

# Efficacy of oxytetracycline for treatment of papillomatous digital dermatitis lesions on various anatomic locations in dairy cows

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RUMINANTS/  
CAMELIDS

**Objective**—To evaluate efficacy of topical treatment with oxytetracycline solution among dairy cows with papillomatous digital dermatitis (PDD) lesions on the interdigital cleft, heels, or dewclaw.

**Design**—Clinical trial.

**Animals**—70 dairy cows from a single herd.

**Procedure**—On the basis of anatomic location of PDD lesions, cows were allocated into 1 of 3 groups (interdigital cleft [n = 14], heels [30], or dewclaw [26]) and treated topically with oxytetracycline solution. Cows were examined 14 and 30 days after initial treatment. During each examination, pain and lesion size scores were recorded.

**Results**—On the basis of pain and lesion size scores, oxytetracycline appeared significantly less effective among cows with lesions on the interdigital cleft than for cows with lesions on the heels or the dewclaw. Number of cows with signs of pain or visible lesions after treatment was significantly higher for cows with lesions on the interdigital cleft than for cows with lesions on heels or the dewclaw.

**Conclusions and Clinical Relevance**—Anatomic location of PDD lesions has an effect on the efficacy of topical treatment with oxytetracycline solution in dairy cows affected with PDD. Cows with lesions on the interdigital cleft were less likely to respond to treatment, compared with cows with lesions on the heels or the dewclaw. (*J Am Vet Med Assoc* 2000;216:1288–1290)

**P**apillomatous digital dermatitis (PDD) is an emerging, contagious, painful, wart-like disease of the digits of dairy cows.<sup>1,3</sup> Clinical signs are characterized by lameness with walking on toes and clubbing of hooves. Initially, PDD lesions appear as superficial inflammation of the skin of the digit. Lesions typically involve the back of the foot near the interdigital cleft or bulb of the heel. Since 1974, PDD has been reported in the United States, Europe, Japan, Iran, Israel, Canada, Mexico, and Chile.<sup>1,6</sup> In the United States, the disorder was first described as lameness outbreaks in New York dairy herds in the late 1970s.<sup>7</sup> More recently, PDD was reported in dairy cows in 43% of 1,182 dairy herds in the United States.<sup>3</sup>

The cause of PDD is unknown. The marked susceptibility of PDD lesions to parenteral or topical administration of antibiotics and detection of spirochetes invading the stratum spinosum and dermal papillae<sup>1,3,8</sup> suggest that bacteria may play an important

role in the pathogenesis. Epidemiologic studies have identified certain management practices that may predispose dairy herds to infection. These factors include herd size, flooring type (eg, concrete or grooved) where cows walk, introduction of dairy replacement heifers to the farm, and hoof-trimming procedures.<sup>2,3</sup>

Studies in California<sup>1,a</sup> and Florida<sup>9,11</sup> have found that most cows with PDD treated with procaine penicillin G, ceftiofur sodium, oxytetracycline, lincomycin, or a combination of lincomycin and spectinomycin (applied topically, followed by bandaging of the affected foot or applied as a topical spray) have responded favorably 7 to 30 days after treatment. However, recurrence of PDD lesions in cows that had previously responded to treatment with antibiotics is possible. Clinical observations suggest that anatomic location or stage (early vs mature) of PDD lesions may have an effect on treatment efficacy in dairy cows. The purpose of the study reported here was to evaluate efficacy of topical treatment with oxytetracycline solution among dairy cows with PDD lesions on different anatomic locations. Pain and lesion size scores and number of cows with signs of pain or presence of lesions after treatment were compared among cows with PDD lesions located on the interdigital cleft, heels, or dewclaw.

## Materials and Methods

**Cows**—Seventy cows from a single dairy herd in Florida were used in the study. The herd selected had a history of lameness associated with PDD; rolling yearly herd average milk production, recorded during the month preceding the study, was 20,130 lb of milk/cow.

Only cows with PDD lesions involving a single hind foot and signs of severe pain (ie, holding the foot off the ground) when lesions were sprayed with water were included in the study. Only cows with lesions involving hind feet were used, because cows were milked in a parallel-style milking parlor, making it difficult to examine and treat lesions of the forefeet.

**Experimental procedure**—On the basis of anatomic location of PDD lesions, cows were allocated into 1 of 3 groups: cows with lesions on the interdigital cleft (n = 14), heels (30), or dewclaw (26). On day 0, prior to treatment, all cows were evaluated, and pain and lesion size scores were assigned. Criteria for evaluation of signs of pain and lesion size have been reported.<sup>11</sup> Briefly, pain scores were based on the cows' responses to direct spraying of water on lesions and ranged from 0 to 2 (0 = no signs of pain; 1 = signs of mild pain; 2 = signs of severe pain). Lesion size scores ranged from 0 to 2 (0 = no visible lesion; 1 = lesion ≤ 2.5 cm in diameter; 2 = lesion > 2.5 cm in diameter). In addition to pain and lesion size scores, stage (early vs mature) of lesions was recorded. Early lesions were round to oval, flat or concave, raw, moist, red-yellow to gray, and had tufted or granular

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strawberry-like surfaces.<sup>1</sup> Mature lesions were raised, with surfaces covered by small filiform papillae.<sup>1</sup>

After initial evaluation on day 0, all cows were treated with oxytetracycline solution<sup>b</sup> (25 mg/ml). Cows were treated once daily for 5 consecutive days, not treated for 2 days, and treated once daily every other day for 3 additional treatments. The oxytetracycline solution was mixed (using distilled water) each day immediately prior to use. Treatment was performed in the milking parlor by 1 animal health technician. While cows were being prepared for milking, all feet were rinsed with a water hose until PDD lesions were exposed for visual inspection. Two-liter spray bottles were used for application of treatment; solution was sprayed on the plantar surface of the feet (with particular emphasis on PDD lesions), in the interdigital cleft, dewclaw, and on the lateral and medial heels.

Cows were reexamined on days 14 and 30 by 1 of the authors (JKS). Pain and lesion size scores were again recorded. Throughout the study, all cows were maintained under the same management and housing conditions and were fed the same ration.

**Statistical analyses**—The null hypothesis was that anatomic location of PDD lesions has no effect on the efficacy of topical spray treatment with oxytetracycline solution in dairy cows naturally affected with PDD. Kruskal-Wallis tests were used to compare rank values of pain and lesion size scores among the 3 groups. The Scheffe method was used on rank-transformed data to test pairwise comparisons among groups.<sup>12</sup> Proportions of cows in each group with pain score > 0 on days 14 and 30 and proportions with lesion size score > 0 on days 14 and 30 were compared among groups by use of a  $\chi^2$  test or Fisher exact test if the number of expected frequencies was < 5.

Baseline comparisons for stage of lesion (early vs mature) were carried out to establish comparability of groups by use of a  $\chi^2$  or Fisher exact test. In addition, parity and days in lactation (rank values) were compared among groups by use of the Kruskal-Wallis test. For all tests, values of  $P \leq 0.05$  were considered significant.

## Results

**Baseline comparisons**—Six (43%) cows had mature lesions located on the interdigital cleft, 15 (50%) had mature lesions on the heels, and 15 (58%) had mature lesions on the dewclaw (Table 1). In addition, a lesion size score of 2 was recorded in 14 (100%), 28 (93%), and 25 (96%) cows, respectively. Proportions of cows with mature lesions or with lesion size score > 0 did not differ significantly among groups ( $P > 0.65$ ). Parity (median, 2; range, 1 to 5) and days since parturition (median, 337 days; range, 54 to 789 days) did not differ significantly among groups ( $P > 0.46$ ). Twenty-one cows were removed before the end of the study (3 cows with lesions on the interdigital cleft, 9 with lesions on the heels, and 9 with lesions on the dewclaw), because they ended their lactations or became ill and

Table 1—Frequency and distribution of lesions in 70 dairy cows with papillomatous digital dermatitis (PPD) treated topically with oxytetracycline solution

Stage of lesions	Location of lesions		
	Interdigital cleft	Heels	Dewclaw
Early	8	15	11
Mature	6	15	15
<b>Total</b>	<b>14</b>	<b>30</b>	<b>26</b>

Table 2—Pain and lesion size scores for 70 dairy cows with PPD treated topically with oxytetracycline solution

Location of lesion	Pain scores*		Lesion score†	
	Day 14	Day 30	Day 14	Day 30
Interdigital cleft	1 (0–2) <sup>a</sup>	2 (0–2) <sup>a</sup>	2 (2–2) <sup>a</sup>	2 (1–2) <sup>a</sup>
Heels	0 (0–1) <sup>b</sup>	1 (0–2) <sup>ab</sup>	2 (0–2) <sup>a</sup>	2 (0–2) <sup>a</sup>
Dewclaw	0 (0–1) <sup>b</sup>	0 (0–2) <sup>b</sup>	2 (0–2) <sup>a</sup>	0 (0–2) <sup>b</sup>

\*Pain scores were based on the cows' responses to direct spraying of water on the lesions (0 = no signs of pain; 1 = signs of mild pain or equivocal signs of pain; 2 = signs of severe pain). †0 = no visible lesion; 1 = lesion  $\leq 2.5$  cm in diameter; 2 = lesion > 2.5 cm in diameter.  
Data are given as median (range). In each column, groups with different superscripts were significantly ( $P < 0.05$ ) different.

Table 3—Numbers of cows with PPD that had signs of pain and visible lesions after treatment with oxytetracycline solution

Location of lesion	Signs of pain*		Visible lesion†	
	Day 14	Day 30	Day 14	Day 30
Interdigital cleft (%)	11/13 (85) <sup>a</sup>	10/11 (91) <sup>a</sup>	13/13 (100) <sup>a</sup>	11/11 (100) <sup>a</sup>
Heels (%)	9/25 (36) <sup>b</sup>	12/21 (57) <sup>ab</sup>	24/25 (96) <sup>a</sup>	14/21 (67) <sup>ab</sup>
Dewclaw (%)	4/22 (18) <sup>b</sup>	4/17 (24) <sup>b</sup>	21/22 (95) <sup>a</sup>	7/17 (41) <sup>b</sup>

\*Pain score > 0. †Lesion size score > 0. In each column, proportions of cows with signs of pain or visible lesions were significantly ( $P < 0.05$ ) different if superscripts are different.  
See Table 2 for key.

required treatment with antibiotics. Proportions of cows removed from the study did not differ significantly ( $P = 0.69$ ) among groups. Fifteen (71%) cows that were removed before the end of the study were cows with mature lesions. Proportions of cows with mature lesions that were removed from the study did not differ significantly ( $P = 0.84$ ) among groups.

**Outcome**—On days 14 and 30, pain scores for cows treated with oxytetracycline solution were significantly higher for cows with lesions on the interdigital cleft, compared with cows with lesions on the dewclaw (Table 2). On day 30, lesion size scores were significantly higher for cows with lesions on the interdigital cleft or heels, compared with cows with lesions on the dewclaw. Similarly, on days 14 and 30, proportions of cows with pain score > 0 were significantly higher among cows with lesions on the interdigital cleft (85 and 91%, respectively), compared with cows with lesions on the dewclaw (18 and 24%, respectively; Table 3). On day 30, proportions of cows with lesion size score > 0 were significantly higher among cows with lesions on the interdigital cleft (100%), compared with cows with lesions on the dewclaw (41%).

## Discussion

Results of our study indicated that anatomic location of PDD lesions can affect the efficacy of topical spray treatment with oxytetracycline in dairy cows. Cows with lesions on the interdigital cleft were less likely to respond to treatment, compared with cows with lesions on the heels or dewclaw. Effect of various treatments, including topical application of oxytetracycline, on PDD lesions in dairy cows has been reported.<sup>1,11,13</sup> However, results from these studies are difficult to compare with results of the present study because of

differences in experimental protocols. In 1 study, no consistent differences in response time were observed in lesions of different sizes or at different anatomic locations.<sup>1</sup> Frequency and distribution of cows by treatment and anatomic location of PPD lesions was not reported.<sup>1</sup> The study included 3 cows with PDD lesions (anatomic location was not described) that responded 7 days after topical application of oxytetracycline powder (5 g) and bandaging of the foot; results from untreated cows were not reported.<sup>1</sup> In another study, anatomic location of PDD lesions was not reported.<sup>13</sup> Finally, in a third study, the assessment of efficacy of oxytetracycline for treatment of PDD lesions on different anatomic locations was not an option, because cows were randomly allocated to different treatment groups, and the number of cows with lesions on the interdigital cleft did not differ significantly.<sup>11</sup> The reason for observed differences in the efficacy of oxytetracycline among dairy cows with PDD lesions on different anatomic locations may have several explanations. Lesions involving the interdigital cleft often extend into the interdigital space where they are inaccessible to topical spray treatments. This may result in partial or temporary improvement of visible lesions, followed by recurrence. Therefore, topical spray treatment alone may not be sufficient to provide optimal control. Alternative procedures, such as topical treatment followed by bandaging of the affected foot, should be evaluated. Another plausible explanation could be that cows with PDD lesions on the interdigital cleft or heels are exposed to more rigorous conditions (greater exposure to risk factors associated with the disease) than cows with PDD lesions on the dewclaw.

In the study reported here, the fact that anatomic location had an effect on the efficacy of treatment of PDD lesions agrees with the hypothesis that the plantar and palmar regions of the foot may be more conducive to the development of PDD because of these regions' moisture retention properties.<sup>1</sup> Epidemiologic observations indicate that risk of PDD is associated with environmental conditions that cause moist feet in commercial dairy herds.<sup>2</sup> In California, cows maintained in drylot corral dairies were more at risk of being affected with PDD, compared with cows in other housing.<sup>2</sup> In addition, clinical observations indicate

that hind limbs are exposed to deeper slurry during feeding times than forelimbs.<sup>1</sup> The plantar and palmar regions of the interdigital space are, therefore, more susceptible to being continually moist, compared with more open dorsal locations.<sup>1</sup>

<sup>a</sup>Guterbock WM, Borelli CL, Read DH. Evaluation of four therapies of papillomatous digital dermatitis in dairy cattle (abstr), in *Proceedings. Annu Meet Am Assoc Bovine Pract* 1995;240-241.

<sup>b</sup>Terramycin-343 Soluble Powder, Pfizer Inc, Lee Summit, Mo.

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