

# Chronic Fibrous Teat End Lesions of Lactating Dairy Cows

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## Introduction

Injury to the teat end and orifice is known to be an important factor in predisposing cows to bacterial infection of the mammary gland. There are numerous obvious causes of such injury such as the stepped-on teats, wire cuts, improper procedures for teat dipping, freezing and obvious malfunction of milking equipment. However, less severe lesions are encountered which occur without an obvious cause. These lesions are usually characterized by a thickened ring of fibrous tissue which forms around the teat orifice. It may begin as a hemorrhagic ring with scab formation, and later progress to a scar type lesion. The lesions may regress with time or continue to progress, resulting in difficulty in obtaining the milk from the affected quarter and an increased rate of clinical mastitis. The etiology of this type lesion is difficult to establish because of its chronic, progressive nature and the inability to correlate it with possible environmental and management factors. In a previous investigation of a similar problem in Minnesota, the involved herd was later found to be infected with the bovine herpes mamillitis virus (4). In a review of the literature describing this viral disease, the classical lesion is a more severe involvement of the skin of the udder and teats (2,3,4,6). A limited project was initiated to study the factors involved in the problem of chronic fibrous teat end lesions, with particular emphasis on the possible role of virus in the etiology.

## Material and Methods

Herds selected had 20-60% of the milking cows with the characteristic teat end lesions and previously mentioned obvious causes had been eliminated. Herd visits were made and detailed histories compiled concerning duration of the problem. The possible introduction of animals, management factors such as teat dips used, udder washing procedures and milk-

ing practices were all considered.

The milking equipment was evaluated with regard to vacuum pump and line capacity, pulsator ratio and general maintenance. Dynamic milking equipment testing was done in some instances. A key biopsy punch was used to obtain tissue samples from the lesions from several cows in each herd for histopathological examination and virus isolation. Serum was collected and sent to the Plum Island Animal Disease Center to determine if antibodies against bovine herpes mamillitis virus were present. All viral isolation attempts were conducted by the virology laboratory of the Minnesota State Diagnostic Laboratory using standard techniques for cell culture and viral identification (1).

## Clinical Case Reports

### *Herd No. 1 - History and Clinical Examination*

This was a 50-cow Holstein herd housed in a conventional type stanchion barn. The problem of teat end lesions had been present in this herd for approximately one year. Ten young cows developed lesions within a short time after freshening. Initially, the lesions appeared as irritation or hemorrhage area around the teat end and then progressed to the fibrous stage with gradual closing of the teat orifice resulting in slow milking and increased incidence of clinical mastitis. The owner stated that it was necessary to leave the milking machine on some cows for 10-15 minutes to obtain all the milk. Several different types of teat dips had been used but no correlation could be made between the teat dips and the lesions. The condition continued to progress through different cows in the herd even though teat dips were changed three times. Iodine and chlorine teat dips previously had been used but presently a chlorhexidine<sup>®</sup> and glycerine mixture\*\* is being used.

The milking machine was a recently installed unit and the design appears adequate for the two bucket claw type units which were being used. The vacuum pump had a capacity of 50 cubic feet per minute (cfm) (New Zealand). A loop pipe line with a two-

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\*Nolvasan - Fort Dodge Laboratories, Fort Dodge, Iowa.

\*\*500 ml. of Nolvasan, 250 ml. glycerine tap water, q.s. one gallon.

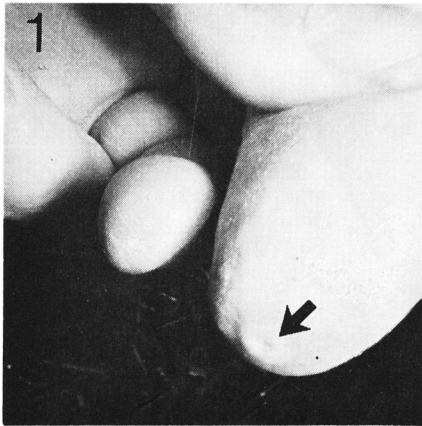


Figure 1. Teat with chronic fibrous ring encircling the teat orifice.

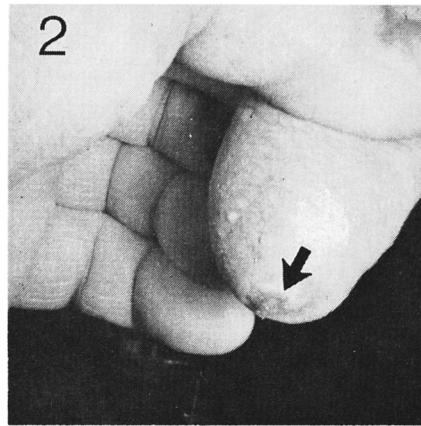


Figure 2. Teat in earlier stage of disease with dried scab over teat end and a developing fibrous ring.

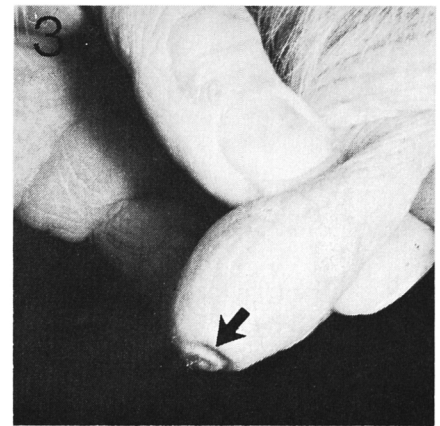


Figure 3. Teat with well-developed fibrous ring around teat orifice and portion still covered with a dried scab.

inch diameter was being used. A two-channel recorder was used to record teat end vacuum and pulsator function during the milking process. This tape showed irregular vacuum fluctuation at the teat end of approximately one inch and a 50-50 milk-rest ratio.

Two cows were examined and biopsies taken for histopathology and virus isolation and serum obtained for determination of antibody titers against mamillitis virus.

### Results

**Gross Pathology:** The area surrounding the teat orifice was raised and thickened in a ring-like fashion. The lesion appeared lighter in color than the normal teat epidermis (Figure 1).

**Histopathology:** Skin biopsy samples showed acanthosis, thickening of the stratum granulosum and hyperkeratosis.

**Virus Isolation:** No viral agents were isolated.

**Serology:** Two serum samples submitted were negative for bovine mamillitis.

#### *Herd No. 2 - History and Clinical Examination*

This herd comprised of 15 Holstein and Guernsey cows maintained in a conventional stanchion barn. The herd had a history of an erosive type of teat lesion. The owner stated he had had several cows which developed hemorrhagic teat end lesions which resulted in difficult milking and clinical mastitis. The milking equipment was evaluated by visual inspection and using a flow meter and pulsator recorder. A 3/4 inch vacuum line was being used along with two suspended type bucket milking units with pneumatic pulsators. The capacity of the vacuum pump was measured and found to be ten cfm (New Zealand).

Further examination revealed a faulty vacuum gauge and regulator which resulted in the system being operated at a vacuum level of 18½ inches of mer-

cury. Pulsator recordings were made after vacuum level corrections and tracings showed a normal open-closed ratio of 50/50.

Only one animal with teat lesions was presently in the herd. The lesions appeared to be covered with a dry scab. Biopsy was taken from the lesion for virus isolation and histopathology and a serum sample was also taken for antibody titer against bovine mamillitis virus.

### Laboratory Results

**Gross Pathology:** The gross appearance of the lesions in this cow appeared to be in an earlier stage than that of cows in other herds. There was the usual raised thickened ring area around the teat orifice but this was covered with a hemorrhagic scab (Figure 2).

**Histopathology:** Skin biopsy samples showed acanthosis, thickened stratum granulosum and hyperkeratosis.

**Viral Isolation:** No viral agents were isolated.

**Serology:** The serum sample was negative for antibodies against bovine mamillitis virus.

#### *Herd No. 3 - History and Clinical Examination*

This was a newly-constructed modern dairy facility. It consisted of a rotary type milking parlor with prep stalls. The herd had 80 Holstein cows. The milking equipment had been thoroughly checked by company representatives and found to be operating correctly.

The primary complaint was that the cows were not completely milking out. A two-piece stretch bore type liner was being used but the owner believed that the liners were creeping up toward the base of the udder resulting in the cows not milking out until considerable machine stripping was done. A change to narrow bore liners with support sleeves had been made in an attempt to obtain more complete milking out. Shortly after this change, irritation and prolapsed teat ends were noticed. When the teat end problem occurred, the owner changed back to the two-piece liner and the problem subsided somewhat.

The owner was of the opinion that one of the milkers was overmilking. This individual was leaving milking units in place during the complete eight minutes necessary for revolution of the parlor. With

the new type liners, the cows were milking out by the time they had completed  $\frac{1}{2}$  revolution, thus they were over-milked by approximately four minutes. A factor contributing to the over-milking was the owner's belief that the prep stall was not properly stimulating milk let down, requiring the milker to spend time hand washing each cow.

Other milking management practices in use on this farm were teat dipping after milking in a chlorhexadine and glycerine mixture (see previous footnote) and a pre-milking udder wash with an utensil cleaner type iodine containing 24% phosphoric acid. This product had the manufacturer's recommendation for use as an udder wash and on this farm it was being used at a slightly greater dilution than recommended.

Examination of the cows revealed prolapsed teat ends and some scar tissue present. None of the animals examined had evidence of hemorrhagic or acute skin irritation of the teat ends. One of the animals examined was stated by the owner to have had a teat irritation problem prior to the occurrence of the particular problem with the milking machines. Three animals were chosen for more complete examination and laboratory tests. Samples were taken with the biopsy punch for histopathology and viral isolation. Blood samples were taken to test for antibodies against bovine mamillitis virus.

#### Laboratory Results

*Histopathology:* Skin biopsies on all three animals showed acanthosis, thickened stratum granulosum and hyperkeratosis.

*Viral Isolation:* No viral agent was isolated from the three samples.

*Serology:* Three sera submitted for antibody titers against bovine mamillitis virus were negative.

#### Herd No. 4

*History and Clinical Signs:* The herd was composed of 50 Holstein cows and housed in a conventional stanchion barn. The owner stated that the problem began approximately one year ago after the purchase and introduction of two animals which had wart-like growths present on the teats. There did not appear to be any immediate spread of the lesions. However, when teat dipping was discontinued for a period of time, lesions began to appear on other cows.

It was noted that heifers became infected rather soon upon entering the herd. There also appeared to be more of a problem in high-producing cows. Lesions usually began as a raised, irritated area around the teat orifice and progressed into the teat canal. In certain animals there had been a clinical mastitis problem which accompanied the lesions. The sanitation appears to be better than average. The cows and their udders appeared to be clean. The milking practices were rather typical; however, a single rag was used to wash the udders of all cows. An iodine type udder wash was being used. Chlorhexadine and glycerine mixture (see previous footnote) was being used as a teat dip.

New milking equipment had recently been installed. Evaluation of it by visual inspection and flow meter and pulsator recorder analysis revealed the vacuum pump could move approximately 55 cfm (New Zealand). However, at the far end of the line, a reading of 40 cfm was obtained. This was a considerable loss and was suggestive of leaking stall cocks or leaks in the vacuum line. Forty cfm, however, should be sufficient to run the milking equipment which consisted of three pneumatic pulsator bucket type claw units and a milk transfer system. The vacuum level was checked on the pulsator line and at the teat end (without load) and was found to be 15 $\frac{1}{2}$  inches of mercury and 14 $\frac{1}{2}$  inches of mercury, respectively. Records made with a pulsator recorder showed a 60/40 pulsator ratio.

Several cows were examined thoroughly and cows having lesions of different durations were selected to biopsy for histopathological study and virus isolation. Serum samples were obtained from these cows plus one of the original cows which was thought to possibly have brought the problem into the herd.

#### Results

*Gross Pathology:* The gross appearance of these lesions were as follows: the area surrounding the teat orifice was raised and formed a thickened ring-like formation. Some lesions appeared darker in color than the normal skin and some the same color as the normal teat epidermis (Figure 1).

*Histopathology:* Skin biopsy samples showed acanthosis, thickened stratum granulosum and hyperkeratosis.

*Viral Isolation:* No viral agents were isolated in standard tissue culture system.

*Serology:* Five serum samples submitted were negative for antibodies against bovine mamillitis virus.

#### Summary

During the winter and spring of 1975, four herds were visited where teat end lesions had been a problem. In three of the four herds, the milking equipment was considered to be functioning within acceptable limits. On one farm, a milking equipment problem was present with an obvious vacuum regulator problem resulting in high vacuum at the teat end (Herd No. 2). Four different brands of milking equipment were being used and both bucket and pipeline type machines were represented.

The role of teat dips was difficult to evaluate since one herd was not dipping teats but the other three herds had switched types of teat dips several times with no apparent correlation to the resulting teat lesions. Iodines and chlorhexadine and glycerine had been used. Milking practices varied in the herds but in general the herdsmen seemed to be aware of proper practices and attempted to follow them.

In two herds (Herd No. 1 and 4), definite over-milking was occurring and in all probability it was in another (Herd No. 3). In the first two herds, the

owners complained that they were not able to remove all the milk from the cows in the normal time required for machine milking and that they were having to leave machines on the cows longer than the recommended times. In the third herd, over-milking was being done partially because of the habits of one of the operators and the nature of the equipment.

There did not appear to be any consistent correlation with inflation type, because both molded and stretch bore inflations were being used. Most of the herds had used different types of inflations at different times and saw no correlation with teat end lesions.

One of the basic questions which we tried to answer was the possibility of a viral agent being the inciting etiologic agent, particularly the herpes bovine mamillitis virus. Three of the herds had a history of spread of the lesions through the herd. In one herd the problem occurred after the introduction of cows with wart-like teat lesions. Serum samples were obtained from all herds and submitted to the Plum Island Laboratory for titers to the bovine mamillitis virus. Eleven samples in all were submitted and all were negative. All biopsy samples tested were negative for viral growth in the standard tissue culture system of bovine turbinate cells. However, this does not completely rule out viral etiology because more cell lines and other systems such as embryonated chicken eggs could be used.

The histopathologic observations were the only consistent findings in all four herds. These findings did not provide evidence for a viral etiology. The variola, varicella and herpes viruses produce intra-epidermal vesicles, ballooning degeneration of epidermal cells, acantholysis and inclusion bodies.

Verrucae (warts) are also ruled out as they are characterized by hyperkeratosis with interspersed areas of parakeratosis, elongated rete ridges, large vacuolated cells containing few or no keratohyaline granules in the upper stratum spinosum, and occasional intranuclear inclusion bodies. Vaccinia or paravaccinia lesions develop from nodules to vesicles and pustules which rupture forming scabs.

Generally, there are also chronic inflammatory cells present (5).

Lesions seen in the cases described resulted in the formation of a circular callous around the teat orifice possibly due to chronic low grade skin irritation (Figures 1, 2 and 3).

### Conclusions

A viral etiology was suspected because of what appeared to be a spread of the lesion through the herd but this was not confirmed in this study. Teat dips were also considered as a possible etiologic factor for these lesions, but this was not confirmed by these observations. Evaluation of the milking equipment did not reveal any constant abnormality, nor any consistent defect that could be a cause of chronic irritation at the teat end. However, it appeared that the trauma to the teat end produced by over-milking may be the important abnormality producing this lesion.

**It was our conclusion that these lesions, because of their fibrous nature, would persist for extended periods of time and resolve slowly following removal of the causative factors. Consequently, veterinarians and dairy farmers should not expect rapid resolution and the problem may persist for several months after the inciting etiology has been corrected.**

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