Comparison of topical application of three products for treatment of papillomatous digital dermatitis in dairy cattle

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Objective—To test the effectiveness of 3 topical sprays for treatment of papillomatous digital dermatitis (PDD) in dairy cattle.

Design—Prospective field trial.

Animals—48 lactating cows with PDD randomly assigned to 4 groups of 12 cows each.

Procedure—For 3 weeks, cows in each group were treated topically with oxytetracycline solution (100 mg/ml), acidified and oxidized copper solution, acidified sodium chlorite solution, or a placebo (tap water). Cows were milked 3 times daily, and at each milking, lesions were sprayed with a pressure hose and treatment solutions were sprayed on the lesions. Degree of lameness was graded before and after 3 weeks of treatment.

Results—Mean lameness score decreased (ie, cows were less lame) for all 3 treatment groups, but increased for the control group.

Clinical Implications—Daily topical application of solutions was effective in decreasing degree of lameness associated with PDD in cattle tested. (J Am Vet Med Assoc 1996;209:1134–1136)

Digital dermatitis or papillomatous digital dermatitis (PDD) was first reported in cattle in Italy in 1974 and in New York in the late 1970s. Similar lesions have been observed in cattle in 40 or more states in the United States and many other countries. The cause of this disease is unknown; however, spirochetalike organisms have been seen in sections of specimens stained with silver stain. The lesion begins as an eroded or ulcerated area between the bulbs of the heel. As the lesion progresses, granulation tissue forms with outgrowths of dermal tissue that grossly resemble hair, thus the common name “hairy heel wart.” Although the lesion is commonly called a wart, there is no evidence of viral involvement, as is the case with true warts. Because lesions are located between the bulbs of the heel, affected cattle are reluctant to move and shift their weight to the toe of the affected foot and off the heel. There is reduced feed intake, signs of estrus are reduced, and the interval between parturition and conception is increased, and there are costs of treatment and costs associated with loss of milk from cows treated with antibiotics.

Surgical and medical treatment of individual animals is labor intensive and costly, and may not be feasible in large outbreaks. Parenteral administration of antibiotics has been effective in California, but others have not had the same results. Application of oxytetracycline followed by bandaging was highly effective, but bandaging is labor intensive, and this treatment may not be feasible in herds in which the prevalence of PDD is ≥5%. Therefore, a rapid, efficacious treatment for large numbers of affected cattle is still needed.

Use of footbaths containing dilute solutions of formaldehyde or copper sulfate is the most common treatment for cattle with PDD. However, formaldehyde footbaths pose human health hazards, are only marginally effective, and may be expensive. Tetracycline or lincomycin–spectinomycin footbaths control the condition, but it can be difficult to manage footbaths effectively, especially because the solutions should be changed after every 300 cow passages.

Direct spraying of effective medications on lesions is a practical method of treatment. Shearer and Elliott, using a pump sprayer for 3 weeks to apply oxytetracycline, treated, controlled, and prevented digital dermatitis in a 300-cow herd. With topical application, only affected cows and individual lesions are treated. However, acidified and oxidized copper solution and acidified sodium chlorite solution have not been used topically, and it is not known whether they would be effective as topical treatments for PDD. The purpose of the study reported here was to compare results of topical application of these 3 solutions in cows with PDD. Nonantibiotic solutions were chosen to compare with oxytetracycline to reduce the possibility that milk or meat from treated animals would have violative antibiotic residues. Acidified and oxidized copper was already on the market as a footbath treatment, and a solution similar to the sodium chlorite solution has been used as a teat dip after milking. In the trial herd, formaldehyde and copper sulfate footbaths had been used on alternate weeks for 52 weeks, and the percentage of lactating cows that were affected had not decreased.

Materials and Methods

Cows—The trial was conducted on a 1,060-cow (832 lactating and 228 nonlactating) commercial, closed Holstein dairy herd in central Wisconsin. Lactating cows were housed in 2 identical free-stall barns, with 4 groups of 104 cows in each barn. Cows were milked 3 times daily in 2 identical double-eight herringbone milking parlors. In all groups, cows in each group were treated topically with oxytetracycline solution (100 mg/ml), acidified and oxidized copper solution, acidified sodium chlorite solution, or a placebo (tap water). Cows were milked 3 times daily, and at each milking, lesions were sprayed with a pressure hose and treatment solutions were sprayed on the lesions. Degree of lameness was graded before and after 3 weeks of treatment.

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cows were uniformly mixed in regard to age, days since par- 
turbation, milk production, and general health. All cows were 
led the same total mixed ration. Estimated prevalence of dig-
tal dermatitis in the herd was 15%.

Cows with PDD were selected from 4 of the 8 milking 
groups on the farm for inclusion in the study. Cows with 
potentially painful foot lesions other than PDD were ex-
cluded from the trial. Cows included in the study were ran-
donically assigned, by order of exit from the parlor, to 1 of 4 
treatment groups of 12 cows each and were marked with 
colored tape to designate their treatment group. Tape was 
placed on the cows' tails and both rear legs just above the 
dewclaws.

Experimental protocol—Prior to any treatment, each 
cow was assigned a lameness score as follows: 0, no visible 
signs of lameness; 1, slight lameness at some gaits; 2, no-
ticeable lameness while walking, and 3, severe lameness and 
limited weightbearing while standing or walking. The lame-
ness evaluation was performed by observing the cows indi-
vidually as they walked at a normal pace in a vacant concrete 
alley. Cows then were treated for 3 weeks with oxytetracy-
cline solution1 (100 mg/ml), acidified ionized copper solu-
tion,4 acidified sodium chloride solution,4 or a placebo (tap 
water). The treatment solutions were stored in gallon jugs 
and poured into 500-ml, color-coded spray bottles for appli-
cation. The herd veterinarian (who visited the farm daily) 
was supervised filling of the bottles and use of the solutions by 
the employees who milked the cows. Milkers were instructed 
to wash the affected area of the heel of the trial cows with 
plain tap water from a medium-pressure water hose until the 
lesion could be seen. The affected area then was sprayed with 
5 ml of the appropriate solution. During the trial period, 
cows were treated during each of the 3 daily milkings, and 
a lameness score was assigned weekly.

Because of shipping problems, cows treated with the 
acidified sodium chloride solution missed 2 days of treatment 
during the middle of the trial. To equalize the number of 
treatment days, this group was treated for 2 days longer at 
the end of the trial than were cows in the other 3 groups.

Statistical analysis—To minimize variations in initial 
lameness scores for individual cows, the change in lameness 
score during the 3-week trial period was calculated for each 
cow. Results were examined for normality, and because of 
the possibility that they were not normally distributed, the 
Kruskal-Wallis test was used to compare the distribution of 
changes in scores for the 4 experimental groups. Pairwise 
comparisons of changes in score for the control group with 
changes in score for each of the 3 treatment groups also were 
performed by use of the Kruskal-Wallis test. All analyses 
were performed with standard software.

Results

Forty-eight cows began the study, but 4 cows (2 
in the acidified sodium chloride solution treatment 
group, 1 in the oxytetracycline treatment group, and 
1 in the acidified ionized copper solution treatment 
group) were culled from the herd before the final lame-
ness scores were recorded. Two cows in the control 
group were removed from the herd during the trial 
because of severe lameness. Final lameness scores for 
these cows were recorded as 3.

Mean differences between final and initial lame-
ness scores for each of the 3 treatment groups was 
negative, which indicated that, on average, there was 
a decrease in degree of lameness during the trial 
period. For the control group, however, the mean dif-
ference was positive, which indicated that there was an 
increase in the degree of lameness. A significant (P < 
0.05) difference was found between the control group 
and each of the 3 treatment groups in regard to the 
difference between final and initial lameness scores.

Discussion

In this study, lameness scores improved when 
treatment solutions were applied daily, but did not im-
prove in the control cows. Treatment did not eradicate 
the disease from the herd, but it did appear to decrease 
its severity. Cows in this herd were confined in free 
stalls with concrete floors when lactating and when not 
lactating. Therefore, the effects of rain, mud, and other 
environmental conditions on efficacy of treatment 
could not be measured.

Subjectively, we found that covering the lesion 
with the treatment solution was sometimes difficult. 
We used a regular spray bottle with the pump handle 
and nozzle located on top of the bottle. Using a pump 
sprayer or bottle with the spray nozzle on the bottom 
might have made it easier to cover the lesion. In this 
study, the acidified sodium chloride solution had to be 
mixed twice daily and became thicker with time after 
mixing. During the last half of the trial, a squirt bottle, 
which was squeezed, was used to apply solution.

Topical application may be used instead of foot-
baths to reduce herd treatment costs and to treat cows 
in tie-stall barns in which cows are not turned outside 
daily, cows kept in cold weather when footbaths would 
freeze, cows in herds in which only a few cows are 
affected, and cows for which bandaging is not possible. 
In this study, topical application allowed visual obser-
vation of all cows in the treatment groups on a daily 
basis. Farms that use footbaths may not be as diligent 
about checking cows daily because of the perception 
that the cows are treating themselves when passing 
through the footbath. The protocol used in this study 
called for washing the affected area before treatment. 
This washing may have allowed the treatment to have 
better penetrated the affected tissue.

Use of oxytetracycline on lactating cows raises 
concerns about antibiotic residues in meat or milk. 
Shearer and Elliott2 did not report any residue prob-
lems when they treated 300 cows topically with oxy-
tetracycline. To our knowledge, there have not been 
any published reports of residues attributed to the use 
of footbaths containing antibiotics. Individual milk 
samples from cows treated with oxytetracycline were 
not tested in this study; however, daily bulk-tank sam-

Table 1—Mean lameness scores before and after 3 
weeks of topical treatment of cattle with papillomatous 
digital dermatitis

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>Lameness score (range)</th>
<th>Initial</th>
<th>Final</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (n = 12)</td>
<td>0.8 (0–2)</td>
<td>1.4 (0–3)</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Acidified ionized copper solution (n = 11)</td>
<td>1.5 (1–3)</td>
<td>0.4 (0–2)</td>
<td>−1.1*</td>
<td></td>
</tr>
<tr>
<td>Acidified sodium chloride solution (n = 10)</td>
<td>1.0 (0–3)</td>
<td>0.2 (0–2)</td>
<td>−0.8</td>
<td></td>
</tr>
<tr>
<td>Oxytetracycline (n = 11)</td>
<td>1.5 (1–2)</td>
<td>0.5 (0–2)</td>
<td>−0.6</td>
<td></td>
</tr>
</tbody>
</table>

*Significantly different from difference for control group. See text for description of lameness scoring system.
samples tested by the milk processor were all negative for antibiotic residues.

"Cooley AJ, School of Veterinary Medicine, University of Wisconsin, Madison, Wis: Personal communication, 1994.

"Allenstein LC, School of Veterinary Medicine, University of Wisconsin, Madison, Wis: Personal communication, 1995.


"Hoof Pro Plus, SSI Corp, Julesburg, Colo.

"Prototype alocide bovine hoof treatment, Alkide Corp, Redmond, Wash.

"Oxytetracycline hydrochloride 100, WA Butler Co, Columbus, Ohio.

References

Book Review:

The seventh edition of this book has been revised by a new editor. There are 29 contributing authors. Several major changes in the organization and content from the sixth edition are apparent in that most of the chapters have been entirely rewritten or have undergone substantial revision. The section on toxicology has been eliminated. Specific chapters on local anesthetics and therapeutic gases have been included in the section on drugs affecting the CNS. A number of chapters, including drugs affecting gastrointestinal function, chemotherapy of neoplastic disease, dermatopharmacology, ophthalmic pharmacology, and respiratory pharmacology, now are grouped under a section on specialty areas of pharmacology. Timely additions are new chapters on principles of pharmacodynamics, pharmacokinetics, and clinical pharmacology that have been added to the introduction, along with an expanded discussion on drug disposition.

The section on cardiovascular pharmacology includes an in-depth discussion of angiotensin-converting enzyme inhibitors and calcium-channel blockers, two classes of drugs that have gained considerable prominence during recent years. Five chapters are devoted to endocrine pharmacology, and this section provides one of the best references available for veterinary endocrinology. The chapters on treatment of microbial diseases, however, are somewhat inadequate. Except for the sulfonamides, antibiotics are only superficially discussed. This is a major drawback, considering the frequency with which these agents are used in veterinary medicine. The book is somewhat overpriced, but given the scope and depth of information provided, it would serve as a useful reference book for veterinary medical students, practicing veterinarians, and biomedical researchers.

Dean D. Schwartz, PhD