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J. Gaines

J. Galland

J. Leedle

*See next page for additional authors*

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# Incidence of digital papillomatosis ("hairy warts") in a dairy herd. Response to surgery and autogenous vaccination

## Authors

J. Gaines, J. Galland, J. Leedle, and R. Basaraba

**INCIDENCE OF DIGITAL PAPILLOMATOSIS  
("HAIRY WARTS") IN A DAIRY HERD. RESPONSE  
TO SURGERY AND AUTOGENOUS VACCINATION**

*J. Gaines, J. Galland, J. Leedle,  
R. Basaraba and D. Anderson<sup>1</sup>*

**Summary**

Digital papillomatosis (hairy warts) was diagnosed in a dairy herd with a high level of lameness (20%). Warts ranged from mild to moderate to severe, with severity increasing with length of lactations. All milking cows (100%) had at least mild lesions. Cows with severe lesions were more likely to be lame. Severity of lesions had no influence on 305-day ME milk production, days open, or somatic cell counts. Cows in milk more than 150 days and lame produced 3 kg less milk per day than cows that were not lame. Almost all warts were in the interdigital cleft near the heel of the rear feet. A few cows had lesions in the front of the interdigital cleft or on the front feet. No viral particles were observed or isolated. A new, Gram-negative, motile, facultatively anaerobic, spiral-shaped bacteria was isolated from one lesion. The cellular fatty acid profile of this bacterium had no match to any other known bacteria in any of three computer databases examined.

Cows with severe lesions were assigned randomly to one of four groups: Group 1: surgical removal and autogenous vaccination; Group 2: surgical removal only; Group 3: autogenous vaccination only, and Group 4: control. Neither surgical removal nor autogenous vaccination had a significant effect on wart severity, lameness, or milk production when cows were

inspected 10 wk later. Contemporary evaluation of 249 herdmates revealed a substantial number of severely affected cows naturally improved. Of 25 severely affected herd contemporaries, only 8 were severely affected 10 wk later. Evidently, natural improvement of lesions is a common phenomenon with "hairy warts."

(Key Words: Bovine, Lameness, Digital Papillomatosis.)

**Introduction**

Hairy warts were first described in Italy, and outbreaks have been reported in England, the Netherlands, and the United States. The disease appears to cause lameness and severe reductions in milk production (20-50%). As many as 70% of cows have warts in affected herds. The cause is unknown. Efforts to isolate and identify a virus have been unsuccessful. Numerous spirochetes are observed in the lesions, however, and positive responses to treatment with disinfectant solution, antibiotics, surgical removal, and vaccination have been reported. An outbreak of digital papillomatosis occurred in a dairy in the U. S. A..

The objectives of this study were to determine prevalence and severity of warts, effect of the disease on productivity and lameness, etiology, and response to removal and vaccination.

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<sup>1</sup>College of Veterinary Medicine.

## Procedures

All lactating cattle were inspected as they were milked in the parlor. The parlor was a herringbone design with eight cows on each side. The heels of the rear feet of the cattle first were rinsed with a wash hose, then examined with a flashlight. The lesions were rated as mild, moderate, or severe. A mild lesion was one with slight reddening and ulcerations present only in the interdigital cleft of the heels. Moderate lesions had active granulation occurring with ulceration. Severe lesions were growths (at least 4 cm in diameter) with frond-like projections (Figure 1). As cows exited the parlor, body condition score and lameness were assessed. DHIA had tested the cows for milk production during the week prior to the second visit. These production records were obtained for analysis.

Only cows severely affected (growths at least 4 cm with frond-like projections) were enrolled in the removal and vaccination trial. A total of 28 severely affected cows was selected. These cows were assigned randomly to four groups: 1) surgical removal and autogenous vaccination; 2) surgical removal with no autogenous vaccination; 3) no surgical removal with autogenous vaccination; and 4) no treatment.

Surgical removal was accomplished by restraining the cow in a foot trimming chute. The size of the warts removed resulted in a large wound, which we were not able to suture closed. The cow was then bandaged, and the wound healed by scarring.

An autogenous vaccine was produced by homogenizing the warts in saline (20% weight to volume solution) and allowing the cellular debris to sediment, then adding 0.5 % formalin as a preservative. Cows were vaccinated by injecting 1 ml of the vaccine intradermally and 15 ml intramuscularly.

These cows were inspected for warts and lameness 3 wk after surgical removal and vaccinated at that time. They were again inspected for warts and lameness 7 wk after removal. Milk production records were collected during the week prior to removal and at week 10. Herd contemporaries were inspected for lameness and severity of warts at the time of surgical removal and 10 wk later. The effect of removal and autogenous vaccination on lameness and recurrence were analyzed by the use of contingency tables. Analysis of co-variance was used to determine the effect of removal or vaccination on milk production.

## Results

All cattle were affected to some degree. Severity was associated with lameness ( $P < .001$ ; Table 1), and a substantial number of cows were lame ( $n = 72$ ). Severity did not increase as lactation number increased (Table 2). However, the prevalence of lameness did increase as lactation number increased ( $P < .01$ ; Table 2). Severity increased as days in milk increased ( $P < .001$ ; Table 3), though the prevalence of lameness did not (Table 3). Mature equivalent 305 day milk yield, somatic cell count, and days open did not vary by severity (Table 4) or lameness (Table 4). Body condition score was affected by lameness (Table 4) but not by severity (Table 4). Cows milking less than 150 days that were lame showed no decrease in milk production. Cows milking more than 150 days and lame had a reduction of 2.94 kg of milk per day, compared to cows that were milking more than 150 days but were not lame.

In the experiment, 23 of the 28 cows were available for inspection 10 wk later. The remaining cows had been culled. Two were sold for dairy purposes, one was culled for failure to conceive, one died, and one was culled for low production. Of these 5 cows, one had received autogenous vaccination and two had warts surgically removed.

The results of surgical removal and vaccination on severity and lameness are shown in Table 5. Neither surgical removal or autogenous vaccination had a significant effect on number of cows severely affected or lame when cattle were

inspected 10 wk later. Surgical removal resulted in 33% of cows severely affected and 17% of cows lame 10 wk later, which was the same as the controls. Accordingly, the effect on milk production of vaccination or removal was not significant.

**Table 1. Prevalence of Interdigital Papillomatosis and Lameness in a Dairy Herd**

Category	N	%	Lame %	Relative risk lameness
None	0	0	0	—
Medium	178	54	16	1.0
Moderate	92	28	10	1.0
Severe	50	15	52	1.80*
Bandaged	12	3.6	33	—
Total	332	100	<b>20.5</b>	—

\*Severity was associated with lameness ( $P < .001$ ).

**Table 2. Distribution of Severity of Interdigital Papillomatosis and Lameness by Lactation**

Severity	Lactation number				Total
	1	2	3	> 3	
Mild	64%	46%	52%	51%	56%
Moderate	24%	34%	28%	31%	29%
Severe	12%	20%	20%	18%	15%
% Lameness	12	22	30	25	20

\*Severity did not increase as lactation number increased.

\*Prevalence of lameness increased as lactation number increased ( $P < .01$ ).

**Table 3. Severity of Digital Papillomatosis by Days in Milk in a Dairy Herd**

Severity	Days in Milk			Total
	< 100	100-200	> 200	
Mild	72%	40%	60%	56%
Moderate	21%	41%	21%	28%
Severe	9%	19%	19%	16%
% Lameness	12.5	20	24	

\*Severity increased as days in milk increased ( $P < .001$ ).

\*Lameness did not increase as days in milk increased.

**Table 4. Influence of Lameness and Severity of Hairy Warts on 305-day ME, Somatic Cell Count (SCC), Body Condition Scores (BCS), and Days Open**

Severity	305 d ME (kg)	SCC (1000)	BCS	Days open
Mild	10318	192	2.7	139
Moderate	10795	107	2.7	130
Severe	10318	157	2.7	154
Bandaged	9717	313	2.5	115
Lameness				
No	10464	185	2.7	134
Yes	10214	134	2.6	145

**Table 5. Effect of Surgical Removal and Autogenous Vaccination of Digital Papillomatosis on Wart Severity and Lameness 10 weeks after Removal**

Treatment	No. severe	No. mild	No. lame	No. not lame
Removal and Vaccination	4	3	2	5
Removal only	0	5	0	5
Vaccination only	2	4	1	5
No treatment	2	3	0	5

Dr. Deryck Read of California Veterinary Diagnostic Laboratory confirmed the lesions as those of digital papillomatosis. The lesions were similar to those he has seen from California, New York, Michigan, Great Britain, and the Netherlands.

No viral particles were isolated or observed with electron microscopy. A new, Gram-negative, motile, facultatively anaerobic bacteria was isolated from a representative lesion. The cellular fatty acid profile of the bacterium was determined and then compared to profiles of known bacteria in three different databases. No match occurred.

### Discussion

This disease has been reported in New York, Great Britain, the Netherlands, and Italy. The characteristic lesion is an epithelial papilloma. Workers in California have observed a spirochete, and we have

isolated a gram-negative, facultatively anaerobe bacterium in the lesion. Attempts at viral isolation have been unsuccessful, and electron microscopy techniques have not demonstrated a virus.

Although reports from the field indicate an increasing prevalence, little is actually known of the epidemiology of this disease. Mild to moderate effects on productivity have been reported. In this herd, the prevalence was very high. Severity increased as lactation length increased, and the rate of lameness increased with severity. Because all cows were affected, we cannot make any conclusions as to the effect on productivity. However, neither severe lesions or lameness significantly changed SCC, 305-day ME milk, or days open. Lameness had a slight reduction in body condition score. Severity increased as days in milk increased, as did lameness. However, the prevalence of lameness was high in this herd (20%), and higher than

most surveys of lameness in dairy cows. Lameness did reduce milk production by 3.0 kgs but only in cows milking for more than 150 days.

Neither surgical removal nor autogenous vaccination had a significant effect on lesion resolution, lameness, or milk production (Tables 5). Lesion severity regressed naturally on a number of cows without intervention. All lactating cows in this herd were inspected at the onset of this study and also at the completion. Of 249 cows not included in the random trial, 10% (n=25) were severe at the initial observation, and 20% were severe 10 wk later. However, only 8 of 25 severely affected cows at the first observation had severe

lesions 10 wk later. A similar phenomenon was observed with lameness. Of 41 cows lame initially, only 11 were lame at the final observation, and 31 cows that were not lame initially developed lameness by the final observation. Therefore, even with a larger sample size, it is unlikely that the intervention used here would show a significant effect.

Future research plans call for continued investigation of the epidemiology of this disease. We are looking for afflicted herds. Please contact the authors if you know of such herds. Furthermore, we plan on pursuing investigations as to the relevance of the gram-negative bacteria we isolated.



**Figure 1. A Severe Lesion of Digital Papillomatosis on the Heel of the Rear Foot of a Dry Third Lactation Holstein Cow. The Lesion Was 6 cm Across and Had Numerous Epidermal Projection "Fronds". This Cow Had a Mild Lameness at the Time This Picture Was Taken.**