected from active DD lesions from 5 cows prior to treatment and from areas adjacent to prior biopsy sites 1 month after treatment with tetracycline (n = 3 cows) or lincomycin (2). Additional biopsy specimens were collected from healthy skin on unaffected, contralateral feet from 2 cows in the tetracycline group, 2 cows in the lincomycin group, and 1 control cow before treatments were initiated. Biopsies were performed as described for histologic evaluation, except that after the procedure, specimens were vigorously rinsed with sterile saline (0.9% NaCl) solution to remove any superficially contaminating bacteria and then placed in a prereduced peptone-yeast-glucose broth10 and transported on ice to the laboratory for processing. Direct microscopic evaluations and processing for bacterial cultures were performed within 12 hours after specimen collection.

For microscopic evaluation of bacterial morphotypes and overall numbers of bacteria present, the epidermal surfaces of the biopsy samples were scraped with a sterile scalpel blade and the scraping material was used to prepare Gram- and Steiner silver–stained slides.12 In addition, scraping material was suspended in an equal volume of sterile saline solution for examination by darkfield microscopy. To further assess bacterial populations on the surface of skin lesions or healthy skin, bacterial cultures of biopsy scraping material were performed. Culture of aerobes, anaerobes, **Campylobacter** spp, and **Mycoplasma** spp was attempted, as well as culture of spiro-
chertes associated with DD. Aerobic cultures consisted of plating biopsy scraping material on 5% sheep blood agar, MacConkey agar, and chocolate agar plates and incubating samples in 7.5% CO₂ for 2 days. Anaerobic cultures were processed on preduced, anaerobically sterilized Brucella blood agar and phenylethyl alcohol blood agar and incubated at 37°C for 5 days in an anaerobic chamber. Cultures for Mycoplasma spp and Campylobacter spp were performed as described elsewhere. Direct plating and broth enrichment cultures for DD-associated spirochetes were also performed as described elsewhere.

Aerobic bacterial isolates were identified through conventional or commercial identification methods. Isolates not clearly identified by these methods were identified to genus level only or classified solely on the basis of morphological characteristics. Obligate anaerobic bacteria were identified to level II group and species. Mycoplasma isolates were identified by positive Dienes staining and susceptibility to digitonin. Serotyping attempts for Mycoplasma isolates were performed by use of an immunoperoxidase method with antisera prepared against common bovine mycoplasmas that included Mycoplasma bovis (strain 201), Mycoplasma bovigenitalium (ATCC 19852), Mycoplasma bovirhinis (ATCC 27748), Mycoplasma arginini (ATCC 23838), Mycoplasma canadense (ATCC 29418), Mycoplasma kallescens (ATCC 29103), and Mycoplasma californicum (ATCC 33461). Spirochetes were identified as described elsewhere.

Statistical analysis—All observations were categorical in nature. Possible scores were integer values from 0 to 4, indicating increasing severity of disease. Because categorical scores are not normally distributed and scores were assessed 3 times for each cow, a GEE approach to data analysis was used. A multinomial link function was used to consider various combinations of the fixed effects of treatment (control, lincomycin, and oxytetracycline), limb chosen for observation (right or left), period of observation (days 0 to 8, days 9 to 20, and > day 20), and cow. Accordingly, the linear predictor for this analysis had the general form for main effects as follows:

\[ \eta_{ijkl} = \text{limb}_i + \text{period}_j + \text{treatment}_k + \text{cow} \left( \text{limb} \times \text{treatment} \right)_{il} \]

in which \( \eta_{ijkl} \) is the expected value of the mean of the multinomial link function for the \( lth (l = 1,2,\ldots,25) \) cow in the \( kth (k = 1,2,3) \) treatment observed on the \( ith (i = 1,2) \) limb at the \( jth (j = 1,2,3) \) time. This model could be expanded to include interactions between pairs of factors (limb, period, or treatment), but for simplicity of presentation, such terms were not included in the preceding formula. The term for cow nested within the limb by treatment interaction, \( \text{cow} \left( \text{limb} \times \text{treatment} \right)_{il} \), was included to accommodate the repeated observations on the same animal. To further assess the difference in gross visual response to treatment at day 14, z statistics were calculated for treated and control cows.

To evaluate the accuracy of the visual scoring system, the presence or absence of disease in visually scored cows was compared with the results of histologic evaluations. In this process, the histologic score was presumed to represent the true presence or absence of disease (ie, the criterion standard), and sensitivity, specificity, and positive and negative predictive values of visual scores were calculated.

Results

Baseline comparisons—At enrollment and before treatment, 14 of 25 (56%) cows (3 control, 5 oxytetracycline-treated, and 6 lincomycin-treated) had a gross visual lesion score of 2, 10 (40%) cows (6 oxytetracycline-treated and 4 lincomycin-treated) had a lesion score of 3, and 1 (4%) cow (lincomycin-treated) had a lesion score of 4. All lesions were assessed as painful as well as visually and histologically active (evidence of ulceration and bacterial invasion) at enrollment. There was no significant difference in gross visual lesion scores among the 3 treatment groups at enrollment.

Gross observations—At 1 month after treatment, lesions in 15 of the 22 (68%) antimicrobial-treated cows appeared healed, 6 (27%) cows had a lower lesion score than at baseline, and 1 (5%) had no change in the appearance of the lesion. Of the 3 untreated control cows, 2 had lesion scores that were the same or higher than at baseline, and 1 cow appeared healed at the original site above the heel but had a developing lesion at the more typical site on the interdigital ridge of the same foot.

Predictions of a lesion score of 0 (healed) given the parameter estimates of the GEE model were graphically displayed (Figure 1). Given that the effect of limb was not significant, this characteristic was not included in the model used for these predictions. Similarly, the analysis distinguished only between control and treated cows; that is, the predictions were made from observations for both antimicrobial treatments (lincomycin and oxytetracycline) combined because of the lack of a significant difference between lesion responses to lincomycin and oxytetracycline. The prediction model included the variables treatment and period as well as the random effect of cow to account for the repeated nature of lesion scoring across evaluation periods. Probability estimates with overlapping 95% CIs were considered not significantly different.

Figure 1—Probabilities and 95% CIs of cows with DD having a visual lesion score of 0 before treatment (day 1) and 14 and 30 days after topical treatment with (gray bars; n = 22) or without (white bars; 2) antimicrobials (10 g of lincomycin or oxytetracycline in paste form). Values were calculated by use of a GEE model.
To further test the hypothesis that treated or control cows were different in their probability of a gross visual lesion score of 0 (healed) at day 14, z statistics were calculated. The parameter for the probability function of a control cow at day 14 being free of disease was 0.584 (SE = 0.98), which was not significantly different from 0 (P = 0.55). When the same parameter was calculated for a cow in the combined treatment group, the value was 2.17 (SE = 0.561), which was significantly different from 0 (P < 0.001). In other words, antimicrobial treatment increased the probability of being healed at day 14, whereas the lack of treatment did not. In addition, antimicrobial-treated cows at day 30 had a significantly higher probability of a 0 lesion score (healed), compared with the control cows.

Sensitivity, the proportion of truly DD-affected cows that were correctly identified as affected by the visual scoring system, was 0.83 (33/40; 95% CI, 0.67 to 0.92). Samples were pooled across evaluation periods to increase the number of available counts in each of the 4 cells. Specificity, the proportion of truly unaffected cows that were correctly identified as unaffected, was 0.89 (8/9; 95% CI, 0.52 to 0.99). The positive predictive value of visual diagnosis was 0.97 (33/34; 95% CI, 0.84 to 0.99), whereas the negative predictive value of visual diagnosis was 0.53 (8/15; 95% CI, 0.33 to 0.79). Probability estimates with overlapping CIs were considered not significantly different.

**Histologic evaluation**—When the total histopathologic score was compared among treatment groups, there was no significant (P = 0.85) difference in treatment response rates between lincomycin and tetracycline; lesions treated with antimicrobials had a significant (P < 0.005) improvement in histopathologic score, compared with untreated lesions. Gross lesion score had no significant (P = 0.08) effect on histopathologic score. There was a significant (P = 0.049) decrease in histopathologic score with increasing study day.

**Bacteriologic evaluation**—Results of direct microscopic evaluations for all 5 pretreatment lesions were similar. Collectively, there was a predominance of gram-negative filaments and faintly staining, long, spiral-shaped rods with occasional rare gram-positive cocci and gram-negative rods. Silver staining revealed large numbers of long, spiral-shaped organisms and moderate to large numbers of long, straight rods, some of which appeared pointed at the ends. Rare short, plump rods were occasionally observed. Darkfield examination of suspensions of the scraping material from untreated lesions revealed numerous long, often motile, spiral-shaped organisms, some of varying thicknesses and numerous long, straight rods. Occasional plump short rods were observed.

Gram staining of similarly prepared material from the previously active lesion sites 1 month after treatment revealed small to rare numbers of gram-positive rods in 2 samples, with rare gram-negative rods also present in 1 of those samples. Rare gram-positive cocci were observed in 1 sample. No organisms were detected in the remaining samples. Silver staining and darkfield examination revealed similar bacteriology morphotypes as were observed in the pretreatment lesion biopsy specimens except that the number of gram-negative filaments and long, spiral-shaped rods was markedly reduced. The results from the 3 control skin samples were all similar. No organisms were detected in any of the smears prepared from these biopsy specimens when examined with Gram stain. Only rare short rods or cocci were seen in the control skin biopsy specimens examined with silver stain or by darkfield microscopy.

Aerobic bacterial cultures of active lesions before treatment yielded predominately gram-positive organisms that consisted of various gram-positive pleomorphic rods collectively identified as diphtheroids. Also identified were occasional Streptococcus spp, Staphylococcus spp, and various rare, nonfermentative and fermentative gram-negative rods, including Escherichia coli. In anaerobic cultures, pigmented gram-negative rods, including Porphyromonas levii, were consistently present. Fusobacterium necrophorum and members of the genera Prevotella, Porphyromonas, and Peptostreptococcus were detected, often in small to rare numbers. An obligately anaerobic gram-negative filamentous rod not identified by methods used was regularly encountered. Mycoplasma spp were isolated from all active lesion samples but did not react with any of the available antisera. No Campylobacter spp were isolated from any samples. Spirochetes consistent with those detected in papillomatous DD lesions were recovered from all lesion site samples.

A similar bacterial population was isolated from lesion sites after treatment on day 30, although in much smaller numbers. Spirochetes were recovered from 2 of the samples, and Mycoplasma spp were recovered from 4. No Campylobacter spp were recovered.

Cultures obtained from control-skin material did not yield any detectable Campylobacter spp, Mycoplasma spp, or spirochetes. Aerobic cultures of control-skin material consisted predominately of rare to small numbers of diphtheroid bacteria of various colony morphologies. Anaerobic cultures yielded no growth from 2 control-skin samples, and rare Prevotella spp, Porphyromonas spp, and anaerobic gram-positive rods were detected in the remaining samples.

**Discussion**

In the study reported here, the effectiveness of 2 antimicrobials, lincomycin and oxytetracycline, for the topical treatment of DD in dairy cattle was assessed. No significant differences were evident between lincomycin and oxytetracycline treatment groups on lesion severity score or histopathologic score. By 1 month after treatment, 15 of the 22 (68%) cows treated with antimicrobials appeared healed by gross visual observation. However, 7 of these 15 cows had histologic evidence of colonization by spirochetes. It could not be determined whether these findings represented incomplete healing or recurrence. Whereas visual lesion scores had not significantly decreased from days 1 (before treatment) to 14 (after treatment), both visual lesion scores and histopathologic scores had significantly decreased by 1 month after treatment, regardless of antimicrobial used. Both lincomycin and oxytetracycline treatment resulted in a significant increase in gross visual lesion healing relative to no treatment by 1 month after treat-
ment, but neither antimicrobial treatment had a sig-
nificant effect on visual lesion healing by 14 days after
treatment, even though there appeared to be a clinical
difference on day 14. When z statistics were calculated
for the day 14 scores, they indicated that the treated
cows had a greater than 0 probability of being healed
and the control cows did not.

The lack of a significant difference in visual lesion
scores between treated and control groups at day 14 ac-
cording to the GEE model was likely attributable to the
small number of control cows at enrollment and the fact
that one of the control cows had a lesion that appeared
to be healing at the original lesion site. This was the only
cow of the 25 evaluated that had a DD lesion distal to the
dewclaw on the paterm rather than on the typical site at the
interdigital commissural ridge. The lesion site for this
control cow also appeared to be healing on day 30 after
treatment, and the biopsy specimen was uninterpretable
by the pathologist. The cow did, however, have a small,
active lesion on the typical site at the interdigital commis-
sural ridge at day 30. We can only speculate why the lesion
on this control cow appeared to be healing, but there has
been at least 1 study that revealed different healing rates
for lesions at different locations after treatment. It may be
that this location on the proximal phalanx allowed the lesion
to dry out and begin healing at the original site after
1 month. Our decision to enroll only a small number of
cows in the control group was based on our observations
in another study, in which we found that spontaneous
healing of DD lesions is rare and that the disease is painful.
Control cows had no significant decrease in histopatho-
logic lesion scores by day 30.

A subset of the lesions from the treatment study was
assessed for bacterial flora prior to and after antimic-
robe treatment as a measure of treatment effect of bacterial population. Healthy skin samples were evalu-
ated to serve as a baseline for comparison. Direct micro-
scopic examinations revealed diverse bacterial popula-
tions in the active lesions, with certain morphotypes predominant and consistently found among all lesions.
Treatment appeared to substantially reduce numbers of
all bacterial morphotypes, but treatment had either not eliminated them entirely or they had reemerged but in
lesser numbers by the time the day 30 biopsy speci-
mens were collected. The same bacteria recovered from
active or healing lesion material were not recovered from control-skin material from the typical site on the
interdigital commissural ridge of the rear foot.

Bacterial cultures yielded organisms consistent with
the findings of direct microscopic examination. Healthy
control skin harbored only few numbers of aerobic,
predominantly gram-positive floras. Uncommonly, ana-
erobic bacteria were detected but not consistently and no spirochetes, *Campylobacter* spp, or *Mycoplasma* spp
were isolated. In the active lesions, anaerobic bacteria including *P. levii*, an unidentified obligately anaerobic
gram-negative filamentous rod, and spirochetes were the most consistent groups detected along with un-
identified *Mycoplasma* spp. Without a specific culture for *Mycoplasma* organisms, it is not likely their regular
presence would have been recognized since they would
not typically have been detected by other culture meth-
ods or by direct microscopic examination. In some in-
stances, however, *Mycoplasma* colonies were detected
on the spirochete isolation media. Bacterial culture of
lesion sites after treatment (day 30) revealed a similar
bacterial composition as that in active lesions, although
with substantially lower numbers of each individual
morphotype as well as overall bacterial numbers.

The direct smear and bacterial culture results were
consistent with what was observed histologically. The bacterial populations that were predominant in active le-
sions were still present but at greatly reduced numbers or
had reestablished colonization or infection by 1 month
after treatment. It is likely that the incipient lesions de-
tected histologically in the 1-month posttreatment bi-
opsy specimens still provided surface areas for these bac-
teria to attach that were not provided in healthy, intact
skin. Although the pathogenesis of DD is still unclear, it
is obvious that both antimicrobial treatments markedly
reduced the numbers of bacteria present. In this study,
the treatment regimen involving 2 different antimicro-
bials either did not result in complete lesion healing in
some of the treated cows or resulted in lesions reoccur-
ring at the same site by 1 month posttreatment. Incom-
plete healing or lesion recurrence appeared to allow for
sites for attachment of the bacterial types associated with
active lesions. Further studies are required to determine
the mechanism of DD lesion recurrence.

If treated DD lesions do not completely heal but
rather enter a period of apparent latent infection, then
more rigorous or extended treatment protocols may be
required to control the infectious process to achieve
complete healing. A second possibility is that the un-
derlying infectious activity was due to a new infection
that had not yet completely eroded the epidermis, in
which situation additional research is required to de-
termine the reason certain cows are more prone to rein-
fection. A third possibility is that the incompletely
healed skin is more prone to reinfection than healthy
healed skin, which still leads to the question of why
some cows healed and others did not. This discrepancy
between gross and histologic findings may also create
a false low prevalence estimate of DD in dairies that
rely only on gross visual examination to identify infec-
tion. This could contribute to failure of DD control
programs in dairy herds because of persisting infection
and treatment failure that are perceived as treatment
success on the basis of visual examination alone. It will be
important to determine the true DD treatment failure
and recurrence rates to understand their impact on the
epidemiology of DD in dairy cattle.

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Evaluation of the effect of bolus administration of 50% dextrose solution on measures of electrolyte and energy balance in postpartum dairy cows

Sarah A. Wagner and Daniel E. Schimek

Objective—To determine the effect of IV administration of a bolus of 50% dextrose solution on electrolyte and energy balance and effect of blood collection site on serum electrolyte values in postparturient dairy cows.

Animals—24 clinically normal multiparous cows.

Procedures—A bolus of 50% dextrose solution (0.5 L [n = 8 cows]), 50% dextrose solution (1.0 L [8]), or saline (0.9% NaCl) solution (1.0 L, control [8]) was administered via jugular venipuncture 5 to 10 days after parturition. Pretreatment and posttreatment blood samples were analyzed for concentrations of calcium, magnesium, phosphorus, potassium, glucose, insulin, β-hydroxybutyric acid (BHBA), and nonesterified fatty acids. Coccygeal vessel and jugular vein blood samples were obtained prior to treatment, and electrolyte concentrations were compared.

Results—Treatment with 50% dextrose decreased phosphorus concentration in serum, compared with the control treatment. Suppression of BHBA and nonesterified fatty acid concentrations following dextrose treatment lasted for < 12 hours; mean BHBA concentrations in all groups were increased 24 hours after treatment. Mean serum phosphorus concentration in coccygeal vessel blood samples was 0.67 mg/dL greater than the concentration in jugular vein blood samples.

Conclusions and Clinical Relevance—Postpartum cows that are treated with dextrose may be at risk for hypophosphatemia, and 1 treatment with 0.5 or 1 L of 50% dextrose is unlikely to prevent or resolve ketosis. The risk of hypophosphatemia may be underestimated when coccygeal vessel blood samples are used for diagnosis. (Am J Vet Res 2010;71:1074–1080)